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Village Level Impacts of Trade Reform in China

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Abbreviations

CAAS	Chinese Academy of Agricultural Sciences
CGE	Computable general equilibrium
CGE-MSS	CGE microsimulation sequential
GAMS	General Algebraic Modeling System
GDP	Gross domestic product
GTAP	Global Trade Analysis Project
IFPRI	International Food Policy Research Institute
IMH-CGE	Integrated multi-household CGE
LES	Linear expenditure system
NELM	New Economics of Labour Migration
OECD	Organisation for Economic Co-operation and Development
PE	Partial equilibrium
RHG	Representative household group
SAM	Social accounting matrix
WTO	World Trade Organization

The exchange rate for Chinese renminbi yuan against US$ was 1US$ = 8.01RMB as of 04 June 2006. One standard mu corresponds to about 1/15 hectare.

Executive Summary

During the past three decades, China has carried out substantial and ambitious economic reforms, which converted the country from a centrally planned to what is now called a socialist market economy. The reforms have resulted in impressive economic growth and a considerable reduction in poverty. The current situation, however, is also characterised by increasing tensions within the country, caused, among others, by rising rural-urban and inland-coastal disparities as well as by a divergent development of the different sectors of the economy. In particular due the high and persisting disparities between rural and urban areas, rural-urban migration occupies central stage, both for the livelihoods of rural households and for the outcome of further policy reforms. In this context, trade liberalisation for a number of reasons can be expected to play an important role for the future development of poverty and inequality in the country: first, poverty in China is still predominantly rural, second, trade liberalisation is likely to unfold its strongest impacts on the agricultural sector and third, because of its historical relevance as a factor contributing to inequality.

Current studies on the impacts of trade reform in China mostly apply simulation models at higher, nation-wide or regional, levels of aggregation. These models are capable of providing insights at a rather general level. They lack, however, the capacity of taking into account production and consumption patterns, initial factor endowments, different responses of individual actors or local market conditions in a highly disaggregated manner. Thereby, they neglect decisive factors which shape the outcomes of policy reforms.

Against this background, the present work analyses and assesses the impacts of further trade liberalisation efforts on a rural community in Guizhou Province in south-western China. Recognising the importance of these issues, special emphasis is put on poverty, inequality and rural-urban labour migration. Subject of the

analysis is Changtian village, located in one of the less developed counties of Guizhou province. Thereby, the case study of Changtian aims not only at shedding light on the impacts of future trade reforms on this particular village, but also has the objective of providing more general insights into the mechanisms which are at work when trade policies are brought down to a local level. The study seeks to promote an enhanced understanding of relevant processes in similar settings, allowing for improved assessments in the field of development oriented trade policy analysis.

The objectives of the study are achieved by the application of a village computable general equilibrium model for Changtian village, which is embedded into a macro-microsimulation framework. In this framework, aggregate results from a national level CGE study of unilateral trade liberalisation in China are administered as a policy shock to the village model, which offers a highly disaggregated picture of the village economy and allows for a detailed analysis of the impacts of trade reform.

The village equilibrium model, which is a CGE representation of the village economy, forms the core part of the present study. The households, which make up the village community, are depicted by six representative household groups. The six groups stratify the village population by household demographics and income levels, thus distinguishing the households by their migration behaviour and by relative poverty. Each representative household can carry out up to four productive activities: agriculture, formal and informal local off-farm work as well as migration. Agricultural production is modelled with a nested Leontief-Cobb-Douglas technology. Household consumption is represented by a per-capita LES which includes self-consumption of agricultural output, purchased goods as well as leisure. By incorporating the assumption of a perfectly neoclassical village land market, the model makes a step towards the modelling of land rental transactions which take place within the village. The land market links the households together and creates local general-equilibrium effects which greatly affect the outcome of the policy reform.

The salient feature of the village model, however, is a novel approach towards the modelling of the households' labour allocation behaviour, and in particular the migration behaviour. The approach takes into account household preferences towards work in different types of employment as well as feedback links between household migration and consumption demand. This is achieved by the assumption of a composite utility function, which defines the behaviour of each household in the model. The composite utility function consists of a consumption utility function, which captures utility created by commodity consumption, and a labour utility function, which allows to account for the utility or disutility associated with the participation in different types of employment.

By considering the disutility arising from certain employment options, the current work offers an important contribution to the methodological development of village equilibrium modelling. It provides a modelling framework, which paves the way for similar applications in different settings and opens an interesting field for future applications, which may also extend to levels of higher regional aggregation. At the same time, the model constitutes a highly valuable tool for the analysis of the migration behaviour of rural households under different policy scenarios along the lines of household demographics and income levels. Thereby, the availability of transparent information on socio-economic characteristics of the household groups, the remittances behaviour as well as the disutility connotations of migration offer great support to such efforts. Not least, it allows to derive theoretically sound hypotheses on the migration behaviour of rural households in different policy situations.

The study is subdivided into eight chapters. Following an introduction, Chapter 2 provides a review of the relevant literature. The chapter starts with a section on China's economic reforms, poverty, inequality and migration, aimed at setting the stage for the present work. Next, theoretical frameworks for the analyses of trade liberalisation and poverty and of positive impacts of migration on source communities are discussed. Along with the concept of village economies, which is also introduced, these frameworks represent the conceptual basis for the analyses to follow. A third section, which has a methodological focus, gives an overview on results obtained from previous studies on trade liberalisation in China and reviews current methodological approaches.

Chapter 3 deals with the methodology, data and the research area. The macro-microsimulation framework, which links a national CGE model with the village equilibrium model, is outlined. The census dataset of the 257 households of Changtian village, which was gathered in 2007 in the scope of a comprehensive research project aimed at studying rural poverty in China and carried out by the International Food Policy Research Institute, the Chinese Academy of Agricultural Sciences, and Guizhou University, is described. Changtian is characterised as a poor village, located in a less developed area, whose inhabitants to a great extent rely on migration to more developed provinces for their livelihoods. The extent and nature of inequality is discussed. Finally, as an important step towards the development of the village model, the market integration of Changtian with the rest of the country is assessed. The results of this assessment show that village markets for agricultural output and for consumption goods can be assumed to be integrated, whereas for land an isolated village market exists.

Chapter 4 provides a microeconomic theory of household behaviour. The chapter departs from a basic farm household model, to which the utility considerations of households regarding different employment options and aspects of migration related to household consumption demand are added in a stepwise manner. Through this process, a nonseparable agricultural household model with feedbacks to the consumption sphere is developed. The core result of this model is that in the household's optimum, all activities including leisure yield the same marginal returns to the household, which are equal to the household shadow wage. Unlike in standard models, however, these marginal returns include the monetary returns as well as the utility considerations of the household. The model serves as the theoretical core of the village equilibrium model.

In Chapter 5, a SAM for Changtian village is constructed. The SAM constitutes the core dataset underlying the village equilibrium model and provides a snapshot of the village economy at the time of the survey. At this, the construction of the SAM is preceded by econometric work oriented towards the analysis of households' migration behaviour and aimed at supporting the construction of representative household groups. Furthermore, household specific shadow prices for family labour and land, which are unobserved in the original sample, are estimated.

In Chapter 6, the theoretical household model of Chapter 4 is translated into an applied village equilibrium model. This work involves the specification of functional forms and the construction of a village equilibrium framework. A first section describes these steps and discusses the main assumptions made, resulting in a full documentation of the applied model. In a second section, a number of stylised simulations are carried out in order to introduce and discuss the depiction of the labour allocation by the households in the model. This first set of simulations demonstrates the merits of the approach taken. It shows that the inclusion of utility considerations in an agricultural household model offers a substantial degree of flexibility in the modelling of the labour market behaviour of rural households. Various labour supply patterns such as the different segments of an S-shaped labour supply curve or complementarity between non-agricultural household production and wage employment can be modelled.

Chapter 7 applies the village equilibrium model in a macro-microsimulation framework to the analysis of the impacts of trade liberalisation on poverty, inequality and migration in Changtian village. The model is applied to a scenario of unilateral trade liberalisation in China. Overall, four simulations are carried out. Two different calibrations of the migration behaviour are implemented, one in which all households have identical own-wage responses in migration and one in which households with higher shares of dependants exhibit weaker own-wage responses. This implies the assumption of a lower propensity to migrate for the latter households. For each of the two calibrations, the impact of trade reforms is simulated once with the assumption of an absent land market and once allowing for land rentals within the village.

Overall, the simulations find only comparatively weak impacts of trade liberalisation on the village. Returns to land as well as to agricultural labour decrease. Along with generally lower off-farm wages, this causes losses in income for all households and leads to slight increases in poverty in the village. Higher relative income losses for low income households result in higher inequality due to trade reform.

The specification of the labour allocation behaviour of the households in the model leads to differences in labour supply responses, in particular in case of migration. Overall, households with higher shares of dependants tend to return home, whereas those with less dependants respond more positively to enhanced incentives to migrate. Thereby, differences arise also within migration groups: low income households appear to have a stronger affinity to migration and migrate more or return home less than other households.

The introduction of a village land rental market into the model leads to more pronounced adjustments in agricultural production. At this, a relationship between migration and land rentals can be observed. Households which have stronger and more positive migration responses make land available on the village market, whereas others increase their land use. In the consequence, the possibility to trade land within the village obviously facilitates migration and leads to more migration from the village. This affects the impacts of trade reform on households' income levels in that the presence of a village market accentuates the differences between migration groups already observed in the set of simulations without a land market. In spite of differences at the household level, however, the land market has no perceivable impact on the poverty outcome of reform. The increase in inequality, in turn, gets slightly weaker with a land market. This points to an inequality reducing effect of such an institutional change.

At a policy level, an important insight gained from the modelling exercise is that trade liberalisation has adverse impacts both on poverty and on the distribution of income in the village. Against this prospect, the authorities in charge should seek to improve the social safety net before embarking on further reforms which go in the direction as those simulated in this study. In addition, a careful approach to further trade reforms should be taken. In any case it would be preferable to undertake further reform steps only in the context of multilateral trade reform, which would entail more positive impacts on the agricultural sector.

The comparison of the simulation results obtained under the two assumptions regarding the presence of a land market gives hints that a reform of the land rental regime would partly offset the inequality enhancing effects of trade liberalisation. Furthermore, the possibility to rent out land without restrictions would facilitate migration by households that wish to leave and in the consequence lead to higher levels of rural-urban migration. Thus, land markets could contribute to reduce rural-urban disparities. On the other hand, this positive assessment should be considered against the observation that households which migrate more would be more negatively affected in terms of income losses in a situation with a land market.

A highly important result of the simulations is that clear differences in the impacts of trade liberalisation arise between the two migration groups as well as within them. The fact that the former as well as the latter can be traced back to different migration responses clearly shows that the migration behaviour of rural households matters for the outcome of trade (and other policy) reforms and underlines the importance of the rural-urban linkages created by migration.

Zusammenfassung

Im Verlauf der vergangenen drei Jahrzehnte hat China tiefgreifende wirtschaftliche Reformen durchgeführt, die das Land von einer Zentralverwaltungswirtschaft zum dem, was heute eine "Sozialistische Marktwirtschaft" genannt wird, gewandelt haben. Zwar haben die Veränderungen ein beeindruckendes Wirtschaftswachstum und eine starke Reduktion der Armut zur Folge, gleichzeitig ist die gegenwärtige Situation jedoch auch durch wachsende Spannungen innerhalb des Landes gekennzeichnet. Zunehmende Disparitäten bestehen sowohl zwischen städtischen und ländlichen Räumen als auch zwischen dem Landesinneren und den an den Küsten gelegenen Gebieten. Als Hauptergebnis des Strukturwandels ist die divergierende Entwicklung der verschiedenen Sektoren der Volkswirtschaft zu nennen. Die zunehmend ungleiche Entwicklung zwischen städtischen und ländlichen Regionen führt zu einer verstärkten Migration von Arbeitskräften. Dieser Prozess, der von existenzieller Bedeutung für die Einkommenssituation in den ländlichen Haushalten ist, wird in starkem Maße von einer Vielfalt wirtschaftspolitischer Maßnahmen beeinflusst. Es ist zu erwarten, dass insbesondere die zunehmende Handelsliberalisierung in starkem Maße die zukünftige Entwicklung von Armut und Ungleichheit im ländlichen Raum beeinflussen wird. Die besondere Bedeutung dieses engen Zusammenhangs ergibt sich auch aus der Tatsache, dass sich aus dem Abbau protektionistischer außenwirtschaftlicher Maßnahmen Auswirkungen auf den landwirtschaftlichen Sektor insgesamt ergeben und dass Handelsliberalisierung bereits in der Vergangenheit zu einem Anstieg der Gegensätze im Land führte.

Bereits vorliegende Studien über die Auswirkungen von Handelsliberalisierung in China beruhen überwiegend auf Simulationsmodellen, die auf höheren Aggregationsebenen, etwa landesweit oder regional, angesiedelt sind. Diese Modelle ermöglichen Einblicke von eher allgemeiner Natur. Sie sind deshalb nicht in der

Lage, Unterschiede in Produktions- und Konsummustern, Faktorausstattungen, Reaktionen unterschiedlicher Akteure oder lokale Marktbedingungen in ausreichend disaggregierter Form abzubilden. Dadurch vernachlässigen sie entscheidende Bestimmungsfaktoren für die möglichen Folgen von Politikreformen.

Vor diesem Hintergrund analysiert und bewertet die vorliegende Arbeit die Auswirkungen weiterer Handelsliberalisierung auf ein Dorf in der Provinz Guizhou in Südwestchina. Dabei liegt besonderes Augenmerk auf Stadt-Land-Migration, Armut und Einkommensverteilung. Der Gegenstand der Analyse ist Changtian, ein Dorf das in einem weniger entwickelten Verwaltungsbezirk der Provinz Guizhou liegt. Dabei hat die Fallstudie nicht nur das Ziel, die Auswirkungen künftiger Reformen der Handelspolitik auf dieses spezielle Dorf zu beleuchten, sondern verfolgt auch die Absicht, Einblick in die Mechanismen zu liefern, die am Werk sind, wenn eine lokale Perspektive einge- nommen wird. Darüber hinaus möchte die vorliegende Untersuchung zu einem besseren Verständnis für Prozesse in vergleichbaren Situationen beitragen und damit eine genauere Einschätzung der Wirkungen handelspolitischer Maßnahmen auf Entwicklungsländer ermöglichen.

Die Zielsetzungen der Studie werden auf dem Wege der Entwicklung und Anwendung eines Dorfgleichgewichtsmodells für Changtian, das in einen Makro-Mikrosimulationsmodellrahmen eingebettet ist, erreicht. Innerhalb dieses Modellrahmens werden aggregierte Ergebnisse einer nationalen CGE-Studie unilateraler Handelsliberalisierung in China als Politikschock in das Dorfmodell eingegeben, welches ein hochgradig disaggregiertes Bild der Dorfwirtschaft liefert und damit eine detaillierte Analyse der Politikfolgen ermöglicht.

Das Dorfgleichgewichtsmodell, welches eine CGE-Abbildung der Dorfwirtschaft ist, bildet das Kernstück der vorliegenden Arbeit. Die Haushalte, aus denen die Dorfgemeinschaft besteht, werden durch sechs repräsentative Haushaltsgruppen abgebildet. Die sechs Gruppen stratifizieren die Bevölkerung des Dorfes nach demografischen Merkmalen sowie nach Höhe der Einkommen und unterscheiden die Haushalte damit in Bezug auf ihr Migrationsverhalten und ihre relative Armut. Konkret gibt es zwei Migrationsgruppen, die jeweils in drei Einkommensgruppen unterteilt sind. Jede Haushaltsgruppe hat Zugang zu vier Produktionsaktivitäten: Landwirtschaft, formelle und informelle lokale nichtlandwirtschaftliche Beschäftigung und Migration. Die Abbildung der landwirtschaftlichen Produktion erfolgt durch eine verschachtelte Leontief-Cobb-Douglas-Technologie. Der Konsum der Haushalte wird durch ein auf Pro-Kopf-Konsum ausgelegtes lineares Nachfragesystem dargestellt, das den Eigenkonsum landwirtschaftlicher Produkte, den Verbrauch auf dem Markt erworbener Güter sowie Freizeit mit einschließt. Das Modell unternimmt einen ersten Schritt hin zur Modellierung der Landtransaktionen, die innerhalb des Dorfes stattfinden, und trifft die Annahme eines perfekt neoklassischen Landmarktes. Dieser Markt verbindet die Haushalte miteinander und ruft lokale allgemeine Gleichgewichtseffekte hervor, die die Auswirkungen der simulierten Politikreformen substanziell beeinflussen.

Das herausragende Merkmal des Dorfgleichgewichtsmodells ist ein neuer Ansatz der Modellierung des Arbeitsallokationsverhaltens der Haushalte und darin insbesondere des Migrationsverhaltens. Der Ansatz berücksichtigt sowohl die Präferenzen der Haushalte für die Arbeit in bestimmten Beschäftigungsarten als auch Rückkopplungseffekte zwischen Arbeitsmigration und Konsumnachfrage. Erreicht wird dies durch die Annahme einer zusammengesetzten Nutzenfunktion, die das Verhalten der einzelnen Haushalte im Modell beschreibt. Die zusammengesetzte Nutzenfunktion besteht aus einer Konsumnutzenfunktion, die den durch Güterkonsum geschaffenen Nutzen erfasst, und eine Arbeitsnutzenfunktion, die es ermög- licht, Nutzen oder Unnutzen, der durch die Teilnahme in verschiedenen Beschäftigungen entsteht, zu berücksichtigen.

Durch die Berücksichtigung des Unnutzens, der aus verschiedenen Beschäftigungsmöglichkeiten erwächst, stellt die vorliegende Arbeit einen wichtigen Beitrag zur methodischen Weiterentwicklung der Dorfgleichgewichtsmodellierung dar. Sie bietet einen grundlegenden Modellrahmen, der den Weg für ähnliche Anwendungen in anderen Zusammenhängen bereitet und eröffnet ein interessantes Feld für zukünftige Anwendungen, die sich auch auf Ebenen höherer regionaler Aggregationen erstrecken können. Gleichzeitig stellt das Modell ein wertvolles Werkzeug für die Analyse des Migrationsverhaltens ländlicher Haushalte unter verschiedenen Politikszenarien unter Einbeziehung von Aspekten der Demografie und des Einkommensniveaus der Haushalte dar.

Die vorliegende Arbeit ist in acht Kapitel unterteilt. Nach einer Einleitung wird in Kapitel 2 eine Übersicht über die relevante Literatur gegeben. Das Kapitel beginnt mit einem Abschnitt über Chinas wirtschaftliche Reformen, Armut, Ungleichheit und Migration. Ziel dieses Abschnittes ist es, den ökonomischen Hintergrund zu beschreiben. Darauf folgend werden theoretische Ansätze zur Analyse von Handelsliberalisierung und Armut und zu den positiven Auswirkungen von Migration auf die Herkunftsorte der Migranten diskutiert. Zusammen mit einem Konzept für Dorfökonomien, das ebenfalls eingeführt wird, bilden diese Ansätze die konzeptionelle Grundlage für die darauf folgenden Analysen. Ein dritter, methodisch ausgerichteter Abschnitt, verschafft einen Überblick über die Ergebnisse bisheriger Studien zu Handelsliberalisierung in China und bespricht relevante methodische Entwicklungen.

Das Kapitel 3 hat die Methodik, die Daten und das Forschungsgebiet zum Gegenstand. Der Makro-Mikrosimulationsmodellrahmen, der ein nationales CGE-Modell mit dem Dorfgleichgewichtsmodell verknüpft, wird umrissen. Die durch eine durch das International Food Policy Research Institute, die Chinesische Akademie der Agrarwissenschaften und die Universität von Guizhou im Rahmen eines umfassenden Vorhabens zur Erforschung ländlicher Armut durchgeführte Vollerhebung von 257 Haushalten in Changtian gewonnenen Daten werden beschrieben. Changtian wird als von Armut stark betroffenes, in einer unterentwickelten Gegend gelegenes Dorf, dessen Einwohner in großem Maße von Migration in weiter entwickelte Gebiete abhängig sind, charakterisiert. Das Ausmaß und die Beschaffenheit der Ungleichheit innerhalb des Dorfes wird diskutiert. Abschließend wird, als wichtiger Schritt für die Entwicklung des Dorfgleichgewichtsmodells, die Marktintegration des Dorfes mit dem Rest des Landes bewertet. Die Ergebnisse dieser Betrachtungen führen zu der Annahme, dass die Dorfmärkte für landwirtschaftliche Produkte und Konsumgüter mit dem Rest Chinas integriert sind, wohingegen im Falle von Land ein isolierter Dorfmarkt existiert.

In Kapitel 4 wird eine mikroökonomische Theorie des Verhaltens der Haushalte vorgestellt. Das Kapitel geht von einem einfachen landwirtschaftlichen Haushaltsmodell aus, das schrittweise um die Nutzenerwägungen der Haushalte in Bezug auf verschiedene Beschäftigungsmöglichkeiten sowie um konsumbezogenen Aspekte der Migration erweitert wird. Im Verlauf dieses Prozesses wird ein nichtseparables landwirtschaftliches Haushaltsmodell mit Rückkopplungen in die Konsumsphäre, das als theoretisches Kernstück des Dorfgleichgewichtsmodells dient, entwickelt. Das wesentliche Ergebnis dieses Modells ist, dass im Haushaltsoptimum alle Produktionsaktivitäten und Freizeit gleiche Grenzerträge liefern. Diese Grenzerträge wiederum entsprechen dem Haushaltsschattenpreis der Arbeit, enthalten im Gegensatz zu Standardmodellen jedoch sowohl monetäre Erträge als auch die Nutzenerwägungen des Haushalts.

In Kapitel 5 wird eine *social accounting matrix* (SAM) für Changtian erstellt. Die SAM stellt den grundlegenden Datenrahmen für das Dorfgleichgewichtsmodell dar und liefert eine Momentaufnahme der Dorfökonomie zum Zeitpunkt der Datenerhebung. Zur Unterstützung der Bildung repräsentativer Haushaltsgruppen wird die Erstellung der SAM dabei von ökonometrischen Analysen des Migrationsverhaltens der Haushalte begleitet. Zudem werden haushaltsspezifische Schattenpreise für Familienarbeit und Land geschätzt.

In Kapitel 6 wird das theoretische Haushaltsmodell aus Kapitel 4 in ein angewandtes Dorfgleichgewichtsmodell übersetzt. Dieses Vorgehen umfasst die Spezifizierung von Funktionsformen sowie die Implementierung eines Dorfgleichgewichtsrahmens. Ein erster Abschnitt des Kapitels beschreibt diese Schritte und liefert eine Diskussion der wichtigsten Annahmen, die getroffen wurden. Das Ergebnis ist eine vollständige Dokumentation des Modells. In einem zweiten Abschnitt werden mit dem Ziel, eine Einführung in die Abbildung des Arbeitsallokationsverhaltens der Haushalte im Modell zu geben, sowie dieses zu diskutieren, eine Reihe stilisierter Simulationen durchgeführt. Diese ersten Simulationen verdeutlichen die Vorzüge des in der vorliegenden Arbeit verfolgten Ansatzes. Es wird gezeigt, dass die Berücksichtigung von Nutzenerwägungen in einem landwirtschaftlichen Haushaltsmodell eine große Flexibilität in der Modellierung des Arbeitsmarktverhaltens ländlicher Haushalte bietet. So können unterschiedliche Muster des Arbeitsangebotes, wie zum Beispiel die verschiedenen Segmente einer S-förmigen Arbeitsangebotskurve oder komplementäre Beziehungen zwischen nichtlandwirtschaftlicher Haushaltsproduktion und Lohnarbeit, modelliert werden.

Kapitel 7 wendet das Dorfgleichgewichtsmodell in einem Mikro-Makrosimulationsmodellrahmen auf die Analyse der Auswirkungen von Handelsliberalisierung auf Armut, Einkommensverteilung und Migration, in Changtian an. Insgesamt werden vier Simulationen eines Szenarios unilateraler Handelsliberalisierung in China durchgeführt. Es werden zwei verschiedene Kalibrierungen für das Migrationsverhalten der Haushalte implementiert: Im ersten Fall werden identische

Eigenlohnreaktionen in der Migration für alle Haushalte angenommen, im zweiten Fall zeigen Haushalte mit höheren Anteilen an Kindern und Alten schwächere Eigenlohnreaktionen, was der Annahme einer niedrigeren Migrationsneigung für diese Haushalte entspricht. Für jede der beiden Kalibrierungen werden die Auswirkungen von Handelsreformen jeweils einmal unter der Annahme eines fehlenden Landmarktes und einmal mit der Möglichkeit für Landtransaktionen innerhalb des Dorfes simuliert.

Insgesamt zeigen die Simulationen nur relativ geringe Auswirkungen der Handelsliberalisierung auf das Dorf. Sinkende Erträge aus Land und landwirtschaftlicher Tätigkeit führen zusammen mit allgemein niedrigeren nichtlandwirtschaftlichen Lohnsätzen für alle Haushalte zu Einkommensverlusten. Dies hat einen leichten Anstieg der Armut im Dorf zur Folge. Da ärmere Haushalte im Verhältnis höhere Einkommenseinbußen in Kauf nehmen müssen, nimmt die Einkommensungleichheit im Dorf in Folge der Handelsreformen zu.

Auf Grund der Art der Ausgestaltung des Arbeitsallokationsverhaltens der Haushalte im Modell treten insbesondere im Falle der Migration Unterschiede in den Arbeitsangebotsreaktionen auf. In der Tendenz kehren Migranten aus Haushalten mit überdurchschnittlichem Anteil Nichterwerbstätiger nach Hause zurück, wohingegen Haushalte mit relativ wenig Nichterwerbstätigen positiver auf verbesserte Migrationsanreize reagieren. Dabei treten insbesondere bei Haushalten mit niedrigerem Einkommen, die augenscheinlich eine stärkere Affinität zur Migration an den Tag legen, auch innerhalb der beiden Migrationsgruppen Unterschiede auf.

Die Einführung eines Landmarktes in das Modell führt zu stärker ausgeprägten Anpassungen der landwirtschaftlichen Produktion. Dabei ist auf Grund der Tatsache, dass Haushalte mit stärkeren und positiven Migrationsreaktionen Land auf dem Dorfmarkt verfügbar machen und die übrigen ihre Landnutzung ausdehnen, ein Zusammenhang zwischen Migration und der Pacht von Land festzustellen. Folglich führt die Möglichkeit, Land innerhalb des Dorfes zu pachten und zu verpachten, zu einer stärkeren Migration aus dem Dorf. Dies hat wiederum Konsequenzen für die Auswirkungen der Handelsreformen auf das Einkommensniveau der Haushalte: Das Vorhandensein eines Dorfmarktes verstärkt die Unterschiede zwischen den Migrationsgruppen, die schon in den Simulationen ohne Landmarkt beobachtet wurden. Entgegen der beobachteten Unterschiede auf der Ebene der Haushalte hat der Landmarkt jedoch keine feststellbare Auswirkung auf die Armutswirkungen der Reformen. Der Anstiege der Einkommensunterschiede hingegen fällt geringfügig schwächer aus. Dies weist auf einen ungleichheitsreduzierenden Effekt dieser Art institutionellen Wandels hin.

In Bezug auf die politische Ebene lässt sich als wichtige, aus den Simulationen gewonnene Einsicht nennen, dass eine unilaterale Handelsliberalisierung Chinas negative Auswirkungen sowohl auf Armut als auch auf die Einkommensverteilung im Dorf hat. Vor diesem Hintergrund sollten die verantwortlichen Regierungsstellen darauf bedacht sein, vor weiteren Reformen, die in die Richtung derer gehen, die in dieser Studie analysiert wurden, das soziale Sicherungsnetz auszubauen. Weiterhin erscheint es angezeigt, eine vorsichtige Herangehensweise an weitere Handelsreformen zu wählen. In jedem Fall wäre es vorzuziehen, weitere Reformschritte im Rahmen einer multilateralen Handelsreform zu unternehmen, welche positivere Auswirkungen für den landwirtschaftlichen Sektor zur Folge hätte.

Der Vergleich der unter den beiden Annahmen bezüglich des Landmarktes erzielten Simulationsergebnisse deutet darauf hin, dass eine Reform der Landmärkte den ungleichheitsfördernden Wirkungen von Handelsliberalisierung zumindest teilweise entgegen wirken kann. Darüber hinaus würde die Möglichkeit, Land ohne Beschränkungen verpachten zu können, die Migration von Haushalten, die dies wünschen, erleichtern und damit zu stärkerer Stadt-Land-Migration führen. Damit könnten Landmärkte einen Beitrag zu einer Reduktion der zwischen städtischen und ländlichen Gebieten bestehenden Disparitäten leisten.

Ein weiteres, sehr wichtiges Ergebnis der Simulationen ist, dass sich die Auswirkungen von Handelsliberalisierung sowohl zwischen als auch innerhalb der Migrationsgruppen deutlich unterscheiden. Dabei zeigt die Tatsache, dass beide Arten von Unterschieden auf unterschiedliche Migrationsreaktionen zurückgeführt werden können nachdrücklich, dass das Migrationsverhalten ländlicher Haushalte eine wichtige Rolle für die Folgen von Handels- oder anderen Politikreformen spielt. Dies unterstreicht die Relevanz der Stadt-Land-Verflechtungen, die durch Migration geschaffen werden.

1. Introduction

More than three decades have passed since China has embarked upon a profound reform of its economic system. Reforms started in 1978 and initially have been oriented towards the agricultural sector. The introduction of the household responsibility system, following more than two decades of collective organisation, again made the family household the basic unit of agricultural production, giving rural families the responsibility for their farming operations (Fan and Gulati, 2007). The reform of the rural and urban marketing systems gradually lead to an end of central planning in the agricultural and later on also in the non-agricultural sectors of China's economy. The establishment of township and village enterprises in rural areas and reforms of state-owned industrial enterprises brought about the development of a non-farm sector in rural areas (Fan et al., 2005) and changed the mode of industrial production from a socialist to a capitalist one. A substantial liberalisation of the trade regime undertaken in the run-up to the accession to the WTO in 2001 and beyond (Bhattasali et al., 2004) has converted China from a country, which has been virtually disconnected from international markets to an open economy, which is one of the most important economic players in the globalised world of today.

The reforms have been highly effective in promoting economic growth and in combating poverty. In agriculture, enhanced production incentives contributed to increases in yields, productivity and efficiency, which allowed the farm sector to grow by around 5% per year since the onset of reforms to the mid of the first decade of the 21st century (Huang et al., 2009). The economy as a whole developed even more rapidly: between 1980 and 2009, average economic growth was at around 9.5% per year (World Bank, 2011). In particular the improvements in economic conditions in the rural areas of the country have lead to a substantial reduction in poverty: while in 1980 still around 53% of the population lived in poverty, the share of the poor declined to less than 8% in 2001 (Ravallion and Chen, 2007).

This impressive development, however, has been accompanied by ever higher levels of inequality within the country. A divergent development of rural and urban areas and more rapid progress in coastal as compared to inland provinces gave rise to growing rural-urban and inland-coastal disparities. Rising differences within rural or urban areas add to overall inequality, which, as measured by the Gini coefficient, has reached a level of 44.7% in 2001, up from around 31.0% in 1981 (Kanbur and Zhang, 2005; Ravallion and Chen, 2007). This rising trend has alarmed both the scientific and the political community, fearing negative consequences for future economic growth, poverty reduction and social stability (Benjamin et al., 2008; Dollar, 2007; OECD, 2004).

One major consequence of the growing disparities are migration flows, which take place at a massive scale (Seeborg et al., 2000). By the mid 2000s, an estimated 100 to 130 million people, or around 20% of the rural labour force, have been moving from rural to urban areas mainly of coastal provinces in order to find employment there (Cai et al., 2008; Fang et al., 2009). Migration to a large extent is seasonal and of circular character, which means that migrants maintain the links with their home communities and return home after a certain migration spell (Zhao, 2003). Thereby, migration is of utmost importance, not only for migrant families themselves, but also for the rural economy as a whole. Flows of remittances are an increasingly important income source (Benjamin et al., 2005) and constitute a core element of the livelihoods of migrant households. Local level economic linkages cause that even non-migrant households are affected by migration. At a more general level, migration links rural areas to the urban sectors, constituting an important mechanism for the transmission of economic shocks, and can be considered to be one of the strongest forces shaping China's rural economy.

In the context of China's economic development, poverty reduction and rising inequality, issues of trade liberalisation are highly important aspects of economic policy making. In the past, the country's opening up to the outside world in terms of international trade and foreign direct investment has disproportionally favoured the economic development of the eastern coastal regions, thereby accentuating inland-coastal disparities and contributing to the increases in overall inequality

(Kanbur and Zhang, 2005). Thus, given present concerns about rising social disparities, future liberalisation efforts should always be considered in light of their possible impacts on inequality.

Although at least until 2001 an effect of trade reforms was not perceivable (Ravallion and Chen, 2007), further liberalisation may well matter for future progress in poverty reduction in China. Across the world, including China, agriculture tends to receive the highest levels of trade protection. Thus, future trade reforms—unilateral, multilateral or in the scope of regional trade agreements—can be expected to disproportionally affect the agricultural sectors and the rural economy. And as poverty in China still is a predominantly rural problem (Yao et al., 2004), poverty impacts of trade liberalisation will be particularly pronounced.

Against this background, the objective of the present study is to analyse the impact of further trade liberalisation on poverty and inequality in China. Recognising its high importance both for the livelihoods of the rural population and as a linkage between rural and urban sectors, a special focus is put on rural-urban labour migration.

The subject of the analysis is Changtian village, a rural community located in Guizhou province, south-western China. Guizhou is among the poorest provinces in China and Changtian lies in one of the less developed counties of the province (Brown et al., 2010; Xing et al., 2009). Changtian village is only one single case in a vast country. However, it may share a number of common characteristics with many communities in rural China: The village is characterised by high levels of poverty and a substantial degree of inequality. Villagers depend on a variety of income sources for their livelihood, relying simultaneously on farm production, local off-farm employment and migration. Indeed, following agriculture, outside province migration is the second most important source of cash income to the villagers, with around one fifth of the labour force being employed in this activity, and at the same time represents a major source of income inequality (Xing et al., 2009).

Thereby, studying the case of Changtian not only sheds light on the impacts of future trade reforms on this particular village but also yields important insights into the mechanisms, which are at work when trade policies are brought down to a local level. It promotes an enhanced understanding of relevant processes in similar settings, allowing for improved assessments in the field of development oriented trade policy analysis.

The nature of the problem studied calls for a comprehensive methodological approach. On the one hand, trade liberalisation unfolds economy-wide effects, such as changes in relative prices, trade flows or government revenues and expenditures. Thus, the ideal approach is capable of capturing these economy-wide or, if necessary, even global processes. On the other hand, the focus on a single rural community requires a substantial level of detail. The impacts of policy reforms on different groups of the local population to a large extent depend on differences in production structure, consumption patterns or the access to productive resources. Local market conditions, such as market imperfections or missing markets may give rise to economic linkages within the community, thus leading to local level general-equilibrium effects (McCulloch et al., 2001).

Taking these requirements into account, the present study employs a sequential macro-microsimulation approach, which combines results from a national level computable general equilibrium (CGE) model for China with a village equilibrium model for Changtian village. In this modelling framework, the national CGE model serves as the macro module, yielding simulation results, which are administered as a policy shock to the village model. At this, the work puts special emphasis on the development of and simulations with the village model, focusing in particular on the modelling of labour migration, whereas the macro level results are taken from a published CGE study on China.

The national level CGE study used for the present purposes is part of a recent and broad based undertaking to analyse the impact of different types of trade liberalisation on inequality and poverty (Anderson et al., 2010a). It applies a comparative static CGE model for the Chinese economy developed by Zhai and Hertel (2010). The model disposes of several features that allow to take into account some of the unique institutional factors, which characterise the functioning of the factor markets in China, such as the household registration (*hukou*) system and the land tenure system. In the present study we use results on price and wage changes from simulations of a scenario of unilateral full trade liberalisation by China.

The village equilibrium model, which is a CGE representation of the economy of Changtian village, forms the core part of the present study. The households, which make up the village community are depicted by six representative household groups. Each representative household groups can carry out up to four productive activities, among them agriculture, formal and informal local off-farm work as well as migration. Agricultural production is modelled with a nested Leontief-Cobb-Douglas technology. Household consumption is represented by a per-capita linear expenditure system (LES), which includes self-consumption of agricultural output, purchased goods as well as leisure. The model makes a step towards the modelling of land rental transactions, which take place within the village by incorporating the assumption of a perfectly neoclassical village land market. This market links the households together and creates local general-equilibrium effects, which greatly affect the outcome of the policy reform.

The salient feature of the village equilibrium model, however, is a novel approach towards the treatment of labour allocation of rural households, which recognises in particular the relevance of rural-urban migration in China. The approach caters to two principal issues, which arise in the context of the modelling of migration in a village CGE model. First, migration always creates feedbacks to a household's consumption sphere by altering consumption demand as a consequence of changes in the household size. These effects constitute a benefit additional to the receipt of remittances to the household, which impacts the migration behaviour. Second, migration involves psychological costs to the households, i.e. creates disutility, which makes engagement in this activity less attractive. These disutilities can determine the migration behaviour and lead to observable differences in migration responses among households and, given the role of migration as income source and a means to cope with economic shocks, different impacts of a given policy reform. The differences in migration behaviour, in turn, can often be linked to certain characteristics of the households. The presence of children or elderly, for example, may make migration a less attractive option for a young couple. Likewise, the need for childcare may require at least one person to stay at home and make farm work the preferred option for this person.

Bearing these considerations in mind, a refined depiction of labour allocation is implemented in the village CGE model. The approach takes into account household preferences towards work in different types of employment as well as feedback links between household migration and consumption demand. This is achieved by the assumption of a composite utility function, which defines the behaviour of each household in the model. At this, the approach offers an innovative extension of previous works on village modelling, such as those by Taylor and Adelman (1996) and Kuiper (2005), which have not considered the disutility arising from certain employment options.

As a whole, the village model offers a highly disaggregated picture of the village economy, allowing for a detailed analysis of the impacts of trade reform, in particular on poverty and inequality. The high level of disaggregation offers the opportunity to take into account differences between households as well as local market conditions, both of which are relevant for the village level impacts of trade liberalisation. The approach towards the modelling of labour allocation for the first time makes it possible to highlight the consequences of differences in migration responses among households for the village level effects of trade reform.

The present study on the impacts of trade liberalisation on poverty and inequality in a rural community in south-western China is subdivided into eight chapters. Following this introduction, the next *Chapter 2* is dedicated to a review of relevant literature. The chapter starts with a section on China's economic reforms, poverty, inequality and migration, aimed at defining the context in which the present work takes place. A second section provides a discussion of several theoretical concepts, which will prove useful for the analyses to follow. A third section, which has a methodological focus, gives an overview on results obtained from previous studies on trade liberalisation in China and on current methodological approaches towards the problem.

Chapter 3 deals with the methodology, data and the research area. It sketches the macro-microsimulation framework, which is applied in the present study. The dataset, which is used is described and Changtian village, the research area, is introduced and characterised.

Chapter 4 provides a microeconomic theory of household behaviour. Pulling together different strands of the literature on agricultural household models in an innovative manner, the chapter departs from a basic farm household model, to which the utility considerations of households regarding different employment options and aspects of migration related to household consumption demand are added in a stepwise manner. Through this process, a nonseparable agricultural household model with feedbacks to the consumption sphere is developed, serving as the theoretical core of the village equilibrium model.

In *Chapter 5*, a social accounting matrix (SAM) for Changtian village is constructed. The SAM constitutes the core dataset underlying the village equilibrium model and provides a snapshot of the village economy at the time of the survey. At this, the construction of the SAM is preceded by econometric work oriented towards the analysis of households' migration behaviour aimed at supporting the construction of representative household groups. Furthermore, household specific shadow prices for family labour and land, which have been unobserved in the sample are estimated.

In *Chapter 6*, the theoretical household model of Chapter 4 is translated into an applied village equilibrium model. This work involves the specification of functional forms and the construction of a village equilibrium framework. A first section describes these steps and discusses the main assumptions made, resulting in a full documentation of the applied model. In a second section, a number of stylised simulations are carried out in order to introduce and discuss the depiction of labour allocation by the households in the model.

Chapter 7 applies the village model in a macro-microsimulation framework to the analysis of the impacts of trade liberalisation on migration, poverty and inequality in Changtian village. In a first section, the specific set-up of the model used for the simulation is described. A second section provides details on the calibration of the model, focusing in particular on the calibration of the households' labour market behaviour. A third section deals with the scenarios applied to the village model. The national CGE study, which is the source of the trade policy shock, is presented in a more detailed manner. Furthermore, four different specifications involving two different calibrations of migration behaviour and two assumptions regarding the village land market, which are used for the analyses are discussed. In a fourth and final section, the results of the simulations are presented and discussed.

Chapter 8 summarises the work. The results of the simulations are reviewed again. Some tentative policy implications are derived and an assessment of the overall quality of the work as well as of the merits of the present approach is provided. Directions for future research efforts are identified.

2. Literature Review

The present chapter prepares the ground for the subsequent analysis of the impacts of trade liberalisation on migration, poverty and inequality on a village community in south-western China. It starts with an overview of the economic reforms which have been carried out in China during the past three decades and which have triggered a remarkable economic development and brought about profound changes to the Chinese society. The discussion focuses in particular on the agricultural sector. The consequences of the reform efforts are analysed, putting special emphasis on aspects of migration, poverty and inequality. The overall goal of this first section is to identify relevant issues, thereby defining the overarching setting of the present study.

A second section introduces theoretical concepts which serve as broad conceptual frameworks for the analyses to follow. The section starts out with a framework for the analysis of the impacts of trade liberalisation on poverty and inequality, which helps to formulate the requirements for the analytical approaches employed in this study. This first part of that section is followed by a detailed discussion of positive impacts of migration on source communities. The discussion recognises the important role rural-urban migration plays for the current study and offers insights about further aspects, which have to be taken into account by the methodological approach chosen. In a third part, the theoretical concept of a village economy is introduced, thus providing the conceptual basis for the simulation model to be developed in later chapters of this study.

In a third section, different analytical approaches which are capable to address the requirements stated by the theoretical frameworks are presented and discussed. The section begins with a discussion of simulation based analysis on distributional impacts of trade reform in China. This part not only gives an overview of the relevant literature on simulation modelling but also presents insights gained from these analyses which are useful for the present study. A second part presents applications of macro-micro simulation models for trade policy analysis. In this part, a sequential macro-microsimulation framework consisting of a CGE model which is linked to a village equilibrium model is identified as the most suitable approach for the purpose of the current analysis. Accordingly, in a third part of that section village equilibrium models are discussed in a detailed manner.

2.1. China's Economic Reforms, Poverty, Inequality and Migration

2.1.1. China's Economic Reforms

In the late 1970s, China launched economic reforms that marked the beginning of the country's transition from a planned economy toward what is now called a "Socialist Market Economy" (Wang, 2000, p.2). During four phases of reform (Fan and Gulati, 2007), China's economic system has been profoundly transformed. In a first phase from 1978 to 1984, which was aimed at the rural sector, institutional and pricing reforms have been carried out. The second reform phase, dated from 1985 to 1993, involved the promotion of urban industrial enterprises as well as a reform of the domestic agricultural marketing system. A third phase, which started in 1994 was characterised by broad-based trade liberalisation in the run-up to China's accession to the WTO in 2001. Following 2001, additional adjustments related to domestic institutional, marketing, and trade reforms have been implemented (Fan et al., 2005; Fan and Gulati, 2007). In the following, the different reform phases will be discussed.

During China's socialist era from 1949 to 1978, rural life was increasingly organised collectively through people's communes. A system of rural and urban residencies, known as the *hukou* system, tied farmers to their collectives, making it impossible for them to move between rural and urban areas (Huang et al., 2008, 2009). Agricultural production as well as agricultural trade was mainly centrally planned. State procurement dominated the commercialisation of agricultural output and farmers had to meet compulsory delivery quotas and received prices set by the central government (Sicular, 1988, 1995). Essentially, marketing of outputs and inputs was carried out by designated state agencies. Individuals or organisations other than the state agencies mentioned have been prohibited from engaging in trade or long-distance transport (Huang et al., 2009; Sicular, 1995). Although farmers have been able to sell to the state at higher prices once compulsory delivery quotas had been met and although occasionally small scale sales of grains or oilseeds on the local market have been permitted (Sicular, 1995), a market mechanism has been practically absent.

Prices for agricultural output were fixed at low levels in order to provide the urban population with cheap food. Although this policy may have helped to support the state's objective to force the development of military and heavy industries, it not only entailed the establishment of a food rationing system in urban areas, but also implied a taxation of the agricultural sector (Huang et al., 2008, 2009; Kanbur and Zhang, 2005). Along with the incentive problems inherent to the commune system, this caused that China's large agricultural sector remained underdeveloped and was characterised by low efficiency and low and stagnant productivity and incomes (Huang et al., 2009).

In the late 1970s, the Chinese government embarked upon a reform of the socialist system, starting with the reform of the rural sector. This first phase of reform is dated from 1978 to 1984 and involved institutional changes and adjustments of the pricing system in order to improve incentives to agricultural production (Fan and Gulati, 2007).

The core element of this first reform phase was the de-collectivisation of agricultural production. The former commune system was dismantled and replaced by the so-called Household Responsibility System (HRS) (Fan et al., 2005; Huang et al., 2009).[1] The new system took the responsibility for agricultural production away from the collective and put it back into the hands of the individual household. Households obtained land contracts as well as residual income rights and became responsible for their own production including the fulfilment of delivery quotas and the contribution to local collectives' accumulation and administrative funds (Fan et al., 2005; Liu et al., 1998). Thereby, in order to ensure an egalitarian distribution, control over land remained with the local collective and households

[1] In fact, various forms of decentralised production organisation have been adopted, but the HRS was the most common (Liu et al., 1998).

received land contracts which granted them income and control rights, but not the right to sell land (Huang et al., 2009; Liu et al., 1998).

Along with the introduction of the HRS, initial reforms of the agricultural marketing system have been undertaken in the late 1970s and early 1980s. Farm level procurement prices for the major agricultural commodities have been raised to market levels and compulsory delivery quotas have been reduced (Huang and Rozelle, 2006; Huang et al., 2009; Sicular, 1988). Overall, the number of products subject to state procurement has been reduced, thus limiting the volumes of mandatory, low-price quota deliveries (Liu et al., 1998). Restrictions on trading activities have been relaxed by granting individuals the permission to small scale trading operations in animal products, vegetables, minor crops and light manufactures in 1981 and by allowing private and individual commercialisation of grains once procurement quotas have been fulfilled in 1982. Furthermore, since the early 1980s, state trading agencies negotiated procurement prices, thus becoming more responsive to market prices (Huang and Rozelle, 2006; Sicular, 1995). This gradual liberalisation of the agricultural marketing system lead to the emergence of periodic rural markets and ultimately undermined the state procurement system (Sicular, 1995).

Apart from the changes in the agricultural sector, sub-national governments started to foster the growth of rural non-agricultural industries (OECD, 2005). This lead to the emergence of rural industrial clusters in the form of township and village enterprises and went hand in hand with a relaxation of the *hukou* system which reduced restrictions to the movement of labour out of agriculture. The consequence was the establishment of small rural towns and a strengthening of rural-urban linkages while at the same time reducing migration from rural to urban areas (Fan et al., 2005; OECD, 2005).

Following this first phase of reforms, the period from 1985 to 1993 witnessed a promotion of industrial enterprises in urban areas, the further strengthening of market institutions, as well as the dismantling of the central planning system. In the urban industrial sectors, the introduction of a dual-track pricing system gradually replaced prices set by the central government with market prices, thus giving an ever greater role to the market. At the same time, the so called enterprise contract responsibility system gave enterprises greater autonomy in their production and employment decisions (Fan et al., 2005).

Regarding the farm sector, the year 1985 marked the beginning of the second stage of the reform of the domestic marketing system (Huang and Rozelle, 2006). Planned procurement for most products except rice, wheat, maize and cotton was eliminated (Huang et al., 2009). During the late 1980s, procurement prices for grains and cotton have been increased to market levels and obligatory quotas for grain delivery have been finally abolished and replaced by voluntary contracts (Rozelle et al., 1997; Sicular, 1995). These changes in the procurement system as well as further reductions in the restrictions on domestic trade of commodities and the gradual commercialization of the state trading system for grains lead to the creation of markets for agricultural outputs in rural and urban areas (Huang et al., 2009). As a consequence, the rationing of grain could be phased out by the early 1990s (Rozelle et al., 1997). Furthermore, the effective isolation of consumers and farmers from international markets due to the distortions which resulted from domestic pricing and marketing policies has been gradually reduced and domestic prices in China became more responsive to world market prices (Huang et al., 2009).

This latter tendency was reinforced by some first changes in the foreign trade regime. During the 1980s and early 1990s, the formerly overvalued exchange rate experienced a sharp depreciation. This removal of an implicit taxation of the agricultural sector lead to an improvement of the competitiveness of agricultural exports and rapid export growth (Huang et al., 2007). Furthermore, restrictions to the access to import and export markets for non-state actors have been gradually relaxed and the role of state trading enterprises in foreign trade has been reduced (Huang et al., 2009).

The third reform period, which dates from 1994 to 2001, was shaped by the perspective of China to enter the WTO. Accordingly, broad-based trade liberalisation has been undertaken and the economy has been opened up to foreign direct investment (FDI) (Fan and Gulati, 2007; Kanbur and Zhang, 2005). In this phase, the socialist market economy which is still primarily under public ownership but in which resource allocation and distribution decisions are fundamentally driven by market forces took shape (Fan et al., 2005).

In order to attract FDI and to create strong export sectors, special economic zones in coastal cities have been established and tax preferences in coastal provinces have been introduced. Thus, economic policies became increasingly biased towards the promotion of the areas located at the coast (Kanbur and Zhang, 2005). At a more general scale, the financial and fiscal sectors have been reformed and rural-urban labour mobility has been facilitated (Fan et al., 2005). Nonetheless, the *hukou* system as such has still been maintained.

Regarding trade policies, the exchange rate was allowed to appreciate again since 1992. At around 30% as compared to a depreciation by more than 400% since the onset of reforms (Huang et al., 2007), however, this appreciation was comparatively small.[2] Import tariffs have been reduced systematically, falling for food products, for example, from a simple average of 42% in 1992 to 21% in 2001. Further liberalisation involved the abolishment of export subsidies, the further relaxation of licensing procedures for foreign trade, the reduction of non-tariff barriers as well as the tariffication of import quotas (Huang et al., 2004).

Following the entry of China to the WTO in December 2001, the fourth phase of reforms began. This phase involved a further deepening of the reforms carried out up to that time. Domestic institutional reforms, as well as reforms of the marketing system and trade reforms have been accelerated (Fan and Gulati, 2007). In case of the agricultural sector, the remaining restrictions on domestic marketing have been removed and government intervention in grain prices fully eliminated (Huang and Rozelle, 2006).

The three decades of reforms have left China as a broadly liberal economy. Product markets across the country have become increasingly integrated and efficient. Labour is more mobile across sectors and in particular rural labour markets are more integrated than before(Huang and Rozelle, 2006; Zhang and Tan, 2007). Nevertheless, obstacles to rural-urban migration, in particular the *hukou* system and the land tenure system, remain (Fleisher and Yang, 2006) and cause continued and significant segmentation (Zhang and Tan, 2007). In contrast to the developments in product and factor markets, however, distortions appear to have increased in the capital market which has become more fragmented (Zhang and Tan, 2007).

[2] This also explains the continuing pressure on China to further appreciate its currency (see, for example, The Economist, 2010).

In case of land markets, the current land tenure arrangements under which land is still collectively owned and leased to farm households for a period of 30 years are seen to lead to tenure insecurity and limit the amount of land market transactions (OECD, 2005). This is seen by many authors as an obstacle to improving competitiveness of agricultural production (Carter et al., 2009; Huang et al., 2008; Zhang et al., 2010). Furthermore, the tenure insecurity which stems from the present arrangements constitutes a barrier to migration, as households which leave the village to migrate run the risk of losing their land use rights. This is all the more important as land still fulfils an important social security function in China by providing households with at least a basic source of income (Huang et al., 2008; Tao and Xu, 2007).

Regarding trade policies, China has become fairly open to the outside world. Overall levels of trade protection are low. By 2009, the simple average of applied most favoured nation tariffs, which are typically higher than applied rates, was 9.6%. Tariffs on agricultural goods were at 15.6% on average and non-agricultural sectors have been protected by average tariff rates of 8.7% (WTO, 2010). However, concerns persist about non-tariff barriers to trade, such as customs procedures, import restrictions, technical regulations or standards, as well as restrictions on foreign investment (WTO, 2008).

In the realm of agriculture, China has now a relatively liberal farm sector in which markets play a central role for the allocation and distribution of inputs and outputs and in which government intervention, apart from the land tenure regime, is limited (Huang et al., 2009). In general, from 1998 onwards the focus of agricultural policies has shifted from increasing agricultural production towards supporting rural incomes. Overall levels of farm support in China, however, are still comparatively low. In 2007, the producer support estimate (PSE) expressed as percent of gross farm receipts was at 8.7%, but had followed a rising trend throughout the preceding decade (OECD, 2010). Support, however, varies greatly among products. Importables such as sugar, milk or cotton tend to be more highly protected, with the commodity specific %PSE averaging between 17% for soy-beans and 39% in case of sugar between 2000 and 2003. Exportables, such as livestock or fruit and vegetables, in contrast, tend to receive lower or even negative levels of protection (OECD, 2005).

Support to China's agricultural sector is provided through a range of domestic policy measures, such as input subsidies for water, electricity, transport, seeds, direct payments based on area farmed with rice, wheat or corn as well as payments for returning farmland to forests (OECD, 2005, 2010). Regarding trade, some protection in the form of import tariffs, tariff rate quotas (TRQs) and export subsidies, the latter in form of domestic marketing, transport and storage subsidies, is retained (Huang et al., 2009). State trading is only relevant for goods covered by TRQs (OECD, 2005).

As already mentioned in the introductory part to this section, China's economic reforms have lead to a profound transformation of the country. Certainly the most cited among the manifold changes which have occurred is the rapid economic growth. According to the World Bank (2011), between 1980 and 2009 the Chinese economy has grown by 9.5% per year on average. This has lead to an increase in the gross domestic product (GDP) per capita from 193 current US$ to 3744 US$ during the same period.

Just as the economy as a whole, the agricultural sector benefited from the reforms. Increases in yields, productivity and efficiency lead to a growth in agricultural GDP by around 5% per year since the onset of reforms to 2004, although growth rates have been higher at around 7% at the beginning and declined to slightly over 3% to the end of that period (Huang et al., 2009). Overall, agricultural production became more diversified and international trade expanded. As a consequence of the opening of trade to international markets, a specialisation in trade on labour intensive commodities such as fruits and vegetables or meat products at the cost of land intensive commodities like grains, soy-beans, edible oils or cotton could be observed (Huang et al., 2009; OECD, 2005). As growth rates in agriculture have been consistently lower than in the economy as a whole, however, the relative importance of the sector in terms of its contribution to the national GDP declined from around 30% in 1980 to 10% in 2009 (World Bank, 2011). Similarly, farming became less important as a source of employment, reducing its contribution to total employment from 71% at the end of 1970s to 42% in 2003 (OECD, 2005).

2.1.2. Poverty and Inequality

China's economic growth and development during the reform period lead to impressive progress with respect to poverty reduction: from 1980 to 2001 the overall poverty headcount ratio fell from approximately 53% to less than 8%; poverty in rural areas declined from 76% to around 13% (Ravallion and Chen, 2007).[3] As the authors point out, the major part of poverty reduction, however, occurred after the initial phase of the reforms. In fact, most of the progress achieved can be attributed to reforms in the agricultural and rural sector, i.e. to the introduction of the HRS in the early 1980s and the reform of the agricultural marketing system in the 1990s, and the resulting growth in the primary sector. Thereby, the positive impact of agricultural growth was enhanced due to the equitable distribution of land which followed from the pre-reform era (Montalvo and Ravallion, 2010; Ravallion and Chen, 2007). In addition, directed government spending had some poverty reducing impact. The contribution of trade reforms, however, is unclear and at least until 2001 no impact could be identified (Ravallion and Chen, 2007).

Ravallion and Chen (2007) also observe that the pace of poverty reduction has slowed down during the reform era and expect more difficulties in achieving further progress in the future. These difficulties are rooted in the fact that economic growth increasingly comes from sources which contribute less to the reduction in poverty, such as the industry and services sectors rather than the primary sector. This latter aspect is particularly critical as poverty still is a predominantly rural problem (Yao et al., 2004). A further cause for the expected difficulties in future poverty reduction is a persistently high and rising inequality which can be found across the country, between and within rural and urban areas as well as between China's inland provinces and the coast (Ravallion and Chen, 2007).

Indeed, the dramatic economic development and the successes in poverty reduction have been accompanied by growing disparities and inequality within China.

[3]The authors use a poverty line of 850 yuan per year for rural areas and 1,200 yuan per year for urban areas in 2002 current prices, which corresponds to a daily consumption allowance of US$ 1.08 (adjusting for differences in purchasing power). These values are chosen to allow for food consumption of 2,100 calories per person and day plus an allowance for non-food consumption. It should also be noted that poverty figures of course differ when using different poverty lines, such as China's official one, which is much lower. The trend of falling poverty, however, remains the same under different poverty lines (Ravallion and Chen, 2007; Chen and Ravallion, 2008).

After declining from about 2.3 at the onset of reforms to around 1.6 by the mid-1980s, the ratio of urban to rural incomes steadily increased to a value of 2.5 in 2001 (Ravallion and Chen, 2007). Other authors present values ranging between 2.3 and 3.2 for the year 2002 or 3.5 in 2003 (Fan et al., 2005; Sicular et al., 2007). Thereby, a further important dimension of inequality are disparities between coastal areas and inland provinces which have grown during the reform era. As a consequence of the growing divides in the Chinese society, indicators on overall inequality follow rising trends during the past decades.

The Gini index for China as a whole, for example, has risen from around 31.0% in 1981 to 44.7% in 2001, thus having reached its highest levels in the country's communist history (Kanbur and Zhang, 2005; Ravallion and Chen, 2007). Other authors even deem these estimates to be too conservative and speak of a Gini index which most likely is higher than 50 (Benjamin et al., 2008). This would imply that the coefficient has reached a critical value, which means that China has passed the threshold to a polarized society in which richer population groups reap most benefits of economic growth, whereas poor people face difficulties to secure a subsistence level of living (Feng, 2004). On the other hand, the pronounced rural-urban divide causes the overall Gini index to be lower than those for either rural or urban areas, which were estimated at around 36.5% and 32.3%, respectively, in 2001.[4] The trend in these indices, however, is also rising (Ravallion and Chen, 2007). In rural areas, for example, the annual income growth rate from 1980-2001 for the poorest decile of the population was at 3%, whereas incomes of the richest decile increased by 8% per year on average (Huang et al., 2009).

Scholars of the Chinese economy present several interpretations of the development of the disparities in the country. In general, the initial reforms steps which focused on the rural areas and the agricultural sector are seen to having brought about a reduction in inequality which reached a through in 1984 (Kanbur and Zhang, 2005; Yao et al., 2004). This observation corresponds to the comparatively strong decline in poverty during the first period described above. In subsequent reform periods, the focus of economic policy shifted away from

[4]As in case of the overall Gini index, Benjamin et al. (2008) again consider these values to be too low. They rather reckon the Gini in both urban and rural areas to be between 40% and 50%.

the rural economy and toward the promotion of the formal urban sector. This policy also had a strong coastal bias, as for example manifested in the establishment of special economic zones, and fostered the development of China's eastern provinces, thus leading to the growing rural-urban and inland-coast disparities. At this, an important role was also played by the opening up to foreign trade and foreign direct investment which further contributed to the economic advances of the coastal regions (Kanbur and Zhang, 2005). In addition, policies of decentralisation caused that local administrations increasingly had to rely on their own tax base. This enhanced the significance of historical levels of development and differences in geographical location for overall inequality and put coastal areas which could benefit from a better agricultural production environment, proximity to foreign markets, a higher initial economic development, better infrastructure and better human resources at further advantage (Kanbur and Zhang, 2005; Yao et al., 2004; Zhang, 2006). In this context, persisting barriers to rural-urban migration through the *hukou* system helped to maintain the rural-urban as well as the inland-coastal disparities (Sicular et al., 2007). On the other hand, recent research carried out by Zhang et al. (2010) finds that nationwide labour shortages have lead to increases in real wages in all provinces since 2003. This development would cause inland provinces to catch up and may result in a reduction of this dimension of inequality.

Regardless of these recent developments, high and growing levels of inequality in China are of great concern and keep occupying central stage in the political and academic debate (see, for example, Benjamin et al., 2008; Dollar, 2007; OECD, 2004). In this context, inequality matters not only from an ethical or philosophical point of view, but also because of its possible consequences for economic growth prospects. Related to the former are, for example, the relationship between inequality and poverty or under-nutrition whereas in case of the latter aspects such as the impact of inequality on aggregate savings rates or the efficiency of capital and other markets may play a role (Ray, 1998). In fact, in case of China rising inequality is found to make further reductions of poverty increasingly difficult, as it causes the poor to benefit less from overall income growth in the economy and thereby dampens the poverty reducing impact of economic growth (Ravallion and Chen, 2007; Yao et al., 2004). Moreover, higher levels of inequality might pose a threat to social stability (OECD, 2004) and are even considered to cast doubt on the overall legitimacy of China's economic reforms (Qin, 2009).

2.1.3. Migration

While rural-urban and inter-provincial disparities in China increase, a further effect which must not be neglected are the massive population movements which are driven by just these disparities, as well as by rising labour demand in expanding industrial and services sectors, land scarcity and few off-farm opportunities in many rural areas (de Brauw et al., 2002; Seeborg et al., 2000; Zhao, 2005). By the mid 2000s, the number of migrants from rural areas has been estimated at between 100 and 130 million (Cai et al., 2008; Fang et al., 2009; Wang and Cai, 2007), with approximately 20% of the rural labour force working as migrants within China (de Brauw and Giles, 2008a; de Brauw and Rozelle, 2008; Murphy, 2006). Following the gradient of economic development in the country, rural-urban migrants usually come from rural areas of the poorer inland provinces and from regions with poorly developed non-farm sectors. Furthermore, they tend to go to wealthier, urban regions, in particular they migrate to the economically more developed coastal provinces in the eastern part of the country (Carrillo Garcia, 2004; Tian et al., 2004; Zhao, 2005).

To a large extent, rural-urban migration is temporary and seasonal. Migrants maintain links with their villages of origin and circular migration dominates (Cai, 2003; Hare, 1999; Zhao, 2003), ensuring an intensive exchange between the migrants and their home communities. It is due to this exchange, combined with the mere scale of migration, that migrants can be expected to play an important role in the development of the communities of origin and thereby of the poor rural areas of the country.

This is of particular importance as non-farm employment in general and especially migration have become an increasingly important source of income for rural households in China during the past three decades (Benjamin et al., 2005). Reflecting this fact, as well as migrants' high propensities to remit, remittances make up a substantial share of the income of recipient households and of rural communities as a whole. For example, in 1995 remittances accounted for 25% of income of recipient households in 19 provinces (Cai, 2003). In a 2002 household survey from Hubei province, Zhu and Luo (2008) even find 55% income shares of remittances. Consequently, it is observed that migration increases the (per capita) income of migrant sending households (de Brauw and Giles, 2008a; Du et al., 2005; Taylor et al., 2003). At the same time, migration benefits poorer households, contributing to the alleviation of rural poverty (de Brauw and Giles, 2008a; Du et al., 2005). On the other hand, it is also found that different access to migration can enhance inequality at the level of rural communities (Xing et al., 2009). Regardless the actual direction of this impact, migration can be considered to be one of the strongest forces affecting the rural economy in the past.

The goal of the preceding explanations was to shed light on the developments which have taken place in China since the onset of the economic reforms in the late 1970s and thereby to define the broader context of the present study. It becomes clear that China has made great advances in increasing the overall income levels of its population and in reducing poverty. Furthermore, growing and persisting inequality can be identified as a highly relevant issue for the future development of the country. Thereby, the role of migration for contributing to the livelihoods of the rural population, in linking rural economies with urban sectors and in transmitting impacts of policy reforms to rural households can hardly be overestimated.

While trade reform is found to having had only limited impacts on poverty reduction (at least until the early 2000s), it appears as a relevant factor for explaining the regionally divergent development of the economy. In addition, not least due to the relatively high levels of protection which remain in the agricultural sector, further liberalisation can be expected to affect in particular this part of the economy. This is particularly relevant against the background that poverty remains a predominantly rural phenomenon. As the impacts of trade reform will not be limited to the farm sector and the rural economy alone, however, migration may fulfil a decisive function in determining the ultimate outcome of reforms.

Proceeding towards an analysis of village level impacts of trade liberalisation, the following section is concerned with theoretical concepts which may prove useful for such an undertaking. Three theoretical frameworks, each of which focusing on a different dimension of the problem, are presented. This more theoretically oriented section is followed by a third part dealing with analytical approaches which are useful for the purpose of the present study.

2.2. Theoretical Concepts

The purpose of this section is to provide a theoretical background for the analyses carried out in this study. It starts with an analytical framework for the analysis of the manifold relationships between trade liberalisation and poverty. In a second subsection, positive impacts of migration on source communities are discussed. This part recognises the particular importance of migration for the current analysis and is aimed to enhance the understanding of relevant local level processes associated with this phenomenon. A third subsection presents the analytical concept of a village economy which constitutes the basis for the modelling framework developed later on.

2.2.1. Analysing Trade Liberalisation and Poverty

When dealing with trade liberalisation and poverty, it is paramount to dispose of a clear conceptual framework regarding the causal connections between trade policy changes and household welfare. Such a general framework which describes the ways how trade policy shocks affect the poverty of households is proposed by McCulloch et al. (2001) and Winters (2002).[5]

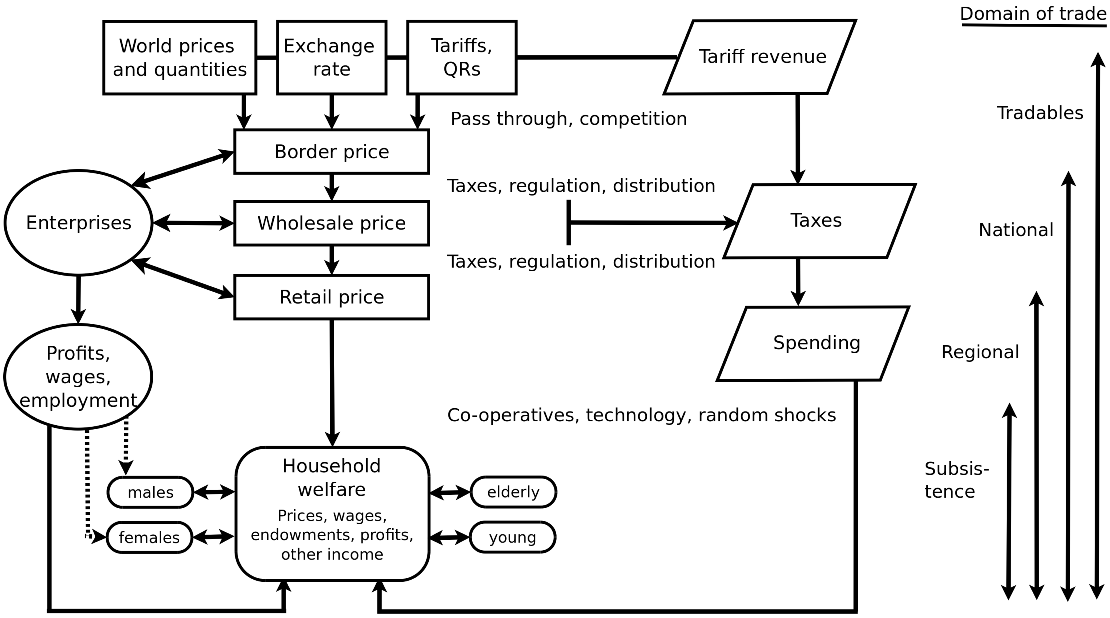
The basic analytical unit identified by the authors is the farm household as described by Singh et al. (1986a,b). The household, which is depicted in the bottom part of Figure 2.1, controls productive resources—labour, land and capital—and seeks to maximize its welfare by making decisions on production, consumption and labour allocation. Trade policy reforms affect household welfare via changes in prices for consumption goods and goods produced by the household, wages and employment, other factor rewards, and changes in taxes and government spending; effects, however, are not uniform across households. Next to the structure of household production, consumption, and factor endowments, the existence of economic alternatives and a household's ability to shift to such alternatives, matter.

[5]Unless stated otherwise, the present section draws upon these studies.

At this, the ability of the household to adjust depends on a number of factors. These factors comprise the endowment with physical and natural assets and human capital and the institutional environment which includes variables such as social barriers that might impede the realization of benefits from liberalisation, the existence and structure of markets for goods, services, and labour and the access to market information. In a survey of the evidence regarding trade liberalisation and poverty, Winters et al. (2004) highlight the importance of adjustments in production and consumption as a response of households to trade policy shocks and the relevance of these reactions for the welfare outcome of reforms. Schiff and Montenegro (1997) study the responses of agricultural producers to price incentives and find that producers tend to be more responsive if they have better access to inputs, information and credit. Likewise, Lopez et al. (1995) present evidence that farmers with low levels of capital input tend to be less responsive to price changes. In this context, they detect a correlation of price responses with access to credit, the level of education, and the quality of land.

Having identified and characterised the household as the basic analytical unit, McCulloch et al. (2001) and Winters (2002) describe the transmission channels between the level at which trade policy changes take place and the household level. The three channels of transmission distinguished by the authors are enterprises, the distribution sector and the government. The three channels are represented by the three columns which make up the conceptual framework in Figure 2.1.

The distribution channel, broadly located in the middle part of the figure, is responsible for the transmission of price changes to the household level. In an import situation, world market prices translate into border prices, depending on the exchange rate, trade policy instruments such as tariffs or quantitative restrictions, and the structure of the import trading sector. At this stage, an alteration in the trade policy instruments applied exerts its most direct influence by changing the translation of world market prices into border prices. The transmission of price changes to the household level, however, still is determined by the translation of border prices into wholesale and retail prices, the latter being those the households ultimately face. Manifold factors influence the price transmission through the distribution channels: further taxes and regulations might be applied, the structure of the trading sector and the level of competition herein play



Source: McCulloch et al. (2001).

Figure 2.1.: Trade policy and poverty.

a role and the way how households access the market—perhaps being organized in cooperatives—matter. In this context, McCulloch et al. (2001) highlight the households' characteristics as well as their access to technologies and exposition to random shocks like weather. The latter two are emphasized because of their crucial influence on productivity and hence the potential to impact on the generation of welfare at any given set of prices. Against this picture, the importance to obtain a clear picture of the transmission channels, including aspects such as the behaviour of the agents or the existence of market links, becomes clear.

A growing body of evidence is available which confirms the importance of taking into account the actual levels of price transmission when carrying out household level analyses. Kleinwechter and Rojas Lara (2010), for example, find that the transmission of prices from the Peruvian coast to the Amazon gets gradually weaker when crossing the Andean mountains. Schüttel et al. (2010) present analyses which show a strong transmission of world market prices to agricultural markets in Bolivia. Luckmann et al. (2010) provide a comprehensive analysis of the marketing chains for maize and rice in Vietnam and find mixed evidence regarding the transmission of world market prices to provincial levels: some provinces appear to be perfectly integrated with world markets, whereas others lack this connection. Nicita (2006) incorporates aspects of price transmission into a CGE analysis for Mexico and shows that differences in price transmission cause the impacts of trade liberalisation to differ between provinces.

In the context of price transmission, indirect effects and the domain of trade play another important role. Indirect effects refer to second round effects caused by the adjustment reactions of economic actors. Changes in supply and demand cause further adjustments of relative prices on the markets. Thereby, shocks may also be transmitted to markets which are not directly affected by the trade policy reforms. The strength of the second round effects, in turn, is determined by the domain of trade, which is depicted on the right hand side of Figure 2.1. The domain of trade refers to the level at which a certain good or factor is traded and defines the level at which price formation takes place. Different domains, such as the international, national, regional or local level can be distinguished. In general, the smaller the domain of trade, the larger the second round effects can be expected to be. Subsistence production is also included into these considerations, because it provides, from a conceptual point of view, goods which are nontraded at the household level.

The second channel of transmission of trade policy shocks to the household identified by McCulloch et al. (2001) and Winters (2002) is the enterprise channel. Enterprises are seen to act on markets for outputs, intermediate inputs and production factors. Thereby, they are affected by policy induced price changes, but, due to their supply and demand responses, also exert an influence on market prices. In this indirect way households are affected by the activities of enterprises. More directly, however, households receive earnings from the enterprises in the form of profits and wages. For wage earning households, it is also the level of employment which matters and which might be altered by trade policy reforms. In this context, household demographics play a role, as both remuneration and employment prospects may differ by gender or age groups.

The third transmission channel is the government, which is included on the right hand side into the framework in Figure 2.1. The government receives income from tariff revenues and taxes. These revenues may be spent in ways which affect the welfare of the households, for example via direct transfers or through public health or education systems. Mainly two major concerns are raised regarding the effect of trade reforms on the government channel. The first concern is that trade liberalisation may lead to falling government revenues. A reduction in tariff revenues might follow the reduction or abolition of tariffs. Furthermore, openness reduces the ability of governments to tax mobile factors (Rodrik, 1997) and increasing competition makes it more difficult to tax exports. In the consequence, governments might have to cut back on social expenditures or introduce alternative taxation schemes, which might shift the tax burden away from capital and towards the labour factor (Rodrik, 1997). Under this scenario, negative impacts on household welfare and in particular on the poor are possible. Negative consequences of trade reforms on the poor, however, might not be inevitable. Trade liberalisation may actually lead to increases in government revenues, for example during tariffication processes at early stages of trade liberalisation, in cases where initial tariffs exceed the revenue maximising rates or through the abolishment of tariff exemptions. Similarly, the impact of alternative taxes may depend on how they are applied and governments may set priorities when deciding upon the reduction of spending (McCulloch et al., 2001).

The second concern relates to the ability of governments to manage spending and taxation in a way that impacts poverty. Commitments on trade liberalisation made for example in multilateral or bilateral trade agreements may reduce the ”policy space” of governments by constraining the use of potentially pro-poor policies such as variable levies or production subsidies. An alternative point of view, however, might be that commitments made in the scope of trade reforms my constrain governments ability to manipulate policies in arbitrary ways, thus potentially limiting redistribution from poor to rich and reducing uncertainties which inhibit productive investments (McCulloch et al., 2001).

An example for the effects of trade reforms on government revenues is given by a study on fiscal implications of structural adjustment loans by Greenaway and Milner (1991). Comparing the experiences of five developing countries, the authors find trade reforms leading to revenue enhancement in three of the countries, whereas two had to cope with decreases in revenues. According to the authors, increases in revenues can be traced back to initial tariff levels above the revenue maximising rate, the replacement of import quotas with equivalent tariffs and the withdrawal of tariff exemptions. The countries which suffer a depletion in revenues, in contrast, had lower initial tariffs and maintained quantitative restrictions instead of replacing them by tariffs.

In addition to the conceptual framework presented by Figure 2.1 and discussed in the preceding paragraphs, McCulloch et al. (2001) discuss the issues of shocks, risks and vulnerability as important aspects for the analysis of trade liberalisation and poverty. The ability to handle economic shocks—of which trade reform is a representative—is identified as an important dimension of poverty. Consequently, if households are poor at the onset, they might be less capable to deal with a given trade policy shock. Similarly, vulnerable households, defined as those which have a high probability of being below the poverty line, may be more negatively affected by trade reforms than others. Trade reform in itself, in turn, may increase the vulnerability of households. This can happen if trade policy induced changes in prices, wages and employment bring households closer to the poverty line. Furthermore, trade liberalisation can affect the risk faced by households, both through changes in price variability due to market integration and/or the restriction of price stabilisation measures and through changes in production patterns in response to changing prices. At this, the empirical evidence of the impact on trade liberalisation on price risk faced by agricultural households points into both directions. Gilbert and Varangis (2003) find increased price variances for cocoa in west Africa. Del Ninno and Dorosh (2001), in contrast, present evidence of price stabilising effects of private imports under a liberal trade regime in Bangladesh.[6]

The conceptual framework developed by McCulloch et al. (2001) and Winters (2002) provides a valuable check-list on the multitude of linkages which have to be taken into account when analysing household level impacts of trade liberalisation. It also underlines the complexity of the processes at work which at large lead to the particular outcome of a specific trade reform. Reflecting this complexity, the empirical evidence regarding the size and direction of the impact of trade liberali-

[6]As a final aspect, McCulloch et al. (2001) mention economic growth as a way in which trade liberalisation affects poverty. They argue that the dynamic effects of openness materialized through economic growth are a crucial determinant of the poverty impacts of trade liberalisation. As the current study takes a rather short-term perspective, this dimension has been left out of the discussion. In any case, evidence regarding the relationship between trade liberalisation and economic growth is still subject to debate (Dollar, 1992; Rodríguez and Rodrik, 2000).

sation through the various channels is typically mixed (Winters et al., 2004). For example, it cannot be generalized that trade liberalisation raises agricultural prices or unskilled wages and hence has a poverty-alleviating effect. Rather, the analysis of trade liberalisation and poverty requires comprehensive, case-specific examinations. In this context, Kanji and Barrientos (2002) and Imber et al. (2003) suggest that a comprehensive analysis of trade policy impacts on welfare and poverty at the household level requires consideration of macroeconomic changes as well as micro-level analyses. Imber et al. (2003) introduce the concept of trade realities: with this approach they refrain from the concept of perfect markets and explain differential impacts of trade policy reforms by the uneven transmission of prices to economic actors, specific market structures, access to capital, the institutional and policy environment, standards and regulations, and domestic market developments. Kanji and Barrientos (2002) also call for an approach that differentiates aggregate macroeconomic effects according to their impact on specific groups.

The preceding discussion provides a guideline along which to proceed in the present analysis. In addition, the insights gained also define a benchmark against which the methodological approach of this study should be assessed.

2.2.2. Positive Impacts of Migration on Source Communities

An important focus of the present study is on migration and its impacts on poverty and inequality in rural communities. These impacts ultimately depend on the effects migratory activity unfolds on the economy of the village in question. Accordingly, the following section is dedicated to a review of the empirical evidence on the positive impacts of migration on source communities. The insights gained are summarised in a conceptual framework which serves as guideline for the subsequent analyses, but which also helps to assess the scope and limitations of the analytical approach chosen in this study. Corresponding to the focus of the study, the review deals exclusively with literature on rural-urban migration in China.[7]

[7]This section represents an extract of a paper titled "Rural-urban migration in China: An empirically based framework of diasporas' contributions to rural development" which has been presented at the Conference on Diaspora and Development in Washington D.C., July 13-14, 2009 (Kleinwechter, 2009). The paper provides an extensive review of the literature on rural-urban migration in China and deals not only with the positive impacts on migration presented here but also with institutional, administrative and social factors which exert an influence on these impacts.

From the perspective of the migrant sending community, migration means outflows of people and resulting return flows of remittances and return migration. These return flows create a number of positive impacts on the communities, ranging from the widely discussed effects of remittances over return migrants' contributions to local development to less obvious general equilibrium effects.

As already discussed in Section 2.1.1, non-farm employment and especially migration play an increasingly important role for the livelihoods of rural households in China. Higher incomes, for example, which potentially result from migration leave households with the choice of how to spend additional funds. Different ways of spending, such as increased consumption or investment in productive activities, assets, health and education are conceivable. Several authors confirm the positive effects of migration on the consumption level of households in source communities (Cai, 2003; de Brauw and Giles, 2008a; de Brauw and Rozelle, 2008; Tian et al., 2004). Theoretically, additional funds available through remittances should loosen credit constraints faced by households, thus allowing the exploitation of investment opportunities (Rozelle et al., 1999; Stark, 1982; Zhu and Luo, 2008). Evidence regarding the impact of migration on productive investments, however, is mixed. Generally, no strong link between migration and productive investment has been empirically established yet (de Brauw and Giles, 2008a; de Brauw and Rozelle, 2008; Murphy, 2006). Nevertheless, de Brauw and Giles (2008a) detect higher productive investment among richer households. De Brauw and Rozelle (2008) find higher investment levels among non-poor households, but with more rigorous testing reject the hypothesis of higher productive investment. The situation somewhat changes when analysing consumptive investments. The studies reviewed agree that remittances lead to higher expenses on durable goods and assets, such as housing and consumer durables, and thus to an improvement in living conditions (de Brauw and Giles, 2008a; de Brauw and Rozelle, 2008; Murphy, 2006). A third field of possible investment is health and education. Murphy (2006) argues that, due to the relatively high costs of health care and education in rural areas, people commonly use remittances for these purposes; however, she only presents scarce empirical evidence, citing a study by Huang and Zhan (2005) which underlines her statement.

Besides remittances, the second return flow to communities of origin is migrants returning home. In principle, return migrants have a high potential to contribute to the development of their communities by bringing back savings, technology, entrepreneurship and experience gained during their stays at the destinations (Murphy, 2006; Zhao, 2002). With respect to the use of savings, households with return migrants are found to have higher investments in production machinery, especially in machines used for farming. Furthermore, return migrants are also found to own more consumer durables and housing stock (Zhao, 2002). Evidence of return migrants creating new businesses is scant and of limited geographical scope. Nevertheless, instances of successful business establishment by returnees and positive development contributions are reported. Murphy (1999) finds that returnees created rural industries in South Jianxi in the late 1990s. Relying on a sample from nine provinces taken in 1997, Ma (2001) finds that return migrants help families engage in commercial activities. The author argues that through a general strengthening of human capital these entrepreneurial activities have substantial positive impacts on other households as well. Murphy (2006) summarizes the evidence stating, "[...]even though returned migrants who create businesses may not be large in number [...]", they may have an "[...] impact on the local economy [...] greater than their numbers alone suggest" (Murphy, 2006, p.26).

So far, the discussion has mainly focused on the impact of the flows associated with migration on the migrant households themselves. Indirect effects on non-migrant households have only been studied peripherally. Such indirect effects can be summarized as general equilibrium effects which affect local economies via the working of factor and product markets.

In theory, migration has the potential to affect the supply and demand for commodities, labour and other production factors, which in turn may change relative prices and wages in the local economy. These effects are stronger the more imperfect the market environment and the weaker the market integration of the locality is with the outside world (Taylor and Adelman, 1996). The reviewed literature on migration in China reports impacts on labour and land markets, which in turn lead to consequences for non-migrant households. With respect to labour markets, out-migration is expected to reduce the local labour force, leading to an increase in marginal productivities of labour. Furthermore, to the extent that migrant employment allows households to invest in productive activities and construction, local labour demand may increase. This may result in higher returns to labour in both home production and off-farm employment (Cai, 2003; de Brauw and Giles, 2008a,b). Indeed, a number of studies, albeit carried out at a rather aggregate level, seem to confirm this hypothesis. Tian et al. (2004) studied the contributions of rural laborers to agricultural and non-agricultural GDP and found that a transfer of rural laborers to off-farm activities increases labour productivities. This result is supported by Zhang and Tan (2007) who, over the period of China's economic reforms, analyzed the facilitation of rural-urban migration, finding increasing and converging marginal products of labour in rural areas. De Brauw and Giles (2008b) analyse the effect of migration on educational attainment of young rural residents and show that migration decreases middle and high school enrolment of both young people with migration opportunities and young people staying in communities with high out-migration. This observation points to increased opportunity costs of attending school through higher returns to local employment.

In addition to the labour market impacts of migration, several authors show that higher availability of land after out-migration benefits households which stay behind. De Brauw and Giles (2008a) report an increase in land per capita after migration. Furthermore, in spite of restricted land markets, poorer households appear to be able to take advantage of larger farm sizes. Zhu and Luo (2008) state that migration reduces demand for land and helps in "breaking up the vicious cycle of poverty – extensive cultivation – ecological deterioration – poverty" (Zhu and Luo, 2008, p.6). Although not strictly of empirical nature, a simulation study employing a village equilibrium model in Jianxi province provides further insights into the workings of these general equilibrium effects. Simulating the impact of a 10% increase in migration from a village, the author shows how households without migrants gain through the increase in (shadow) wages associated with a reduction of the village labour force and also benefit from a decreased demand for animal traction services (Kuiper, 2005).

To conclude this discussion of positive impacts of migration on source communities, it may prove interesting to take a more general perspective and look at the relationship between migration and income distribution in source communities. In fact, according to the reviewed studies, migration can be seen as a means to

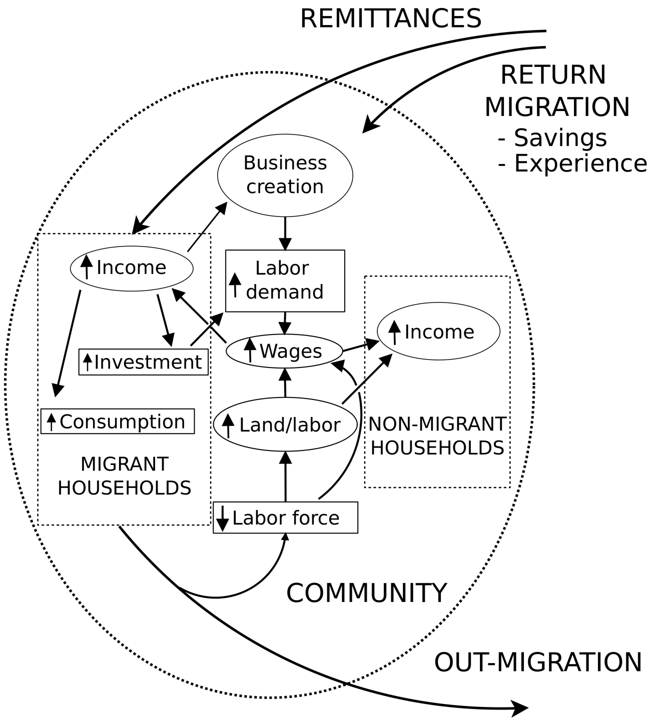


Figure 2.2.: Positive impacts of migration on source communities.

reduce income inequality and is found to disproportionately benefit poorer households, thus leading to a reduction in income gaps within villages (Benjamin et al., 2005; de Brauw and Giles, 2008a; Zhu and Luo, 2008).

The review of the empirical evidence in the previous section offers the opportunity to identify impacts of migration and allows extracting the main mechanisms at work. Figure 2.2 summarizes these impacts and mechanisms, proposing a condensed framework of positive impacts of migration at the local level.

The oval shape in the figure depicts the local community, consisting of migrant and non-migrant households. At the lower part of the diagram, the flow of migrants out of the village is shown. This outflow leads to a depletion of the labour force and to higher returns to labour, transmitted through higher land/labour ratios. This implies higher incomes for non-migrant households and for non-migrated members of migrant households.

The upper part of Figure 2.2 displays the return flows to the community, which consist of remittances and return migration. Remittances directly increase the income of migrant households. Extra income is spent on either current consumption or on investment. Investment includes productive and consumptive investment, as well as spending on health and education. Productive investments, including business creation in particular and investment in house construction, have the potential to enhance local labour demand, further increasing returns to labour. Return migration, the second return flow as indicated by the second upper arrow in the graph can further enhance business creation through financial and human capital brought by returnees.

In summary, the preceding discussion shows that migration unfolds manifold impacts on migrants' source communities, which an analysis focusing on migration most ideally should take into account. Apart from potential benefits which accrue to the households directly involved in migration and more mid- and long-term effects on economic development, general equilibrium effects are highlighted. In the following section, a more general view on these general equilibrium effects is taken by introducing a theoretical framework of village economies.

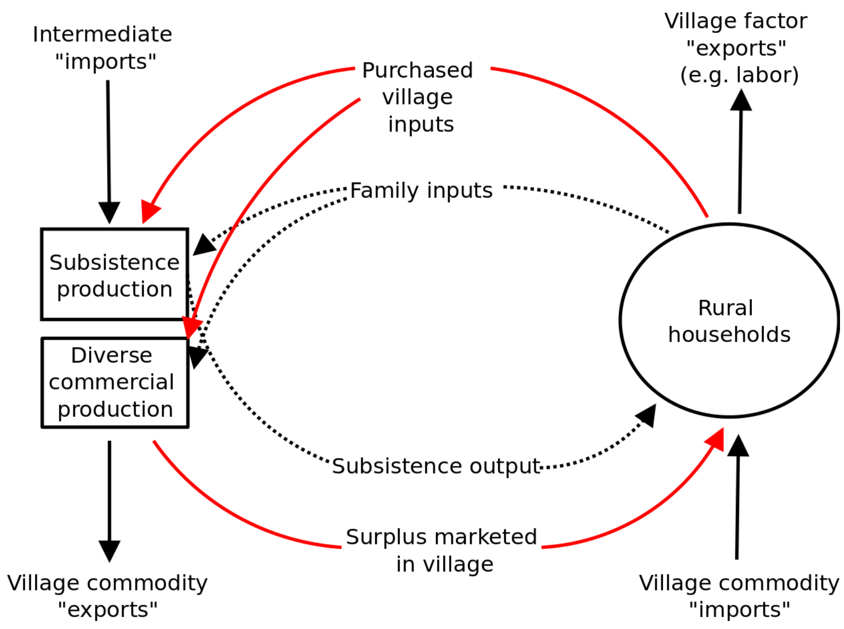
2.2.3. Village Economies

Recognizing that economic relationships between households which live together in rural communities are often characterised and shaped by interactions on local level commodity and factor markets, Taylor and Adelman (1996) propose a conceptual framework for the analysis of village economies.[8] Their framework provides for the existence of local income linkages and general-equilibrium feedbacks which arise from the interactions between households and which may to a large extent shape the outcomes of a given change in policies, markets, or the environment, both from a quantitative and a qualitative point of view.

The starting point of Taylor and Adelman (1996) is the acknowledgement that markets in rural communities in developing countries frequently are imperfect or even missing. These imperfections greatly determine the domain of trade of the goods and factors supplied and demanded in the village and may give rise to village-wide economic effects.

According to the authors, different levels of market development and thereby different levels of integration of rural households and villages with the rest of the world can be distinguished. At the one extreme, markets for goods and factors

[8] Unless stated otherwise, this section draws on the contents of the first two chapters of Taylor and Adelman (1996).



Source: Taylor and Adelman (1996).

Figure 2.3.: Village economy at intermediate level of market development.

would be entirely absent. In this case, households would act in isolation from each other, using only own resources to provide for the own subsistence.[9] At the other extreme, markets would be fully developed and the village would be perfectly integrated with the outside world. Markets would be perfect in the neoclassical sense. In such a situation, linkages between households in the village would become negligible and households would interact directly with the outside world. The situation in reality, however, most likely might be one in between these two extremes. While some goods or factors may be easily traded beyond village borders, others might only be traded within the villages and some markets might still be completely absent. In this case, the village economy would be at an intermediate level of market development.

Figure 2.3 depicts such a village economy at an intermediate level of market development. The basic production and consumption unit is the rural household, several of which constitute the village community. The households engage in the production of agricultural products for subsistence purposes as well as for commercialisation and work in off-farm jobs. For agricultural production, inter-

[9]Of course, there may still be rich social interactions. As the perspective of the present analysis, however, is economic, these aspects are neglected here.

mediate inputs imported into the village, inputs purchased from a village market and inputs owned by the households are used. Outputs are, as mentioned, either exported, marketed within the village, or directly consumed by the households. Subsistence consumption is supplemented by the consumption of commodities bought from village markets and imported into the village.

The short description of the framework already pointed to a differentiation of commodities and factors which is crucial for the model of a village economy. In the model, goods and factors are classified according the their level of tradability. The level of tradability is akin to the domain of trade and determines the level at which price formation takes place. At the lowest level are nontradables. These are goods or factors households do not trade at all and for which a household internal balance of supply and demand is established. In theory, the household balance is achieved under an unobservable shadow price. The existence of nontradables is often explained by the presence of transaction costs. These costs—conceptually a mark-up on sales or purchase prices—create a price band which causes households to choose a position of autarky instead of carrying out transactions on a market. In other instances, for example in case of family labour and hired labour, limited substitutability between the goods or factors supplied by the household and those traded on the market will again lead the household to become autarkic in the respective item (de Janvry et al., 1991; de Janvry and Sadoulet, 2003; Lopez, 1986; Singh et al., 1986a,a; Skoufias, 1994).[10]

Next to nontradables, there can be village nontradables. Village nontradables are traded only within the village. Village supply and demand are reconciled through transactions on a village market. A uniform village market price for the respective village traded item is the result of a price formation process which takes place at the village level. Village nontradables can be, for example, surplus production or inputs provided from within the village (see Figure 2.3). In case of village nontradables, the village will be self-sufficient, whereas single households may be net-sellers or net-buyers (or, if they choose autarky, even self-sufficient).

The third class of goods and factors dealt with in a village model are village tradables. Village tradables are traded beyond village borders. As a principal

[10] Nontradables are dealt with extensively in the context of agricultural household models. The interested reader might wish to refer to the cited sources for more information.

characteristic, the village is a price-taker for these items. Akin to economic trade theories, the village is considered to be a small economy which cannot exert any influence the prices which are formed at the regional, national, or even international level. Typical examples for village tradables would be intermediate agricultural inputs, agricultural output bound for commercialisation, imported manufactured consumption goods or migrant labour (see Figure 2.3).

The fact that economic feedbacks and linkages which are mediated via local level price formation mechanisms exist implies that outcomes of a given policy shock are shaped by local general-equilibrium effects (recall the discussion in Section 2.2.1). While the strength and relative importance of such second round effects depends on the level of market development, they may influence policy impacts both quantitatively and qualitatively and ignoring them might distort economic analyses to a non-trivial extent. These concerns which have arisen from the theoretical contemplation of village economies have lead to the development of village CGE models. Being an approach which occupies the ground between agricultural household models and more aggregate (e.g. national level) CGE models, village equilibrium models allow to capture economic interactions which take place at the local level and hence permit to account for local general-equilibrium effects in the analysis. Following sections on simulation based analyses on distributional and poverty impacts of trade liberalisation in China and on the application of macro-micro models for trade policy analysis, a more detailed discussion of the methodology is provided in Section 2.3.3.

2.3. Analytical Approaches

In the previous Section 2.2, theoretical concepts for the analysis of trade liberalisation and poverty and of the impacts of migration on source communities are discussed. Furthermore, a conceptual framework of village economies in developing countries is introduced. More than all, the discussions show that analysing migration, poverty and inequality in the context of trade liberalisation is a complex endeavour.

The apparent complexity of the processes to be analysed calls for a methodological approach which is comprehensive but at the same time capable to offer sufficient level of detail. Processes which take place at national or even global levels have to be captured at the same time as aspects which are relevant at the household and village level have to be taken into account. Simulation models which are based on economic theories of partial or general equilibrium represent obvious candidates. Equilibrium models are not only comprehensive in their coverage and able to capture the different feedback relationships and interdependencies which characterise economic systems. They also offer substantial flexibility and thereby are attractive tools to address a great variety of research questions.

The following sections are dedicated to a review of studies employing equilibrium modelling techniques. Due to the sheer size of the body of literature available, the review is limited to studies of direct relevance for the present analysis. In a first section, on overview on simulation based analyses on distributional and poverty impacts of trade liberalisation in China is presented. A second section deals with the application of macro-micro models for trade policy analysis. In the final section of this chapter, the village equilibrium modelling approach is discussed in a detailed manner, and a special focus is put on the modelling of migration in this type of models.

2.3.1. Simulation based analyses on distributional and poverty impacts of trade liberalisation in China

Since the mid-1990s, China's trade policies have increasingly attracted the interest of researchers. Early studies typically employed CGE models to assess the welfare impacts of different trade liberalisation scenarios (Gilbert and Wahl, 2002; Wang and Zhai, 1998; Yang and Huang, 1997). After 2001, several studies analysed China's WTO accession and later on possible impacts of the Doha Round, as well as other, more stylised, liberalisation scenarios. Research employed PE agricultural sector models (Huang et al., 2003, 2007), CGE models (Anderson et al., 2004; Diao et al., 2003a,b; Hertel et al., 2004b; Ianchovichina and Martin, 2004; Li et al., 2006; Zhai and Wang, 2002; Zhai and Hertel, 2006, 2010), or combined macro-microsimulation approaches (Chen and Ravallion, 2004; Kuiper and van Tongeren, 2006a; Yang et al., 2010; Zhai and Hertel, 2010).

Using an agricultural sector model (CAPSiM), Huang et al. (2007) found that trade liberalisation may contribute to poverty alleviation in some provinces, but can lead to adverse poverty and equality impacts in others. Poor households in northern and western provinces gain proportionally less, due to their initial production structure including a high share of products with little competitive advantage and limited access to off-farm labour.

In the area of CGE models, some studies use the GTAP global trade model (Hertel, 1997). Research by Anderson et al. (2004) and Ianchovichina and Martin (2004) found increasing farm/non-farm inequality as a result of trade liberalisation. The authors all agree that households are likely to benefit from trade reforms if they are able to send members to jobs in the expanding industrial and service industries. This highlights the importance of rural-urban migration.

Zhai and Wang (2002) and Hertel et al. (2004b) incorporate explicit treatment of the rigidities of the Chinese labour market in national CGE models for China. Results show that WTO accession leads to the expansion of labour-intensive exports. Due to labour mobility restrictions, gains from the corresponding expansion in the manufacturing sector are smaller for rural households than for urban households, which leads to an increase in rural-urban income disparities. Household gains increase along the gradients of rural-urban location and specialization in non-farm labour income (Hertel et al., 2004b).

In a later study which employs an updated version of their model, Zhai and Hertel (2010) simulate the impacts of unilateral trade liberalisation by China. A scenario of full unilateral liberalisation shows that the removal of the relatively higher protection in the agricultural sector leads to lower returns to farm land and unskilled labour. This triggers increased rural-urban migration and causes rises in poverty and inequality.

Regional impacts of WTO accession are emphasized by Diao et al. (2003a,b), who apply a regionally disaggregated CGE model for China. The effects on agricultural households depend on their production structure, which differs regionally. Access to non-farm labour plays an important role, as returns on non-agricultural activities rise relatively more.

The first application of a macro-microsimulation approach to Chinese trade policies was performed by Chen and Ravallion (2004). In order to derive welfare changes, results from GTAP are mapped into households' marginal utility functions. Overall, there is almost no impact on inequality but a slight increase in poverty. The authors conclude that ”the most vulnerable households tend to be in rural areas, dependent on agriculture, with relatively fewer workers and with weak economic links to the outside economy through migration” (Chen and Ravallion, 2004, p.20).

More recent works address the likely impacts of a conclusion of the WTO Doha Round and of global free trade scenarios (Kuiper and van Tongeren, 2006a; Yang et al., 2010; Zhai and Hertel, 2006, 2010). As a common characteristic, the studies all employ coupled modelling frameworks which use global CGE models as macro modules to provide shock variables for lower level models, such as national CGE or PE models or village equilibrium models.

Zhai and Hertel (2006) draw upon global results from the GTAP model which are fed into a version of the national CGE model already used in Zhai and Wang (2002) and Hertel et al. (2004b). Their analysis shows that—due to its low import protection after WTO accession—China’s future welfare gains will come entirely from liberalisation of other countries. Liberalization does lead to expanded outputs of some manufacturing sectors, but output of other sectors might decline. Agricultural outputs increase as well, and, consequently, labour is diverted from high-productivity manufacturing sectors to low-productivity agricultural sectors. Rural agricultural households are expected to see the greatest gains, while the smallest welfare increases are with urban, diversified households. For both scenarios, the overall result is a small decline in poverty and in rural-urban income inequality.

Using a policy shock generated with the World Bank’s Linkage model and an updated version of their model already mentioned, Zhai and Hertel (2010) assess the impacts of trade liberalisation in the rest of the world. In this simulation, similarly to those described before, improved access to agricultural export markets would favour China’s farm sector and lead to a reallocation of labour away from non-agricultural sectors and thereby to less rural-urban migration. Such reform would favour the rural poor and entail reductions in poverty and inequality.

Yang et al. (2010) link the GTAP model to a version of the CAPSiM agricultural sector model and simulate different Doha Round proposals. While the simulated reforms in general favour the agricultural sector as a whole and lead to increases in incomes of all farmers, more wealthy farmers benefit from disproportionally higher increases whereas poorer and ethnic minority households have lower income growth. Furthermore, there are differences across the provinces of China. Similar to Huang et al. (2007), the authors explain this result with differences in initial production structures.

While the studies by Zhai and Hertel and Yang et al. still take a rather aggregate perspective, Kuiper and van Tongeren (2006a) provide the first analysis to bring trade policies down to the level of a rural community. Relying upon the same GTAP results as Zhai and Hertel (2006), they present a village equilibrium model of a Chinese village economy and emphasize that uneven access to migration transmits rural-urban inequalities to the village and increases intra-village inequality. However, this effect might be mitigated by specialization of households without access to migration, leading to ambiguous inequality effects. The study reveals that the impact of trade reforms on poverty and inequality results from a complex process that is shaped "by the interplay of initial endowments, village markets for inputs and outputs, and market imperfections" (Kuiper and van Tongeren, 2006a, p.241).

The conclusions from the studies reviewed are relevant to the present work for two main reasons. First, many of the authors emphasize the importance of non-farm incomes and rural-urban migration for poverty alleviation. This implies that effects of trade policy on rural communities need to be analysed in an economy-wide framework that includes urban sectors as well. Second, changing rural-urban inequality, different regional impacts, and different impacts within village economies are explained, to a large extent, by production and consumption patterns as well as initial factor endowments. Therefore, these aspects must be depicted at a disaggregated level, such as in microsimulation models.

The major drawback of the studies reviewed in this section with respect to poverty and income distribution lies in their high level of aggregation, which permits only rough statements about the differential responses of individual actors and does not take local market conditions into account. An exception is the sequential macro-microsimulation approach applied by Kuiper and van Tongeren (2006a). Following the route shown by this study, the following section provides an overview on integrated macro-microsimulation approaches that are suitable to address the issues which are in the focus of this research.

2.3.2. The application of macro-micro models for trade policy analysis

The basic idea of macro-micro simulation is to assess the effects of macroeconomic changes at the micro-level (e.g., households), taking into account the heterogeneity of individuals and households. The distinguishing features of these approaches are that the microeconomic assumption of a representative agent is fully or partly abandoned (Reimer, 2002) and that local economic conditions can be taken into account.

According to Boccanfuso et al. (2008), there are three distinct groups of macro-microsimulation models: the fully integrated multi-household model (IMH-CGE), the CGE microsimulation sequential (CGE-MSS) approach, and the CGE top down-bottom up approach. For the IMH-CGE, disaggregated household data and microsimulation specifications are integrated into a national CGE model. In so doing, the models allow calculation of welfare changes for individual households while accounting for equilibrium effects in the economy.

An example of this approach is given by Cogneau and Robilliard (2000), who integrate an econometrically-estimated labour allocation model for 4,508 households into a general equilibrium model and simulate the impact of different growth strategies on poverty and income distribution in Madagascar. A second example is a study by Cockburn (2004). In a CGE model that is designed to depict poverty impacts of trade liberalisation in Nepal, the number of household categories in the model is increased to match the actual number of households from a nationally representative sample. More recent studies using IMH-CGE models (Cororaton and Cockburn, 2007; Emini et al., 2006) draw upon these approaches. These models eliminate the representative household hypothesis, but the impact of local market conditions still is not captured.

To apply the CGE-MSS approach, a two-staged modelling framework is constructed. First, changes in aggregate economic variables (e.g. prices) are calculated, usually by an economy wide CGE-model. In a second step, the results of this first simulation are fed into a post-simulation framework that allows computing effects on real or highly disaggregated representative households. Poverty and distributional impacts can be calculated by applying poverty and income distribution measures to the data obtained from the second step of the simulation (Reimer, 2002).

In their pioneering study, Robilliard et al. (2001) use a CGE-MSS approach to quantify the effects of the 1997 financial crisis on poverty and inequality in Indonesia. A standard CGE model is applied to generate a vector of changes in prices, wages, and aggregate employment. The post-simulation framework consists of a combination of an econometrically estimated occupational choice model with an income generation model. The occupational choice model allows individuals to switch their sector of employment, depending on macroeconomic changes and individual characteristics. The income generation model allows calculation of household income as a function of attributes of individual household members and general household characteristics. Several studies have followed this approach, with slight variations with respect to the macro model and with varying econometric specifications of the occupational choice model and the income generation model (Arntz et al., 2008; Bourguignon et al., 2003; Bussolo et al., 2006; Ganuza et al., 2005; Herault, 2006; Lay et al., 2008; Vos and de Jong, 2003). In a related manner, Filho and Horridge (2006) used a household model to simulate income generation, household demand, and labour supply in an analysis of the WTO Doha Round in Brazil.

Other authors limit their microsimulation module to a pure income generation model without occupational choice specifications (Nicita, 2006). Chen and Ravallion (2004) use a CGE-MSS approach to assess the welfare effect of China's accession to the WTO based on a household utility function. Unlike the work of Robilliard et al. (2001), this specification of a microsimulation model also accounts for changes in consumption and expenditure and thus allows for a more comprehensive welfare analysis. Similar applications of this utility function-based approach are found in Hertel et al. (2004a) and Arndt (2006). An extension is the work by Ravallion and Lokshin (2008) who use first-order approximations of households' revenue and demand functions to derive welfare impacts of trade reform in Morocco.

Overall, the approaches discussed up to this point advance the practice of considering household characteristics. Actual market conditions, however, are still neglected. This becomes different in the study by Kuiper and van Tongeren (2006a) already mentioned above. In their village level analysis of the impacts of a WTO policy scenario on rural China, the authors explicitly account for the fact that some production factors, as well as locally-produced consumption goods, are not traded outside the village and depict price equilibriums on village markets disintegrated from national or world markets. Furthermore, imperfect labour and land markets are considered. The modelling framework used in that study consists of the GTAP model that simulates changes in commodity prices and manufacturing labour demand and a village equilibrium model such as originally proposed by Taylor and Adelman (1996). The basic units of village models are agricultural household models. These models are used to depict production and consumption decisions of agricultural households, if necessary under conditions of market imperfections that lead to non-separability of household decisions (Singh et al., 1986a; de Janvry et al., 1991). The village equilibrium framework connects several household models through a set of local general equilibrium closures that allow general equilibrium effects to be captured within a local economy (Taylor and Adelman, 1996).[11]

The CGE top down-bottom up approach was pioneered by Savard (2003). Savard combines a national CGE model for the Philippines with a household model. Household behaviour (i.e., consumption, income generation, and occupational choices) is excluded from the CGE model and simulated with a household model for individual households from a nationally-representative sample. To solve the combined model, results are fed iteratively from the CGE-model to the household model and back until solutions converge. Thus, the approach differs from the CGE-MSS approaches in that communication between the models not only takes place from the top down, but a recursive link back from the micro level is integrated. Further studies by Savard (2005), Thierfelder et al. (2007) and Bourguignon and Savard (2008) build upon this approach.

For the present work, a CGE-MSS approach is envisaged, as the focus is on a specific village in Guizhou province which is not representative of rural China and therefore does not allow results to be fed back into a national CGE level. CGE-

[11]For a more detailed discussion of the approach, see the following Section 2.3.3.

MSS approaches are well developed; however, to the knowledge of the author, a specification of micro-modules that convincingly brings together the depiction of local market conditions and occupational choices, especially with respect to labour migration, is still missing.

2.3.3. Village Equilibrium Models

Village equilibrium models are CGE implementations of agricultural household models in a village equilibrium framework. Developed on the basis of the theoretical framework presented in Section 2.2.3, they are used to describe and depict village economies in developing countries. As an overlap of micro-level agricultural household models and more aggregate CGE models, village equilibrium models have the salient feature of being able to take into account heterogeneity of economic actors up to a substantial degree as well as to capture general equilibrium effects arising at the rural community level. The provision for heterogeneous agents reduces the aggregation bias inherent to macroeconomic modelling approaches. At the same time, the consideration of interactions among agents, which take place at a local level, catches important characteristics of economic systems which are neglected in microeconomic agricultural household models. Thus, village equilibrium models constitute useful tools to analyse policy outcomes for small groups with varying characteristics within a population, while these models accurately capture the transmission of a particular economic shock throughout a local economy.

Village equilibrium models are built upon micro-level SAMs which, by providing a consistent snapshot of a village economy at a certain point in time, have soon become the preferred framework for carrying out further analyses. Departing from village SAMs, early village level modelling studies applied SAM multiplier approaches, including multiplier decomposition (Pyatt and Round, 1979) and structural path analysis (Defourny and Thorbecke, 1984), with the aim of exploring the nature and strength of economic linkages within as well as assessing the impact of economic shocks on local economies. Issues which have been studied include, for example, the effect of changes in inflows of remittances and government transfers (Adelman et al., 1988), impacts of output fluctuations and investment in irrigation (Subramanian and Sadoulet, 1990) or the assessment of alternative rural development schemes (Parikh and Thorbecke, 1996).[12]

Recognizing the rather restrictive assumptions of the SAM multiplier approach, Taylor and Adelman (1996) developed a first village CGE model by embedding a neoclassical agricultural household model (Singh et al., 1986a) into a local general equilibrium framework. Compared to SAM multiplier models, the village equilibrium model has the advantage of abandoning the fixed price assumption as well as the advantage of allowing for a much more flexible depiction of the behaviour of economic agents. Moreover, the Taylor-Adelman model incorporates the assumption of nonseparable household decisions, an important feature of agricultural household models which helps to explain behavioural patterns which otherwise might appear irrational from an economic perspective (de Janvry et al., 1991; de Janvry and Sadoulet, 2003). The main insight from nonseparable household models is that decisions of a household subject to nonseparability are not governed by market prices, which are exogenous to the household alone, but are instead governed by endogenous shadow prices determined inside the household. Nonseparability implies that household behaviour can no longer be analysed in a separable and recursive manner by first optimizing income from household production and then utility from consumption (Singh et al., 1986a). It is rather necessary to consider maximization of profit and utility as interdependent optimization processes. As this interdependence affects the comparative statics of a household model (Singh et al., 1986a; Lopez, 1986), its implementation in a village equilibrium model constituted a major step towards a more realistic depiction of household behaviour.

Following Singh et al. (1986a), Taylor and Adelman (1996) assume missing markets for family labour and land as the reason underlying the nonseparable nature of household decisions in their model; however, household decisions may become nonseparable due to a larger variety of conditions. Nonseparability may occur when farm households act in an imperfect market environment (de Janvry et al.,

[12]Although not strictly at the village but rather at a regional level, a study by Lewis and Thorbecke (1992) which analyses aggregate and household level impacts of sectoral changes in production should be mentioned in this context, as well. Furthermore, more recent studies which apply multiplier approaches to village level data exist (Yuñez Naude et al., 2006; Subramanian and Qaim, 2009).

1991; de Janvry and Sadoulet, 2003; Singh et al., 1986a). Reasons why markets might be imperfect or even fail include variable transaction costs on product or factor markets, fixed transaction costs which constitute market entry barriers or constraints on market participation, and missing markets such as for capital, land or labour (see, for example, de Janvry and Sadoulet, 2003). Apart from market imperfections, nonseparability may be caused by imperfect substitutability between hired labour and family labour or by preferences of households regarding the participation in certain employment activities (Lopez, 1986; Singh et al., 1986a; Skoufias, 1994)[13]. Nevertheless, these reasons for nonseparability have not been considered yet in village equilibrium models.

Kuiper (2005), however, recognizes the rather strong character of the assumption on the reason which underlie the nonseparability of household behaviour in the Taylor-Adelman model. Offering an extension of the village equilibrium approach, she introduces fixed transaction costs in product and factor markets into her village equilibrium study of a rural community in China. This implementation of the price band model proposed by Sadoulet and de Janvry (1995) relaxes the strong assumption of missing factor markets and allows for the consideration of imperfect markets as an intermediate case between a perfect and a missing market. To date, the Kuiper model represents the latest development in village equilibrium modelling.[14]

The modelling of migration in village equilibrium models exploits the possibility to flexibly incorporate assumptions on household behaviour. This offers scope for a realistic depiction of the migration behaviour of households and their migration responses due to economic shocks. Moreover, village equilibrium models are able

[13] There are a number of studies available which carry out analyses based on a nonseparable agricultural household model under different assumptions regarding the reasons which lead to nonseparability. Benjamin (1992), Sadoulet et al. (1998), Sonoda and Maruyama (1999) and Sonoda (2008), for example, assume imperfect labour markets. Carter and Yao (2002) carry out an analysis of nonseparability due to imperfections in the market for land. Benjamin (1992) adds the case of nonseparability caused by imperfect substitutability of hired and family labour and Lopez (1984, 1986) presents a nonseparable model in which households have preferences regarding different occupations.
Please also note the conceptual parallel to the theoretical discussion of Section 2.2.3, where the concept of nontradables has been introduced. As supply and demand are reconciled within the household in case of nontradables, a shadow price which is endogenous to the household arises and the model becomes nonseparable.

[14] Applications of this model include Heerink et al. (2006), Heerink et al. (2007) and Kuiper and van Tongeren (2006a).

to capture potential impacts of economic shocks which can be, for example, an assumed variation in migration or flows of remittances or any change in economic policies which in turn may provoke alterations in migration and remittances on all members of a local community, including those who are not directly involved in migration. Accordingly, the approach has been successfully applied to study different aspects of migration. Taylor et al. (1999a) and Taylor et al. (1999b), for instance, analyse the impacts of alternative agricultural and trade policy scenarios on production, income and migration in rural Mexico.[15] Kuiper (2005) simulates the effects of an increase in migration on production and consumption in a Chinese village. In a similar fashion, Kuiper and van Tongeren (2006a) administer a migration shock which is part of a broader Doha Round trade liberalization scenario to the same Chinese village model. All studies highlight the importance not only of migration, but also of economic interactions within a village and local general equilibrium effects for the nature of a particular policy outcome.

With respect to the modelling of migration, the village equilibrium studies cited above use two different approaches. Taylor et al. (1999a) and Taylor et al. (1999b) apply the model developed by Taylor and Adelman (1996). In this model, the level of migration is determined endogenously, as households allocate labour to migration until the marginal returns to migration (i.e. remittances) equal the marginal returns from labour in each alternative income generating activity. The marginal returns, in turn, correspond to the household shadow wage. The household shadow wage itself reflects the marginal valuation of family time and leisure. That is, the extent to which a household engages in migration is determined to be an equilibrium between the allocation of family time to migration and other activities and the consumption of leisure. While this approach offers the great advantage of allowing for endogenous changes in the level of migration as a response to a given economic shock, it captures only two ways of how migration impacts the household economy; namely the income from migration which accrues to the household and the competition between migration, other activities and leisure for the scarce time the household is endowed with Taylor and Adelman (1996). It neglects, however, the impact of migration on consumption demand due to mi-

[15]Further studies, which apply the approach economy-wide are Materer and Taylor (2003) and Taylor and Dyer (2009).

gration related changes in the household size which can constitute an additional benefit to the household.[16] Furthermore, the approach does not take into account potential disutility generated through the engagement in migration. This, as the authors themselves acknowledge, may lead to an overestimation of the level of migration (Taylor and Adelman, 1996). Kuiper (2005) tackles the issue of the consumption impacts of migration by implementing a per capita LES, thus creating a feedback between the level of migration and the consumption sphere of the household. The change in migration, however, is modelled as an exogenous shock and not as a decision endogenous to the household.

Following this discussion, two major challenges with respect to modelling migration in village equilibrium models can be identified. The first challenge consists of modelling migration as a decision endogenous to the household while simultaneously taking into account the impact of migration on consumption demand. The second challenge, related to the question of disutilities arising from participation in migration, involves a more general issue with respect to the depiction of the migration responses of households. In principle, both Taylor and Adelman (1996) and Kuiper (2005) model migration as demand driven in the sense that an external demand shock triggers a supply response by households. Such an external demand shock can either consist of changes of the wage rate in migration, i.e. in the returns to migration as in case of Taylor and Adelman (1996), or of a change in employment in migration as in the studies by Kuiper. In reality, however, it can be observed that households respond differently to changes in incentives to migration and these differences are often due to supply side characteristics of the households. The presence of children or elderly, for example, may make migration a less attractive option for a young couple. Likewise, the need for childcare may require at least one person to stay at home (i.e. on the farm) and make farm work the preferred option for this person. It can be argued that in both of the current village equilibrium modelling approaches it is possible to accommodate migration responses which differ among households. In the Kuiper model one could simply define household group specific migration shocks according to assumed differences

[16] It constitutes a benefit in case of increasing household migration as there will be less persons with demand for consumption. In case of decreasing migration, total demand inside the household will increase. Hence, the competition for income intensifies.

in migration responses. In the Taylor-Adelman model differences in migration responses can be implemented through the household specific calibration of an elasticity of remittances with respect to family time allocated to migration which forms part of a remittances function.[17] Nonetheless, both approaches would be rather ad hoc and would lack a sound theoretical base with respect to the supply side considerations mentioned above. Thus, while village equilibrium models appear to be a promising choice for the present study, there is still scope for improvement related to the modelling of migration in such models.

2.4. Summary

The discussions of China's economic reforms make clear that the country has carried out substantial and ambitious reforms during the past three decades. These reforms have resulted in impressive economic growth and a substantial reduction in poverty on the one hand and in increases in inequality on the other hand. In particular as substantial disparities between rural and urban areas persist, rural-urban migration occupies central stage both for the livelihood of rural households and for the outcome of further policy reforms. In this context, because of the fact that poverty is still predominantly rural, the likely impacts on the agricultural sector as well as its historical relevance as a factor contributing to inequality, trade liberalisation can be expected to play an important role for the future development of poverty and inequality in the country.

From an analytical point of view, when seeking to analyse impacts of trade reform at the household level, a number of different factors and impact pathways have to be taken into account as well as a broad range of complex interactions among them. Thereby, the ultimate outcome of trade reform depends on characteristics of individual actors as well as on local market conditions. Similarly, in the specific case of the effects of migration on source communities, direct and indirect effects which also involve non-migrant households play a role.

These findings call for a methodological approach capable of taking economy-wide processes into account while at the same time being able to offer a detailed

[17] Taylor and Adelman (1996) do exactly this, but state differential access to migrant labour markets rather than supply side factors as the underlying rationale.

perspective at the level of individual actors as well as covering local market conditions. Here, macro-microsimulation approaches can be identified as the method of choice and in particular a village equilibrium model coupled to a CGE model constitutes the most adequate tool for the purposes of the present study. In such village models, special emphasis should be put on the depiction of households' labour migration decisions. Building upon these insights, the following chapter proceeds with the presentation of the methodological approach taken. In addition, information on the data as well as on the research area is provided.

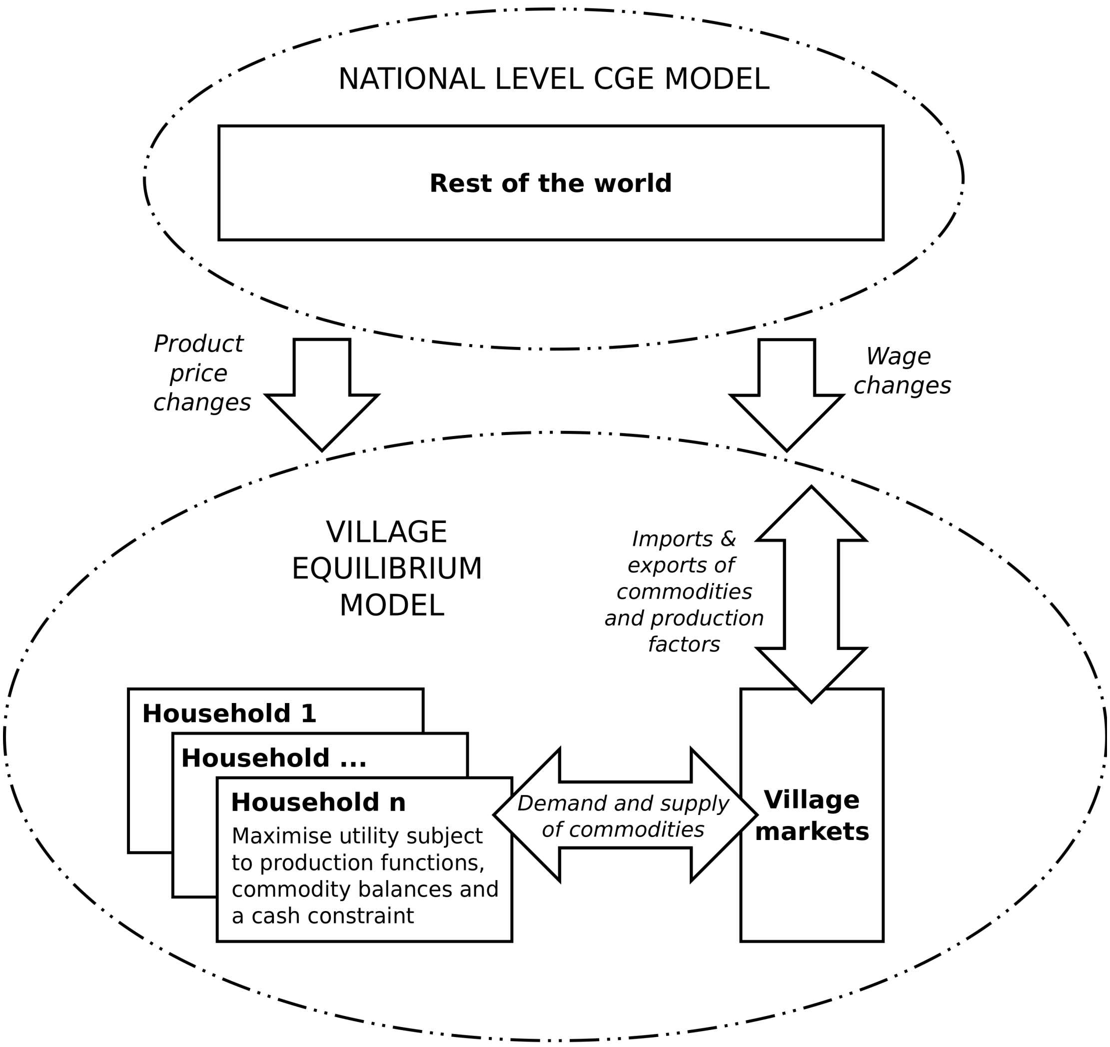
3. Methodology and Data

During the discussions of the theoretical approaches related to the analysis of impacts of trade liberalisation on poverty and inequality, macro-microsimulation approaches are identified as the most suitable methodology. The following section provides a first general overview of this methodological framework. Following a presentation of the general set-up of the framework, it is discussed against the background of the theoretical concepts introduced in Section 2.2. A second section offers an introduction to the data used and provides detailed information on the research area.

3.1. Methodological Framework

In order to assess the impacts of trade liberalisation on poverty and inequality on a rural community in south-western China, the present study applies a village equilibrium model in a macro-microsimulation framework. The modelling framework, depicted in Figure 3.1, consists of a national level CGE model which serves as a macro-module and a village equilibrium model which constitutes the micro-module. From a conceptual point of view, the national CGE model represents the rest of the world for the village and provides national level changes in prices and wages following trade reform. The price and wage changes are fed as a shock into the village equilibrium model. The village model itself facilitates a disaggregated contemplation of a number of household groups, which represent the village population. It depicts comparative static adjustment reactions while taking into account local market conditions, such as missing markets or the presence of village markets.

In order to limit the scope of the present study, the focus is put on the village equilibrium model. Starting from a theory of household behaviour to the creation



Source: Adapted from Kuiper (2005).

Figure 3.1.: Village equilibrium model in a macro-microsimulation framework.

of a village SAM and the establishment of the final model, it is developed in the following Chapters 4 to 6. Results from a national CGE model are taken from published studies and used for policy simulations. Details are presented in Chapter 7. As no feedback between the village model and the national CGE model is established, the framework constitutes a sequential top-down approach.

The bottom part of Figure 3.1 offers a schematic overview of the village equilibrium model. In the model, the village is made up by a number of representative households. The households demand and supply commodities from and to village markets.[1] Village surplus is exported from the village and anything the village

[1]The term “commodities“ used here refers to both goods and factors. According to the discus-

cannot provide on its own in sufficient amounts is imported. Household and village level market balances constitute the general equilibrium framework of the model and define the domain of trade. Depending on whether a commodity is nontradable, village nontradable or village tradable, the general equilibrium framework determines the level of price formation: Prices can be formed within the household, at the village level or in the rest of the world, in the latter case taken as exogenous by the village.

The village equilibrium framework connects a number of agricultural household models, which constitute the basic building blocks of the village model. The agricultural household models are extensions of the basic model proposed by Singh et al. (1986a) and define the behaviour of each representative household group. Households are assumed to maximise utility subject to production functions, commodity balances and a cash income constraint. The models take into account nonseparability of households' production and consumption decisions. Nonseparability stems from two sources. First, family labour and hired labour are assumed to be imperfect substitutes in agricultural production. Second, utility considerations are taken into account in the modelling of households' decisions on the supply of labour to local off-farm employment and migration.

The proposed approach to the modelling of off-farm labour supply represents the methodological novelty in this study. The approach allows for an incorporation of supply side related differences in migration responses between households, which arise due to differences in socio-economic characteristics into a village equilibrium model. Thereby, it addresses the methodological challenges related to the modelling of migration which have been formulated in Section 2.3.3 and contributes a proposition for a refined treatment of migration to the literature on village equilibrium models.

The review of the theoretical approaches to the poverty impacts of trade liberalisation in Section 2.2.1 and the effects of migration on source communities in Section 2.2.2 provide the guideline for the choice of the methodological framework used in this study. In addition, the review constitutes a benchmark against which to assess the scope and the limitations of the approach chosen. Accordingly, a

sion in Section 2.2, these can comprise intermediate inputs, produced outputs, manufactured consumption goods, as well as land and labour.

number of limitations of the proposed modelling framework are highlighted in the discussion to follow. However, rather than leading the reader to dismiss the approach as insufficient, it is aimed at providing a background for the interpretation of the simulation results presented in later parts of this study. The goal is to prevent the results from being taken at face value and to force the reader to recognise the real character of the present work: a modelling exercise based on a set of restrictive assumptions which nevertheless has the potential to yield interesting and new insights into an arguably complex matter.

At the household level, the analytical framework for the impact of trade liberalisation presented in Section 2.2.1 highlights a number of factors which determine the poverty effects of trade reforms: next to the structure of household production, consumption and factor endowments, it is the existence of economic alternatives as well as households' ability to adjust which matters. The latter, in turn, is related to households' endowment with physical assets and human capital as well as the institutional environment, such as social barriers to market entrance or the existence of markets for commodities or credit. Finally, aspects of risk and vulnerability are mentioned. By taking an explicit micro-level perspective, the village equilibrium model applied in this study is well suited to address a broad range of these factors.

Although not depicted as individual units, households are dealt with in a highly disaggregated manner. Thus, differences in production, consumption and factor endowments are taken into account up to a certain point. The existence of economic alternatives is considered insofar as households can adjust to trade reforms by choosing out of the portfolio of activities they have been engaged in in the initial situation. The set of activities, however, is static and no new alternatives can be developed.[2] Regarding households' ability to adjust, the model takes a simplistic approach. As the model constitutes a comparative static analysis, households can reallocate their production factors and adjust their consumption pattern following changes in relative prices. Aspects of human capital are taken

[2]This problem is similar to the so called "small shares stay small problem" known from the CGE literature. It refers to the problem that in CGE trade models, which apply the Armington approach (i.e. the modelling of imports and exports as imperfect substitutes using Constant Elasticity of Substitution (CES) functions) the trade impact of tariff reductions will be small or nil if there is no or little trade in the base period (Kuiper and van Tongeren, 2006b).

into account insofar as the approach to the modelling of migration and off-farm labour allocation takes an explicit supply side perspective, rooted in an analysis of the socio-economic characteristics of the households. Further aspects, in particular those which are related to the dynamics of households' adjustment reactions, are neglected. With respect to market institutions, the model departs from the standard neoclassical assumption of perfect markets and allows for market imperfections, which lead to nonseparability of household decisions and the existence of village markets. Thereby, it makes a significant step towards a more realistic analysis. On the other hand, credit markets, which can be expected to play an important role for the dynamics of adjustment, are not modelled. Likewise, the model does not account for other institutional factors such as social barriers to market entrance, which might be of particular relevance in the Chinese context. The dynamic aspects of risk have been neglected due to the comparative static nature of the model and issues of vulnerability have not been taken into account.

In the context of the pathways via which impacts of trade reforms are transmitted to the household level, the theoretical framework discussed distinguishes three different channels: the distribution channel, which determines price transmission, the enterprise channel and the government channel. At this, the challenge is to take into account the different channels in a comprehensive manner and to capture the complex interactions which take place between the different channels. Not least due to its comprehensiveness and internal consistency, the national CGE model this study draws upon can be expected to serve well to address these challenges. As always, however, the simulation results the village equilibrium model are shocked with depend to a substantial degree on the design of and the assumptions made in the CGE model. As no own CGE analysis is carried out, these assumptions cannot be influenced nor are fully transparent. Similarly, the CGE analysis cannot be tailored to exactly fit the needs of the current analysis and some assumptions regarding the transferability of results have to be made.[3]

According to the framework discussed in Section 2.2.2, positive impacts of migration on source communities comprise direct as well as indirect effects and comparative static as well as dynamic effects. Direct effects include the impact of remittances as well as lost labour effects on migrant households themselves. Sim-

[3]A detailed discussion is provided in Chapter 7.

ilarly, return migrants which bring home savings and experience may directly benefit the migrant sending household. Indirect effects include general equilibrium effects generated through migration induced changes in demand for goods and factors. Furthermore, migration can unfold general development impacts which can benefit the community as a whole. The village modelling approach taken in this study is able to capture the effects of remittances on the income and consumption of migrant households. Similarly, lost labour effects as well as second round effects which are transmitted via village markets are taken into account. Again, due to its comparative static nature, the model, however, fails to account for dynamic effects, which arise from investment and business creation and which are more likely to influence the development of the village in the longer run. Furthermore, relevant dimensions of return migration, namely the savings and experience brought along by return migrants, are omitted.

The present section introduced the modelling framework—a village equilibrium model in a macro-microsimulation framework—which is employed in the present study. The goal was to offer a general overview and to discuss the scope and limitations of the approach. More details are provided throughout the following chapters which are dedicated to develop the village equilibrium model and to provide a detailed documentation of the model. In Chapter 4, a theory of a nonseparable agricultural household model with a special focus on the modelling of migration is presented. This model forms the theoretical basis for the village equilibrium model, which is the subject of Chapter 6. The national CGE study, which forms the macro module in the present modelling efforts is discussed more in detail in the context of the presentation of the policy scenario in Chapter 7. It should be noted that the framework described in this section constitutes the methodological core of the present study. In addition to the simulation models, complementary econometric techniques are applied where appropriate. The corresponding methodological discussions will be provided at the respective places.

3.2. Data and Research Area

The subject of the present study is Changtian village, a rural community in Puding county in the Chinese province of Guizhou. It is one of three villages which have been surveyed in the years 2005 and 2007 in the scope of a comprehensive research project aimed at studying rural poverty in China, which has been jointly carried out by IFPRI in Washington D.C., the CAAS in Beijing and Guizhou University in Guiyang.

During the duration of the research project, two rounds of surveys have been conducted in three administrative villages, which together consist of 26 natural villages in 2005 and 2007.[4]. The data covers the years 2004 and 2006. The villages have been chosen in order to represent the range of economic development in the county (Brown et al., 2010). The surveys employed structured questionnaires, took a census form and covered 805 households which constitute the three villages. The questionnaires have originally been designed for the purposes of the overall research project, but have been adapted to the requirements of a village modelling study under cooperation of the author. Depending on the information requested, recall periods ranged from ten years in case of major family events and related expenses/income to a year in case of household demographics, production and employment, living conditions and public goods, land use and income and expenditure. The work resulted in a rich set of socio-economic data, including the mentioned aspects of demographics, employment, income, expenditure, agricultural production, as well as natural resources, health, asset ownership or access to public services.

For the present study, Changtian, one of the three administrative villages has been selected. The data used comes from the 2007 survey, thus the period covered is the year 2006. Changtian consists of 11 natural villages in which 257 households reside. In the following section, Changtian village is presented in detail, following overviews on Guizhou province and Puding county.

3.2.1. Guizhou Province and Puding County

The province of Guizhou has a total area of 176,167 sq.km. and is situated in the south-western part of the People's Republic of China, bordering the provinces of Sichuan and Chongqing in the north, Hunan in the east, Guanxi in the south and Yunnan in the west. It is of high geographic diversity (Xing et al., 2009), with

[4] In China, the term administrative village refers to an administrative unit, which consists of a number of hamlets, or natural villages.

hilly regions to the west and relatively flat areas to the east, and a subtropical humid climate (Britannica, 2011).

In 2005, Guizhou had a population of 37.3 m people, making up 2.9% of the total population of China. Around half of the population belongs to ethnic minorities (Hong Kong Trade Development Council, 2011). With 26.9% of the population living in urban and 73.1% residing in rural areas, the degree of urbanization is lower than in China as a whole (see Table 3.1).

Guizhou is rich in natural resources, comprising a broad range of minerals, coal and hydro-energy (Hong Kong Trade Development Council, 2011). The mild climate without freezes in winter permits year-round agricultural production (Xing et al., 2009). Major agricultural products are corn, rice, tobacco, tubers and rapeseed, as well as tea, fruits and vegetables and medical herbs. As a consequence of the wealth in natural resources, a substantial share of the province's industrial output consists of electricity, heat and gas (23.6% of industrial value-added) and the production of ferrous and non-ferrous metal (15%). Further important industries are the manufacturing of tobacco (11.4%) and beverages (8.4%) as well as the chemical industry (7.7%). Furthermore, Guizhou is an important tourist destination in China (Hong Kong Trade Development Council, 2011).

As was the case for the whole country, the economy of Guizhou grew rapidly during the first five years of the century. The average growth rate was 10.2%, and the GDP of the province reached a level of 197.9 bn yuan in 2005, which corresponds to 1.1% of the Chinese GDP (National Bureau of Statistics (NBS), 2006). This disproportionately low contribution to the national economy stems in parts from the still comparatively high significance of the primary sector and the lower level of development of the industrial sector, as reflected both by the sectoral composition of GDP and the structure of employment (see Table 3.1). Some authors relate the comparatively low level of industrial development to the limited integration of the province with the world outside China: in 2003, Guizhou had the fourth lowest value of foreign direct investment out of 31 Chinese provinces and cities and was insignificant as a destination of imports and origin of exports (Lin and Liu, 2006). Labour productivity in industrial enterprises is comparatively low, accounting only for around 82% of the national average.[5] Accordingly, official

[5]Figure based on a labour productivity measure of yuan per person and year in enterprises

Source: Wikimedia Commons (2011).

Figure 3.2.: China and Guizhou.

statistics show that wages paid in the province are also below the national average, accounting for between 76% to 93%, depending on the type of ownership of the enterprise (National Bureau of Statistics (NBS), 2006).

Compared to China as a whole, rural as well as urban incomes are low. In 2006, the disposable income of urban households was only 77.5% of the Chinese average, reaching a level of 9,117 yuan per capita at current prices. In case of rural households, the difference was even more pronounced. With an average value of 1,985 yuan of annual net income per capita, Guizhou's rural population earned around 55.3% of the national average (compare Table 3.1). Both in terms of net income and living expenditure of the rural population, the province ranked last among the 31 provinces in mainland China (UNDP, 2008; Xing et al., 2009).

"above designated size" (National Bureau of Statistics (NBS), 2006).

The relatively low level of economic development of Guizhou is reflected by the poverty situation in the province. Official figures put the rate of rural poverty in Guizhou at 10.7% in 2002. This was the fourth highest out of China's 31 provinces and cities (NBS, cited from Lin and Liu, 2006), making Guizhou one of the poorest provinces in the country.[6] The trend in poverty, however, follows the general trend in China: as incomes rise, poverty declines. Ravallion and Chen (2007) estimate that the incidence of rural poverty declined by 6.5% per year in the period from 1988 to 2001. The reduction in urban poverty was even more pronounced, declining at a rate of 18% per year (Montalvo and Ravallion, 2010). The decline in poverty, however, was accompanied by an increase in inequality by 1.0% per year (Ravallion and Chen, 2007).[7]

The general level of human development in Guizhou mirrors the low level of economic development and the high poverty rates. Illiteracy is higher than in most of the other provinces of China, the live expectancy of the population is lower and access to health services and education is poor compared to the rest of the country (UNDP, 2005, 2008). The United Nations Development Program summarizes these and other dimensions of human development in the Human Development Index (HDI). For Guizhou, the HDI is significantly below the Chinese average and comparable to that of Botswana or Namibia (UNDP, 2008, see Table 3.1).

The lagging economic development certainly plays a role in the conversion of Guizhou into one of the principal labour exporting provinces in China during the 1980s and 1990s. In fact, the provincial government long tried to encourage rural surplus labour to search for job opportunities in other provinces, thus pursuing a ”labour export for development” policy (Zhang, 2003, p.143). Estimates of the net out-migration state population losses of 2.27 m people due to migration between 1990 to 2000. With a decline of the population by -7.0%, this is the highest

[6] Please note that the figures presented depend very much on the poverty line chosen. Ravallion and Chen (2007), for instance, estimate the poverty headcount for China as a whole at 12.5% in 2001. Given that Guizhou is a comparatively poor province, it is unlikely that its poverty headcount is below the Chinese average. Xing et al. (2009), for example, mention that in 1998 the poverty rate was 42% and almost the double of the national average. Nonetheless, as the current discussion is about the relative position of Guizhou in the national context, the official figures are sufficient.

[7] The authors measure inequality with the Gini index, which stood at 23.4% in 1988. Unfortunately, the figure for 2001 is not provided, but using the growth rate provided, the Gini index for Guizhou can be estimated at around 26.6 in 2001 and 28.0 in 2006.

Table 3.1.: Selected statistics of China and Guizhou, 2006.

	National total	Guizhou
Population		
Population (m persons)	1,314.5	37.6
Urban population (% of total, 2005)	43.0	26.9
Economy		
GDP (bn yuan, 2005)	18,308.5	197.9
Per capita GDP (yuan, 2005)	16,084	5787
GDP - Sectoral composition (%, 2005)		
Primary sector	11.6	18.6
Secondary sector	49.0	41.8
Tertiary sector	39.4	39.6
Employment structure (%, 2005)		
Primary sector	44.8	57.4
Secondary sector	23.8	10.3
Tertiary sector	31.4	32.3
Per capita income (yuan)		
Urban households, disposable income	11,759	9,117
Rural households, net income	3,587	1,985
Per capita living expenses (yuan)		
Urban households	8,697	6,848
Rural households	2,829	1,627
Human development		
Human Development Index	0.78	0.66
Live expectancy (years)	72.5	66.0
Adult literacy ratio (%)	91.0	81.2
Combined school enrolment ratio (%)	66.6	60.0

Source: National Bureau of Statistics (NBS) (2006), UNDP (2008), own calculations.

rate of all Chinese provinces (Johnson, 2003). The main destinations of migrant workers are the eastern provinces. According to estimates from 1997, around 90% of migrant workers from Guizhou had gone mainly to the coast, where they found employment mostly as factory workers, cleaners, security guards and construction workers. This reflects the typical "interior-to-coastal" migration pattern in China (Zhang, 2003, p.144).

Puding county, in which the study villages are located, is situated in the central part of Guizhou province. It lies about 120 km west of Guiyang, the provincial capital and 20 km from the prefecture city of Anshun. Puding consists of 11 townships and 317 administrative villages and had a population of 402,000 people in 2004. Just as the rest of Guizhou province, the county is ethnically highly diverse. About 20% of the population belong to one of over 20 ethnic minority groups, such as, for example, Miao, Blang, Bouyei, Gelao or Yi. The county is predominantly rural, around 94% of the population lives in rural areas and about 63% of the labour force is employed in agriculture. Puding is one of the 592 counties which have been designated as poor by the central government; by the end of 2002, 31% of the population lived below the official poverty line (Xing et al., 2009).

3.2.2. Changtian Village

3.2.2.1. General Overview

Changtian consists of 11 natural villages, in which 257 households reside (see Table 3.2). Around 79% of the population belong to ethnic minority groups and different dialects are spoken apart from Han. Changtian is located around ten km from the county seat and has only poor road connections. Thus, among the three villages surveyed, it is the most remote from major markets and offers the most limited marketing and the fewest non-farm opportunities. It is located in a hilly landscape, and only 40% of the agricultural area is flat (Brown et al., 2010). Each household holds on average 3.72 mu of agricultural area, of which around 92% is non-irrigated land.[8] In dry seasons, water shortages can turn severe. In 2004, for

[8] In China, land is communal property and land use rights are granted to the households by the village authorities for a period of 30 years (Huang et al., 2008).

Table 3.2.: Basic village characteristics.

Population	
Households	257
Individuals	1,089
Ethnic minority population (%)	78.7
Migration	
Migrants in working age population (%)[1]	20.7
Households with at least one migrant (%)	50.0
Land resources	
Contract land (mu/household)	3.72
Irrigated	0.28
Non-irrigated	3.43
Land in use (mu/household)	4.48
Irrigated	0.41
Non-irrigated	4.07
Income	
Net income per capita (yuan)	1,084
Net income per adult equivalent (yuan)	1,464
Poverty & inequality	
Poverty headcount (P0)	
Low poverty line	0.22
High poverty line	0.45
Poverty gap (P1)	
Low poverty line	0.05
High poverty line	0.11
Poverty severity (P2)	
Low poverty line	0.02
High poverty line	0.04
Gini (%)	29.4

[1]Persons older than 14 and younger than 60.

example, about 80% of the families reported that they had problems with access to drinking water (Brown et al., 2010; Xing et al., 2006, 2009).

Changtian is the poorest of the three villages surveyed by the research project. Annual net income reached 1,084 yuan per capita or 1,464 yuan per adult equivalent in 2006.[9]. Based on consumption expenditure and depending on the poverty line chosen, the poverty headcount was 0.22 and 0.45 for the low and for the high poverty line, respectively.[10] The poverty gap index was 0.05 and 0.11 and the

[9]For the calculation of adult equivalents the OECD adult equivalent scale has been used (Haughton and Khandker, 2009):
$AE = 1 + 0.7 \times ((N - C) - 1) + 0.5 \times C)$
where N is the household size and C is the number of children older than 14.

[10]Following Brown et al. (2010) and Xing et al. (2009), the low poverty line is 668 yuan and the high poverty line is 892 yuan per capita and year in 2004 prices. The low poverty line reflects China's official poverty line. The high poverty line corresponds to a daily consumption allowance of US$ 1.08. For a more detailed discussion of the methodology used for the measurement of poverty and inequality, see Annex B.

poverty severity index was estimated at 0.02 and 0.04. The Gini coefficient on consumption expenditure was 29.4% in 2006.

In their detailed study of the economic situation of the three surveyed villages in 2004, Xing et al. (2009) analyse the determinants of income, poverty and inequality. According to their results, income levels are correlated with endowments with productive assets, human capital, as well as geographical factors. In fact, variables representing average years of schooling, job training, family relationships to government employees as well as the per capita area of contract land have a significantly positive influence on income levels. Household size, ethnic minority status and the distance to the township capital, in turn, cause income levels to be lower. Related to poverty, Xing et al. (2009) accordingly find that the poor dispose of lower land areas, have comparatively low levels of educational attainment and higher dependency ratios in the household. The authors also analyse the sensitivity of poverty measures with respect to changes in income from different sources and highlight the relevance of agricultural production, migration and blood donations for poverty alleviation.

With respect to inequality, Xing et al. (2009) identify local off-farm income, including full-time employment, part-time jobs and self-employment, as well as remittances as the primary sources of income inequality. Income from blood donations, in turn, reduces inequality.[11] The endowment with contract land, household size, human capital, minority status as well as the distance to the county seat, again, are identified as contributors to overall inequality.

3.2.2.2. Income Sources and Expenditure Patterns

Table 3.3 gives an overview on the composition of household income in the village. The larger part, around 61%, stems from agricultural production, in the form of both cash income for sales and self-consumption.[12] Within agriculture, crops con-

[11] In the past, many households (around 41% in Changtian) supplemented their incomes by selling blood. However, as blood donation stations in the county were shut down in 2006, this source of income became less relevant by the time of the second round of the survey (Brown et al., 2010).

[12] For the valuation of self-consumed agricultural products sales prices reported in the survey have been used. In case, a household had not reported any sales, self-consumption has been valued with the village median of the respective sales price. In case of rice, which has only been sold by two households in the village, the median value of all three villages which have been surveyed has been taken.

Table 3.3.: Composition of household income.

	Share in total value
Agricultural income	**0.61**
Crops	0.49
Maize	0.24
Rice	0.01
Rape	0.17
Fruits & vegetables	0.04
Other crops	0.02
Livestock	0.12
Pigs	0.07
Cows	0.02
Other livestock	0.01
Other produced	0.04
Non-agricultural income	**0.39**
Employment	0.24
Wage employment	0.01
Seasonal employment	0.09
Self employment	0.01
Remittances	0.13
Other sources	0.15
Blood donations	0.04
Other non-agricultural income	0.11
Total	**1.00**

tribute a much higher share to overall income than livestock. The most important crops are maize and rapeseed for the purpose of oil production. The typical cropping pattern is to produce maize or rice in the main season and rapeseed as well as vegetables in the slack season (Xing et al., 2009). The main livestock products are pigs.

Non-agricultural income accounts for about 39% of total household income of which the largest part stems from different types of employment. Other non-agricultural income sources comprise blood donations as well as gifts, transfers (from government and private sources), or interest income. The figures in Table 3.3 illustrate the high importance of migration as a livelihood strategy. Income from remittances makes up 13% of total household income and represents on average the third most important item in the income portfolio of the households in the village. Given that maize is mainly self-consumed, it even constitutes the second most important source of cash income to the village. The high contribution of remittances to household income also reflects the high share of migrants in the population—around 21% of the working age population has migrated in 2006 and

50% of the households had at least on migrant (see Table 3.2).[13]

Apart from remittances, income from employment stems from seasonal employment, which comprises irregular agricultural and non-farm jobs and accounts for 9% of total income on average. Wage work, i.e. employment as government official, as teacher, or at state-owned, collective or private companies, on average contributes by 1% to total household income. Self-employment, for example through the processing of agricultural products, construction, the provision of services or the provision of education or health care, with another 1% also makes up a minor share of overall household income.

Of their total gross income, households spend on average 41% on farm inputs. The remaining net income, accounting for around 59% on average, serve to cover the households' consumption needs. The distinction of broad categories of expenditure—food and non-food expenditure and expenses on savings, transfers and other purposes—shows that food accounts for the largest share of households' total consumption expenditure, The average Engel coefficient in the village is 0.58 (see Table 3.4). Non-food expenditures make up about a quarter of total expenses on average and savings, transfers and other expenses sum up to slightly more than an eighth.

Households either purchase the food they consume on the market or consume products produced on the own farm. Overall, staples have a very prominent position in the food consumption basket. In value terms, own-consumption, which consists mainly of maize, accounts for about a third of food consumption expenditure and around 17% of the total. The major item in purchased food products, which contribute about two thirds to food and on average 41% to total consumption expenses, is cereals (rice, wheat, etc.), followed by processed food products (including eating out and condiments) and fruits and vegetables. In spite of the overall modest levels of income, a rather high share of 5% is spent on tobacco and beverages.

Non-food expenditures consist mainly of purchased services. Health and education feature prominently here and together account for a higher share than all other services, which include transport, communication, water and energy, among

[13]Brown et al. (2010) even report that the share of households with at least one migrant has increased from 31% to the mentioned 50% between 2004 and 2006.

Table 3.4.: Composition of household consumption expenditure.

	Share in total value
Food	**0.58**
Own-consumption	0.17
Maize	0.11
Other crops	0.05
Livestock products	0.01
Purchased food	0.41
Cereals	0.19
Fruits & vegetables	0.06
Processed food	0.08
Livestock products	0.03
Drinks and Tobacco	0.05
Non-food	**0.28**
Durable consumption goods	0.05
Services	0.22
Health	0.07
Education	0.05
Other services	0.10
Other non-food	0.01
Savings, transfers and others	**0.14**
Gifts	0.05
Big events	0.02
Interest	0.03
Housing	0.04
Total	**1.00**

Table 3.5.: Composition of household expenditure on farm inputs.

	Share in total value
Inputs for crop production	**0.59**
Fertiliser	0.48
Seeds	0.08
Others	0.03
Inputs for livestock production	**0.40**
Feed	0.21
Livestock replacement	0.18
Veterinary services	0.01
Other inputs	**0.01**
Total	**1.00**

others, combined. About 6% of net income is spent on durable consumption goods, including clothing, and other non-food items.

The third broad category of expenditure comprises savings, transfers and other expenditures. The most important item here are gifts. Together with expenses on big family events, such as weddings and funerals, gifts play an important role in the village society to establish and maintain social relationships.[14] Expenses on housing make up about 4% of household consumption expenditures on average. As sales and rentals of houses are prohibited, this figure, however, only includes expenditures on construction incurred during the period covered by the survey. Accordingly, the average figure masks a high variability between the households. Finally, interest payments account for 3% of household expenditure on average.[15]

Table 3.5 provides an overview on the composition of household expenditure on farm inputs. Inputs for crop production make up 59% on average, inputs for livestock production around 40%. Other inputs, which include inputs used for fishery and forestry, have a share of 1%.[16] Fertilizer has the highest value share of all crop production inputs. followed by seeds and other inputs, like pesticides, for example. Inputs for livestock production consist mainly of feed and young animals for the purpose of livestock replacement. A minor item is expenditure on veterinary services, consisting mainly in the vaccination of the animals.

[14] A detailed study on positional spending is provided by Brown et al. (2010). The authors analyse the role of expenses on gifts, weddings and funerals in the quest for social status and discuss the welfare implications of these, in particular for poor households.

[15] Household savings other than the investment in housing have not been reported in the survey.

[16] Expenses on purchased inputs used in other economic activities are also included in this item, but play only a marginal role.

3.2.2.3. Commercialisation and Price Transmission

The discussions in Sections 2.2 and 3.1 have highlighted the importance of the domain of trade for the analysis of village level impacts of trade reforms. In essence, it is about finding out how and to which extent prices are transmitted from the outside world to the village and identifying at which levels price formation processes take place. Most ideally, this would involve the combination of a qualitative analysis of the commercialisation of products and factors and an econometric price transmission analysis. Due to the lack of the necessary price series data, however, it is not possible to carry out own price transmission analyses in the scope of the present study. Instead, householders have been asked for details about the commercialisation of agricultural products in the survey in order to allow for an assessment of price transmission and the domains of trade. The results of these efforts are presented in the first part of this section. In the second section, the integration of the village with national and international markets is discussed. This part relies on results from unstructured interviews carried out in early 2007 on wholesale markets in Guiyang and on evidence from the literature on price transmission in China.

In order to obtain a picture of the commercialisation of the village's farm output, villagers have been asked about the way they commercialise their output as well as about the destination of the products. Furthermore, to assess the relative importance of sales and subsistence consumption, the corresponding shares are calculated from the survey data. In case of land, the locations of land rentals, whether inside or outside the natural village, are distinguished. The ultimate goal of this analysis is to identify products or factors for which a village market, i.e. local price formation mechanisms which have to be modelled in the village equilibrium model, exists.

Table 3.6 shows the results of the analysis of the commercialisation of different agricultural products. The absolute numbers of sales reported in column four of the table show that the most commercialised products are maize and corn as well as rapeseed and oil produced of this. Rapeseed is the most important cash crop in the village, more than two thirds (77%) of all households sell it to earn some income and virtually the entire harvest (96%) is sold.[17] Maize and corn is sold by 41% of all households, and the sales share is much lower than in case of rapeseed. Both paddy and rice and fruits and vegetables are mainly produced for subsistence purposes. In case of rice, hardly any sales take place, at all. In case of fruits and vegetables only 12% of the output is sold on the market, on average.

Table 3.6.: Commercialisation of agricultural products (absolute numbers and shares).

	Selling way			**Total**	**Sales**
	Village fair	**Trader**	**Other**		**share**[1]
Maize & corn	58	47	2	107	0.23
	0.54	0.44	0.02		
Paddy & rice	1	1	0	2	0.05
	0.50	0.50	0.00		
Rapeseed & oil	108	89	0	197	0.96
	0.55	0.45	0.00		
Fruits & vegetables	19	5	0	24	0.12
	0.79	0.21	0.00		
Pigs	20	25	2	47	0.87
	0.43	0.53	0.04		
Cows	8	3	1	12	1.00
	0.67	0.25	0.08		
Other livestock	13	0	2	15	0.45
	0.87	0.00	0.13		

[1]Sales share refers to the quotient of sales value and total output value.

In case of livestock products, mostly pigs are sold. The sales share is high, reaching 87% of total output value. Much lesser cases of cow sales have been reported and no self-consumption of cows took place in 2006. Other output from livestock (poultry, eggs, etc.) is marketed on a similarly small scale. Sales account for about 45% of the output value. Agricultural output is mainly sold on a village fair—a weekly market held at a location close to the village—and to traders which visit the village to purchase products. In case of maize, rice, rapeseed and pigs, about half of the sales go to each of the two channels. Fruits and vegetables, cows and other livestock products are sold more on the village fair.

Table 3.7 reports the answers of the villagers on the destination of the agricultural output sold. Except in case of pigs, consistently more than half stated the county, in fact the county capital, as the destination. In case of pigs, the figure still accounts for 37%. The next important destination is the village itself. Other

[17]Rapeseed oil makes up only a marginal share. Most sales are rapeseed for processing.

destinations, such as the township or regions outside the county are of minor importance.

Table 3.7.: Destination of agricultural products (absolute numbers and shares).

	Destination				Total
	Village	**Township**	**County**	**Outside county**	
Maize & corn	42	5	52	0	99
	0.42	0.05	0.53	0.00	
Paddy & rice	0	0	2	0	2
	0.00	0.00	1.00	0.00	
Rapeseed & oil	82	9	102	1	194
	0.42	0.05	0.53	0.01	
Other grains	5	0	13	0	18
	0.28	0.00	0.72	0.00	
Fruits & vegetables	5	1	17	0	23
	0.22	0.04	0.74	0.00	
Other crops	4	1	12	0	17
	0.24	0.06	0.71	0.00	
Pigs	25	4	17	0	46
	0.54	0.09	0.37	0.00	
Cows	4	1	7	0	12
	0.33	0.08	0.58	0.00	
Poultry & eggs	3	1	11	0	15
	0.20	0.07	0.73	0.00	

The results of Table 3.7 show that substantial trade of agricultural products takes place within the village. The importance of agricultural trade beyond village borders, however, also shows that the village is integrated with the outside world. Following this observation, it would be hard to assume that markets for agricultural output are confined to the village and that price formation takes place at the village level.[18]

A different picture reveals the analysis of land rental transactions by the villagers. As Table 3.8 shows, most land rented is non-irrigated land. Only seven out of the 59 households which report having rented in or out land have done so with irrigated land. Furthermore, the table reveals a large discrepancy between the number of households which rent in land (47) and those which rent out (11). Two explanations for this observation can be found. First, as land rentals are not

[18] This careful formulation has been consciously chosen. For more reliable evidence it would be necessary to test for co-integration of village markets with the markets outside the village. As mentioned above, however, the necessary price data could not be obtained and it was not possible to carry out the corresponding analyses.

yet fully legally sanctioned, householders may have an incentive to under-report when they rent out land in order to avoid losing (parts of) their contract land. Second, much of the land rent in may come from households which have left the village and migrated to other parts of the country. As these households have been absent at the time of the survey, land rented out by them is not recorded. Indeed, Brown et al. (2010) state that during the time of the survey of 183 out of the 987 households which officially reside in the three villages no household member could be met. According to the authors, neighbours had reported that most of these households had migrated out of the county. Given that this number makes up almost one fifth of all households, land rentals by absent households can largely explain the discrepancies.[19][20]

Table 3.8.: Location of land rentals (absolute number of cases and share).

		Location		Total
		Within natural village	**Outside natural village**	
Irrigated land	Rent in	3	2	5
		0.6	0.4	
	Rent out	2	0	2
		1.0	0.0	
Non-irrigated land	Rent in	39	3	42
		0.93	0.07	
	Rent out	8	1	9
		0.89	0.11	
All land transactions		52	6	58
		0.90	0.10	

The main result of Table 3.8 is that 90% of the land rental transactions take place in the natural village. In only 10% of the cases land is rent in from or rent out to outside the natural village. Moreover, although the corresponding information is not available, out of the transactions from or to places outside the natural village the largest part can be assumed to happen still within the administrative village. Hence, as land transactions appear to be confined to the village, the existence of a land rental market with price formation at the village

[19] See also Zhang (2010).

[20] Theoretically, there would also be a third explanations according to which larger plots are rent out to several households. Due to the general scarcity of land and the overall small plot sizes, however, this option appears to be little conceivable. Moreover, the survey data did not point into this direction.

level can be assumed.

Purchased consumption goods and services in their great majority, some households services such as transport might be an exception, come from outside the village. Hence, the village can be assumed to be a price taker for these items and the remaining good or factor to be discussed is labour. The discussion of households' income source above already revealed that labour in general is traded beyond the village borders: villagers take local employment outside the village or even migrate. Likewise, agricultural labour is contracted from outside the village. Accordingly, wage rates can be assumed to be determined by the outside world. In any case, labour will receive a distinctive treatment in the model, which will largely determine price and wage formation mechanisms (see Chapter 4).

A further point worth mentioning, in this context is the presence of labour exchanges in the village: It is common for villagers to support each other by helping in case of need, which is in particular the case at the time of maize harvest. According to reports from the village, this type of labour exchange, which forms part of the complex system of social interactions, which exist in the village, makes up the major part of labour traded among the residents. As the exchange of labour is based on reciprocity, wages are generally not paid. Furthermore, exchange labour has not been reported in the survey and the information to carry out a deeper analysis is not available. Hence, exchange labour is neglected here and in the following.[21]

As the preceding discussion shows, prices for most goods and factors purchased or sold in the village are determined by price formation mechanisms, which take place at domains beyond the village levels. Only for agricultural land, a village market has to be assumed and taken into account in the modelling exercise to follow. In case of the village traded goods (i.e. those which are traded beyond the village borders), the relevant domain for price formation remains to be identified. The results presented in Table 3.7 suggest that most trade takes place within the county. This, however, represents the perspective of the villagers and the actual domain of trade might be much larger. Moreover, markets of Puding county itself may be integrated with the rest of the country and take national prices as given. Indeed, Puding county disposes of sufficient road infrastructure to keep transport

[21]For a further discussion on this issue, see Chapter 5.

costs to and from other parts of the country low. Furthermore, wholesale markets across Guizhou province communicate strongly with wholesale markets in the province capital of Guiyang, both involving flows of information on prices and through trade flows. Regarding the integration of provincial markets with the rest of the country, interviews carried out on the wholesale markets for fruits and vegetables and for cereals in Guiyang revealed that Guizhou is connected through trade flows to places throughout the country. In case of fruits and vegetables, for example, products from the province are distributed to provinces as distant as Xinjiang. During winter, products are imported from different parts of China as well as from abroad. The like can be said of cereals. Furthermore, with the dismantling of delivery quotas for grains in 2006, domestic agricultural markets are now fully liberalised and markets can be expected to work more efficiently. Likewise, government efforts to promote transparency through the publication of prices may enhance price transmission and improve the integration of the province with national agricultural markets.

While these considerations point to an integration of agricultural markets of Guizhou province with the rest of the country, and hence a good transmission of prices, it unfortunately is hard to find up-to-date empirical evidence on the integration of China's domestic markets, which would confirm this hypothesis. Available studies, however, agree in their findings that throughout the reform period market reforms have increased the integration and the efficiency of agricultural markets in China. In a cointegration analysis of price series from the period from 1987-1998, Wu (2001), for example, finds that prices follow a common long-term trend. Cointegration is found between all pairs of wheat and corn markets of 15 provinces, including Guizhou. In case of hogs, markets are found to be cointegrated in 80% of the cases. In a later study, Wu and McErlean (2003) test for market efficiency in Chinese wheat markets. Their results show that wheat markets have become more integrated and therefore more efficient between the late 1980s and the late 1990s. However, following the criterion that the law of one price holds, markets could not yet be considered efficient.[22] Huang and Rozelle

[22]According to the definition of the authors, the law of one price holds if price transmission is estimated to be perfect and the differences between two prices is zero in the context of a vector error correction model.

(2006) analyse price series of rice, maize and soy bean from 15 provinces from the period 1996-2000 and test for pairwise cointegration. As a general result, they find increases in the share of cointegrated market pairs throughout the 1990s and even mention that in case of maize and soy bean almost 100% of all market pairs have been integrated after 2000. The authors state a steady improvement in agricultural commodity markets during the period considered.

From the reviewed studies arises the consistent picture that changes in agricultural prices are transmitted throughout the country. Not all markets, however, appear to be integrated nor is more precise information on the actual degree of price transmission available. On the other hand, market reforms have been completed in the decade which followed the studies and the trend towards increasing market integration can be expected to have been continued. In fact, upon request one of the authors of the studies mentioned confirmed that he expected agricultural markets in 2007 to be fully integrated. He argued with the increasing efficiency of grain markets, which have been the last to be liberalised and thus would provide the most conservative estimate of market integration (Huang, 2007).

Following these considerations, we assume that agricultural markets in Guizhou are well integrated with national markets. Price changes, such as those induced by trade reforms, are assumed to be fully transmitted to the provincial and county levels.

The present section introduced the research area, Changtian village, located in Puding county in the Chinese province of Guizhou. In terms of economic and human development, the provinces lags compared to the rest of China. Likewise, Puding county is officially designated as poor and the village is the poorest of the three communities which have been surveyed. Village inequality is high. Agricultural production has been identified as the principal income source in the village, and food production for subsistence purposes still plays a major role in covering households consumption needs. Migration constitutes an important component of the households' livelihood strategies. The analysis of product and factor market in the village shows that village markets are generally integrated with the rest of the country. The exception are land rental markets, where most transactions are confined to the village level. In the following chapter, an agricultural household model, which represents the theory of households behaviour to be used in the subsequent modelling efforts is developed.

4. A Theory of Household Behaviour

In this chapter the agricultural household model, which serves as the theoretical foundation for the subsequent analyses, namely the estimation of shadow prices, tests for nonseparability of household decisions, the analysis of determinants of household migration decisions and finally the derivation of the behavioural assumptions implemented in the applied village equilibrium model is developed. Bearing in mind the central position it assumes in this study, special emphasis is put on the analysis of household migration. The goal is to obtain a theoretically consistent framework, which allows households to be engaged in various productive activities at the same time while allowing for differences in wage rates between sectors and locations. Furthermore, the model shall provide space to model differences in migration behaviour between households, which are rooted in the households' socio-economic characteristics. As an attempt to satisfy these demands, which stem from real world observations from Guizhou province (see Chapter 5), an agricultural household model with the salient feature of an endogenous allocation of labour to migration is constructed. This goes in hand with the incorporation of interactions between migration and consumption demand and different (dis)utilities arising to the household due to its participation in different productive activities, leading to nonseparability of household decisions.

Thereby, a number of considerations make the assumption of nonseparability of household decisions in Guizhou province a priori a conceivable option. First, land and labour markets can be expected not to work smoothly, leading to market imperfections and market failures (Liu et al., 1998; Kung, 2002; Yao, 2000). This is also supported by recent studies on nonseparability from different provinces in China, which reject the separability hypothesis in agricultural household models

(Bowlus and Sicular, 2003; Kuiper, 2005; Carter and Yao, 2002). Second, and more importantly, the survey data from the Guizhou villages exhibits a high share of households, which do not participate in local labour markets. In the entire sample, around 40% of the households don't participate in local labour markets at all. In Changtian, around 60% of the households neither sell nor hire labour on and from local off-farm labour markets. Furthermore, the higher share of households participating in migration in Changtian (52.4% as opposed to 43% in all villages) suggests that migration constitutes a substitute for restricted local off-farm opportunities.

As a starting point, a basic household model with endogenous migration decisions in the fashion of Singh et al. (1986a) is constructed in Section 4.1. The requirements with respect to the depiction of the households' labour allocation, in particular to migration, which ought to be met by the theoretical model to be used in this study are discussed against the results obtained from this first basic model. After a short excursus to the literature on the treatment of migration in village equilibrium models in Section 4.1.3, the basic model is amended to introduce nonseparability induced by imperfect substitutability of productive activities. In Section 4.3 the basic model is modified to allow for a feedback between household migration and the consumption sphere. In Section 4.4 the results obtained up to that point are pulled together into a nonseparable household model with endogenous migration decisions and feedback to the consumption sphere. This last section summarizes the theoretical model.

4.1. A Basic Model with Endogenous Migration Decisions

4.1.1. Set-up of the Model and First Order Conditions

The basic model closely follows the approach developed and first presented by Singh et al. (1986a). The household is assumed to operate in an environment of perfect markets in the neoclassical sense, that is, there are no transaction costs, no barriers to market entry and the household disposes of perfect information, leading to separability of household production and consumption decisions. Migration is included into the model as a normal off-farm activity. Land endowments are assumed to be fixed and only interior solutions are allowed for.

The household is assumed to maximize utility through the consumption of an agricultural good X_a produced by the household, a manufactured market purchased good X_m and leisure X_l measured in time units[1]:

$$\max\ U(X_a, X_m, X_l) \tag{4.1}$$

w.r.t $X_a, X_m, X_l, L_f, L_{of}, L_{oi}, L_m, V$ and assuming strict concavity of the utility function and with L_f being family labour used on the farm, L_{of} and L_{oi} formal and informal local off-farm work, respectively, L_m migratory work and V a vector of variable inputs.

Utility is maximized subject to the production constraint

$$Q_a = f(L_f, V; A) \tag{4.2}$$

where Q_a is the quantity of the agricultural good and A is land area. Produced quantity and inputs are related through a production technology $f(\cdot)$.[2]

In addition to the production constraint, the amount of time allocated to the different uses, namely, farm work, formal and informal local off-farm work, migratory work and leisure must be equal to the total family time endowment T:

$$L_f + L_{of} + L_{oi} + L_m + X_l = T \tag{4.3}$$

Total family income I consists of agricultural income, formal and informal off-farm income and remittances, which accrue to the household, described by the

[1] The term "leisure" has to be interpreted here as a broader concept. It may comprise leisure in its literal sense as well as any other time spent for activities with a purpose other than earning money such as childcare, housework, etc.

[2] The possibility of hiring farm labour is ruled out by assumption. The inclusion of hired labour in the nonseparable versions of the model would require additional assumptions on the workings of the market for hired labour or the substitutability of hired and family labour on the farm in order to avoid the model to become separable. Although this is in principle feasible, it would complicate the analyses without yielding important additional insights. The neglect of hired labour for sure is a simplification, but due to the low importance of the factor in farm production a defensible one (in Changtian village only 4% of the households rely on hired labour at all).

remittance function $r(L_m; w_m)$:

$$I = p_a Q_a w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) \tag{4.4}$$

with p_a being the price of the agricultural commodity, w_{of} and w_{oi} are the prevailing wage rates at the formal and informal local labour markets, respectively,[3] and w_m is the wage rate at the destination of migration. The remittances function $r(L_m; w_m)$ incorporates the assumption that remittances are a function of the time dedicated to migration L_m and the wage rate at the destination w_m. Finally, total expenditures must be equal to total income I:

$$p_a X_a + p_m X_m + \sum_i v_i V_i = p_a Q_a w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) \tag{4.5}$$

where p_m is the price of the manufactured commodity and v is the vector of variable input prices.

(4.2) and (4.5) can be collapsed into a combined full income constraint:

$$p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) = p_a X_a + p_m X_m + vV \equiv I \tag{4.6}$$

The household optimization problem can be summarized by the objective function (Equation 4.1), which is subject to the time constraint (Equation 4.3) and the combined full income constraint (Equation 4.6). Let λ and ψ denote the Langrange multipliers of the income (Equation 4.6) and time constraint (Equation 4.3), respectively, the Lagrangian for the households optimization problem is as follows:

$$\begin{aligned}
\mathcal{L} \;=\; & U(X_a, X_m, X_l) + \\
& + \lambda[p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) - \\
& - p_a X_a - p_m X_m - vV] + \\
& + \psi(T - L_f - L_{of} - L_{oi} - L_m - X_l)
\end{aligned} \tag{4.7}$$

Partial differentiation of the Lagrangian leads to the following first order con-

[3]Formal and informal local off-farm activities are distinguished as they will be treated differently in the applied village model.

ditions:

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial X_a} &= \frac{\partial U}{\partial X_a} - p_a\lambda && = 0 && (4.8a)\\
\frac{\partial \mathcal{L}}{\partial X_m} &= \frac{\partial U}{\partial X_m} - p_m\lambda && = 0 && (4.8b)\\
\frac{\partial \mathcal{L}}{\partial X_l} &= \frac{\partial U}{\partial X_l} - \psi && = 0 && (4.8c)\\
\frac{\partial \mathcal{L}}{\partial L_f} &= \lambda p_a \frac{\partial f(\cdot)}{\partial L_f} - \psi && = 0 && (4.8d)\\
\frac{\partial \mathcal{L}}{\partial L_{of}} &= \lambda w_{of} - \psi && = 0 && (4.8e)\\
\frac{\partial \mathcal{L}}{\partial L_{oi}} &= \lambda w_{oi} - \psi && = 0 && (4.8f)\\
\frac{\partial \mathcal{L}}{\partial L_m} &= \lambda \frac{\partial r(\cdot)}{\partial L_m} - \psi && = 0 && (4.8g)\\
\frac{\partial \mathcal{L}}{\partial V} &= \lambda p_a \frac{\partial f(\cdot)}{\partial V} - \lambda v && = 0 && (4.8h)\\
\frac{\partial \mathcal{L}}{\partial \lambda} &= p_a f(L_f, V; A) + w_{of}L_{of} + w_{oi}L_{oi} && && (4.8i)\\
&\qquad + r(L_m; w_m) - p_a X_a - p_m X_m - vV && = 0 &&\\
\frac{\partial \mathcal{L}}{\partial \psi} &= T - L_f - L_{of} - L_{oi} - L_m - X_l && = 0 && (4.8j)
\end{aligned}$$

4.1.2. Analytical Results

4.1.2.1. Household Demand

An analysis of the first order conditions concerned with the household's demand for consumption goods and leisure yields the standard results from consumption theory:

- Demand is described by :

$$\frac{\partial U}{\partial X_a} = \lambda p_a \qquad (4.9a)$$

$$\frac{\partial U}{\partial X_m} = \lambda p_m \qquad (4.9b)$$

$$\frac{\partial U}{\partial X_l} = \lambda w_{of} = \lambda w_{oi} = \frac{\psi}{\lambda} \qquad (4.9c)$$

  which follows from equations (4.8a) - (4.8c), (4.8e) and (4.8f).

- Each good yields the same marginal utility per unit of income spent on that good:

$$\frac{\frac{\partial U}{\partial X_a}}{p_a} = \frac{\frac{\partial U}{\partial X_m}}{p_m} = \frac{\frac{\partial U}{\partial X_l}}{w_{of}} = \frac{\frac{\partial U}{\partial X_l}}{w_{oi}} = \lambda \tag{4.10}$$

This follows straight from (4.9).

- The ratios of the marginal utilities of the goods consumed are equal to the inverse price ratios of the goods, which in turn are equal to the marginal rate of substitution:

$$\text{MRS}(X_a \text{ for } X_m) := \frac{\frac{\partial U}{\partial X_a}}{\frac{\partial U}{\partial X_m}} = \frac{p_m}{p_a} \tag{4.11a}$$

$$\text{MRS}(X_a \text{ for } X_l) := \frac{\frac{\partial U}{\partial X_a}}{\frac{\partial U}{\partial X_l}} = \frac{w_{of}}{p_a} = \frac{w_{oi}}{p_a} \tag{4.11b}$$

$$\text{MRS}(X_m \text{ for } X_l) := \frac{\frac{\partial U}{\partial X_m}}{\frac{\partial U}{\partial X_l}} = \frac{w_{of}}{p_m} = \frac{w_{oi}}{p_m} \tag{4.11c}$$

- The price of each good represents the evaluation of the utility generated to the consumer through the last unit consumed:

$$\frac{\frac{\partial U}{\partial X_a}}{\lambda} = p_a \tag{4.12a}$$

$$\frac{\frac{\partial U}{\partial X_m}}{\lambda} = p_m \tag{4.12b}$$

$$\frac{\frac{\partial U}{\partial X_l}}{\lambda} = w_{of} = w_{oi} \tag{4.12c}$$

- In case of leisure the price is its opportunity cost, which is the local off-farm wage w_{of} or w_{oi} or the shadow wage $\frac{\psi}{\lambda}$.

4.1.2.2. Allocation of Labour to Productive Activities and Migration

A first step of the analysis of the labour allocation of the household is the result from (4.8e) and (4.8f) according to which the household shadow price in the optimum is equal to the wage rates in the formal and informal local off-farm labour markets:

$$\frac{\psi}{\lambda} = w_{of} = w_{oi} \tag{4.13}$$

Through this condition it becomes evident that in order to make the household allocate labour to both formal and informal local off-farm jobs, the wage rate in both sectors must be equal. As in practice the wage rates are exogenous to the household it would shift all its labour into the activity, which offers the higher wage rate in case the wages differ. The household would be fully specialized in its local off-farm activities and the sector with the lower wage rate would drop out of the model. It is precisely this problem, which is subject of a later modification of the model. For the moment, however, and assuming equal wage rates, equations (4.8c) and (4.8d) - (4.8g) along with the result from (4.13) can be used to describe the household's allocation of labour to the different local productive activities, migration and leisure:

$$p_a \frac{\partial f(\cdot)}{\partial L_f} = \frac{\partial r(\cdot)}{\partial L_m} = \frac{1}{\lambda} \frac{\partial U}{\partial X_l} = \frac{\psi}{\lambda} = w_{of} = w_{oi} \tag{4.14}$$

According to equation (4.14) the household puts its labour to the different uses in a way that their respective marginal returns in monetary terms equal the household shadow wage. In case of farm labour this is the marginal value product, in case of migration the remittances and in case of leisure it is the marginal utility divided by the marginal utility of income. The household shadow wage, in turn, is equal to the wage rate of the local off-farm market. The amount of labour allocated to local off-farm work can be determined from (4.8j) as the residual of the total time available to the household. As w_{of} and w_{oi} are assumed to be equal, the mix between formal and informal local off-farm work, however, is undetermined.

4.1.2.3. Factor Demand

The conditions for the demand of variable inputs used in farm production follows from equation (4.8h):

$$p_a \frac{\partial f(\cdot)}{\partial V} = v \tag{4.15}$$

This is the standard result from production theory for optimal factor allocation, which states that at the optimum the marginal value products of the production factors must equal their market prices.

4.1.3. Caveats to the Treatment of Labour Allocation in the Model

The aim of this first basic analysis was to provide a theoretical benchmark for the depiction of labour allocation and, in particular, migration in an agricultural household model. There are two major caveats regarding the treatment of households' labour allocation as proposed by this model.

The first caveat, which has already been touched in the discussion of results (4.13) and (4.14), concerns the requirement imposed by the model that the wage rates in different local off-farm sectors have to be equal should the household be engaged in more than one local off-farm activity. This is contrary to the observation that households have diversified off-farm income sources. Applied in a simulation model it will lead, as mentioned above, to complete specialization of the household with respect to its off-farm activities. Furthermore, even in case the wage rates are equal, the model does not provide a means to determine the exact amount of labour allocated to the different activities, as the household is indifferent to either alternative.

The second concern refers to the treatment of migration in the model. As one can safely assume that $r(L_m; w_m)$ is only a fraction of the migrant's earnings, the difference between w_{of}/w_{oi} and the wages earned at the destination have to be very high to make sure that condition (4.14) can actually be fulfilled. In the likely case that the wage difference is too small, no migration would take place. While a level of migration of zero could in principle be allowed for through the formulation of the corresponding Kuhn-Tucker conditions, in practice migration appears to take place. Another alternative would be to include a margin into the remittances function $r(L_m; w_m)$, which accounts for the difference between w_{of}/w_{oi} and the household returns from migration. While an interpretation of this margin would be that it represents additional value (e.g. utility) accruing to the household, which goes beyond the mere monetary value of the remittances, this approach is weak from a theoretical point of view.

In order to address the concerns expressed in a theoretically sound manner, two solutions are proposed. First, it may be taken into account that people, and thereby households, may have preferences with respect to different types of employment. That is, a decision maker could be assumed to experience additional utility or disutility from being engaged in a particular activity. This would allow households to work in different employments at different prevailing wage rates. Likewise, a first contribution would be made to explain the occurrence of migration in the presence of relatively small differences between wage rates at areas of origin and destination.

The second solution to be proposed is an extension of the impact of out-migration on the economy of the household. According to the basic model the household trades migration against the use of labour in other production activities and against the consumption of leisure. But beyond that, the considerations of the household should also include the fact that migration changes the demand of the household for other goods than leisure, as the household (temporarily) becomes smaller. Hence, the marginal benefit accruing to the household from an additional migrant is not only $\frac{\partial r(\cdot)}{\partial L_m}$ but also a benefit due to lower consumption demand. With lower consumption demand considered it appears more likely that the marginal benefit from migration actually can equal the local wage rates w_{of}/w_{oi}. A calibration of the remittances function as mentioned above may be a way to implicitly including the lower consumption demand. At his point, however, it remains questionable whether this is sufficient to adequately consider the interactions between migration and household consumption demand in the household's decision making.

A short excursus to the literature on applied models, which have an agricultural household model at their core, namely equilibrium studies of village economies by Kuiper (2005), Materer and Taylor (2003) and Taylor et al. (1999a), shows that an implementation of the two solutions proposed above will fill a still existent research gap. The studies by Materer and Taylor (2003) and Taylor et al. (1999a) rest on a theoretical model developed by Taylor and Adelman (1996). In this model, migration is determined endogenously as households allocate labour to migration until the marginal returns to migration (i.e. remittances) equal the household shadow wage. This approach corresponds to the basic model presented in this section. While it seems that in case of the applied studies (Materer and Taylor, 2003; Taylor et al., 1999a) the problem of a too small difference between household shadow wages and household returns to migration is solved through a corresponding calibration of the remittances function, the link between migration and the households' consumption demand is not taken into account. The associated consequences for the households' incentives to migrate are not considered. Kuiper (2005) solves this problem by applying a per capita equivalent LES, which defines per capita consumption in the household as a function of income per capita. Still, Kuiper (2005) models changes in migration as an exogenous shock and not as a decision endogenous to the household. So, the challenge of modelling migration as a decision endogenous to the household while at the same time taking into account the impact of migration on consumption demand remains.

The following section 4.2 proceeds with a modification of the basic model, which includes labour market choices into the preference structure of the household, leading to nonseparability of the household's production and consumption decisions. In section 4.3 the basic model is extended to take into account the feedback of migration to the household's consumption sphere. A synthesis, which combines the aspects of the two previous variants of the model in a single, unified framework is presented in section 4.4. This framework serves as the reference for the analyses carried out in the subsequent chapters.

4.2. A Nonseparable Household Model with Endogenous Migration Decisions

The first caveat to the treatment of labour allocation in the basic model stems from the requirement of local off-farm wage rates being equal, preventing the household from being engaged in several local off-farm activities at the same time. Following an approach pioneered by Lopez (1984, 1986) and applied by Sonoda (2008), the solution to this problem, which is set out in this section is the inclusion of choices of labour market participation into the preference structure of the household. Households are assumed to have certain preferences regarding the different types of activities. This implies that the different activities are imperfect substitutes from the perspective of the household. As mentioned before, the rationale behind this is that households might experience different utility or disutility from working on the farm, on local off-farm labour markets or from migration. The presence of children or elder, for example, may make migration a less attractive option for the household. Likewise, the need for childcare may require at least one person to stay at home (i.e. on the farm) and make farm work the preferred choice for this person. Hence, the problem may boil down to intra-household distribution of labour due to the different fitness of different members of the household to perform different tasks (Sonoda, 2008). As is shown below, this approach leads to the household's decisions of labour allocation and leisure demand to be governed by a shadow wage endogenous to the household rather than an exogenous market wage rate. In the consequence, production and consumption decisions of the household become nonseparable in the sense described in section 2.3.3.[4]

4.2.1. Set-up of the Model and First Order Conditions

In order to formalize nonseparability in the household model, the utility function of the basic model from equation (4.1) now includes the time spent by the household on work in the different activities:

$$max\ U(X_a, X_m, L_f, L_{of}, L_{oi}, L_m, X_l) \tag{4.16}$$

w.r.t $X_a, X_m, X_l, L_f, L_{of}, L_{oi}, L_m, V$.

It is important to note that L_f, L_{of}, L_{oi} and L_m are directly included in the utility function. Since no further assumptions are made, this implies that it is *a priori* undetermined whether the utility function is increasing or decreasing in the different amounts of time spent on the different activities. That is, a certain

[4]It can be argued that nonseparability of household decisions may not be caused by the imperfect substitutability of different labour market choices alone. Land and labour market imperfections or the imperfect substitutability of family and hired labour can be a reason for nonseparability, as well (de Janvry et al. (1991); de Janvry and Sadoulet (2003); Singh et al. (1986b), for a formalization, see for example Benjamin (1992)). In fact, from an empirical point of view such a situation is entirely conceivable in Guizhou, as the survey data from the villages exhibits a high share of households which do not participate in local labour markets. In the entire sample, around 40% of the households do not participate in local labour markets at all. In Changtian, around 60% of the households neither sell nor hire labour on and from local off-farm labour markets. Furthermore, the higher share of households participating in migration in Changtian (52.4% as opposed to 43% in all villages) suggests that migration constitutes a substitute for restricted local off-farm opportunities. Unfortunately, as villagers appear to have unrestricted access to an informal local off-farm labour market as well as to migration, a model with imperfect labour markets would not be able to explain the prevailing patterns of labour market participation of the households. Nonetheless, a restriction on formal local off-farm employment will be introduced into the model at a later point.

activity can create either additional utility of disutility to the household. This can be interpreted as a more general approach than the models by Lopez (1984, 1986) and Sonoda (2008) who assume that all time worked in any activity decreases the household's utility.

As the production function (4.2), the time constraint (4.3) and the cash income constraint (4.5) faced by the household remain as before, the Lagrangian of the modified model becomes:

$$\begin{aligned}\mathcal{L} &= U(X_a, X_m, L_f, L_{of}, L_{oi}, L_m, X_l) + \\ &\quad + \lambda[p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) - p_a X_a - p_m X_m - vV] + \\ &\quad + \psi(T - L_f - L_{of} - L_{oi} - L_m - X_l) \end{aligned} \tag{4.17}$$

While the conditions governing the demand for consumption goods (4.8a) and (4.8b), leisure (4.8c) and variable production factors (4.8h) do not change, the first order conditions for the allocation of labour allocation to the different activities have to be altered:

$$\frac{\partial \mathcal{L}}{\partial L_f} = \frac{\partial U}{\partial L_f} + \lambda p_a \frac{\partial f(\cdot)}{\partial L_f} - \psi = 0 \tag{4.18a}$$

$$\frac{\partial \mathcal{L}}{\partial L_{of}} = \frac{\partial U}{\partial L_{of}} + \lambda w_{of} - \psi = 0 \tag{4.18b}$$

$$\frac{\partial \mathcal{L}}{\partial L_{oi}} = \frac{\partial U}{\partial L_{oi}} + \lambda w_{oi} - \psi = 0 \tag{4.18c}$$

$$\frac{\partial \mathcal{L}}{\partial L_m} = \frac{\partial U}{\partial L_m} + \lambda \frac{\partial r(L_m; w_m)}{\partial L_m} - \psi = 0 \tag{4.18d}$$

4.2.2. Analytical Results

Along with the first order condition for leisure demand (4.8c), the conditions governing the allocation of labour by the household to the different activities (4.18a) - (4.18d) can be manipulated and combined to obtain

$$\begin{aligned}\frac{\psi}{\lambda} &= \frac{1}{\lambda}\frac{\partial U}{\partial X_l} \\ &= \frac{1}{\lambda}\frac{\partial U}{\partial L_f} + p_a \frac{\partial f(\cdot)}{\partial L_f} \\ &= \frac{1}{\lambda}\frac{\partial U}{\partial L_{of}} + w_{of} = \frac{1}{\lambda}\frac{\partial U}{\partial L_{oi}} + w_{oi}\end{aligned}$$

$$= \frac{1}{\lambda}\frac{\partial U}{\partial L_m} + \frac{\partial r(L_m; w_m)}{\partial L_m} \tag{4.19}$$

Equation (4.19) shows that in the optimum the household allocates labour in a way that the marginal returns from each activity and leisure equal the household shadow wage $\frac{\psi}{\lambda}$ (i.e. the marginal utility of time translated into monetary terms by division by the marginal utility of income). In case of leisure the marginal returns still consist of the marginal utility of leisure expressed in monetary terms. With respect to each productive activity the monetary marginal return is now corrected by a term which takes into account the marginal utility of participation in the respective activity. The consequence from an analytical point of view is that household decisions have become nonseparable. Unlike in the basic model from section 4.1, household labour allocation is now governed by the household shadow price of labour, which is no longer equal to the off-farm market wages, but which depends on the preference structure of the household. As desired, the model also includes the possibility of the household being engaged in different activities simultaneously while wage rates are allowed to differ. Nonetheless, under the little restrictive assumptions of the model it remains undetermined how the household shadow wage relates to the market wage rates. In case utility is an increasing function of the time spent in an activity the shadow wage may be higher than the respective wage. In case utility decreases with increasing time worked,[5] the household shadow wage can be expected to be lower than the market wage. The actual decision which assumption will be more valid, meanwhile, is an empirical matter.

In particular with respect to migration, the model opens an interesting option. Since the utility connotation of migration is explicitly included, a theoretical base is provided to model migration responses, which are different among households. Depending on considerations as those presented in the introductory part of this section, households may exhibit stronger or weaker responses to changes in incentives to migration, i.e. to changes in relative wage rates. Subsequent analyses, in particular the applied model, will exploit this property of the model.

[5]This is the assumption made by Lopez (1984, 1986) and Sonoda (2008).

4.3. A Household Model with Endogenous Migration Decisions and Feedback to the Consumption Sphere

The first modification of the basic model included labour market participation choices into the preference structure of the household. While this can already contribute to the explanation of the occurrence of migration in situations with comparatively low differences in wage rates at areas of origin and destinations, the inclusion of a feedback from migration to the household's consumption sphere adds another important aspect of households' migration decisions to the model. Starting again from the basic model from section 4.1, a framework is constructed, which depicts migration decisions as endogenous to the household while considering the consumption impact of migration. The section basically draws on a work by Wouterse (2006) who analyses migration of rural households in Burkina Faso with an agricultural household model, offering an adequate base for the model to be presented in the following.

4.3.1. Set-up of the Model and First Order Conditions

As before, the household is still assumed to maximize utility through the consumption of an agricultural good, a manufactured market purchased good and leisure

$$max\ U(X_a, X_m, X_l) \tag{4.20}$$

w.r.t $X_a, X_m, X_l, L_f, L_{of}, L_{oi}, L_m, V$, but unlike in the previous utility function (4.1) consumption is now defined per adult equivalent.

While the production constraint remains as before ((4.2)), the time and the budget constraint have to be modified in order to take into account that consumption of leisure and goods has been defined in per adult equivalents:

$$\begin{aligned} T &= L_f + L_{of} + L_{oi} + L_m + X_l(N - M) \\ &= L_f + L_{of} + L_{oi} + L_m + X_l(N - \frac{L_m}{E}). \end{aligned} \tag{4.21}$$

The term $(N-M)$ describes the number of household members in the active age living in the household. It is the difference between the total number of members in the active age N and the number of migrants M. M, the relevant number of migrants is calculated as $\frac{L_m}{E}$ with E being the time covered by the survey and L_m the time worked in migration, expressed in the same unit of measurement; so, if the survey covers one year, a migration duration of 365 days would be equivalent to one economically active person less in the household.

Taking into account the new way consumption is defined, the combined cash income constraint becomes:

$$\begin{aligned} & p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) \\ & = (N - M + \gamma D)(p_a X_a + p_m X_m) + vV \equiv I \end{aligned} \tag{4.22}$$

or

$$\begin{aligned} & p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) \\ & = (N - \frac{L_m}{E} + \gamma D)(p_a X_a + p_m X_m) + vV \equiv I \end{aligned} \tag{4.23}$$

Here, through multiplication with $(N - M + \gamma D)$ or $(N - \frac{L_m}{E} + \gamma D)$, respectively, consumption of X_a and X_m is scaled to total amounts consumed, with a parameter γ, which scales the number of dependants to adult equivalent consumption levels.

By combining the utility function (4.20) with the time constraint (4.21) and the combined cash income constraint (4.23) the Lagrangian expression associated with this problem becomes:

$$\begin{aligned} \mathcal{L} = & U(X_a, X_m, X_l)+ \\ & + \lambda[p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m)- \\ & - vV - (N - \frac{L_m}{E} + \gamma D)(p_a X_a + p_m X_m)]+ \\ & + \psi[T - L_f - L_{of} - L_{oi} - L_m - X_l(N - \frac{L_m}{E})] \end{aligned} \tag{4.24}$$

Partial differentiation of the Lagrangian shows that the first order conditions for consumption demand including leisure as well as the one for migration change according to the new formulation of the model:

$$\frac{\partial \mathcal{L}}{\partial X_a} = \frac{\partial U}{\partial X_a} - \lambda p_a (N - \frac{L_m}{E} + \gamma D) = 0 \tag{4.25a}$$
$$\frac{\partial \mathcal{L}}{\partial X_m} = \frac{\partial U}{\partial X_m} - \lambda p_m (N - \frac{L_m}{E} + \gamma D) = 0 \tag{4.25b}$$
$$\frac{\partial \mathcal{L}}{\partial X_l} = \frac{\partial U}{\partial X_l} - \psi (N - \frac{L_m}{E}) = 0 \tag{4.25c}$$
$$\frac{\partial \mathcal{L}}{\partial L_m} = \lambda \frac{\partial r(L_m; w_m)}{\partial L_m} + \frac{1}{E} \left[\lambda (p_a X_a + p_m X_m) + \psi X_l\right] - \psi = 0 \tag{4.25d}$$

The conditions for the allocation of household labour to farm production (4.8d) and local off-farm activities (4.8e) and (4.8f) as well as the demand for variable farm inputs (4.8h) remain the same.

4.3.2. Analytical Results

According to equations (4.25a) - (4.25c), (4.8e) and (4.8f), the conditions governing household demand become:

$$\begin{aligned}
\frac{\partial U}{\partial X_a (N - \frac{L_m}{E} + \gamma D)} &= \lambda p_a \\
\frac{\partial U}{\partial X_m (N - \frac{L_m}{E} + \gamma D)} &= \lambda p_m \\
\frac{\partial U}{\partial X_l (N - \frac{L_m}{E})} &= \lambda w_{of} = \lambda w_{oi}
\end{aligned} \tag{4.26}$$

This resembles the results of equations (4.9), with the difference that consumption of an adult equivalent is now scaled to the entire household by multiplication with $(N - \frac{L_m}{E} + \gamma D)$ and $(N - \frac{L_m}{E})$, respectively.

The most important insight for our purposes, however, is provided by a contemplation of equation (4.25d), which describes the allocation of labour to migration in the household's optimum. After combination with equations (4.25c) and (4.8d) - (4.8f) and division by λ, the equation yields the following result:

$$\begin{aligned}
\frac{\psi}{\lambda} &= \frac{\partial r(L_m)}{\partial L_m} + \frac{1}{E}[(p_a X_a + p_m X_m) + \frac{\psi}{\lambda} X_l] \\
&= p_a \frac{\partial f(\cdot)}{\partial L_f}
\end{aligned}$$

$$
\begin{aligned}
&= \frac{1}{\lambda}\frac{1}{(N-\frac{L_m}{E})}\frac{\partial U}{\partial X_l} \\
&= w_{of} = w_{oi} \qquad (4.27)
\end{aligned}
$$

As (4.27) shows, the household allocates labour to migration in a way that the marginal returns from migration, the marginal utility of leisure expressed in monetary terms and the marginal returns from work on the farm equal the household shadow wage. The household shadow wage itself corresponds to the market wage rates w_{of} and w_{oi}, which constitute the marginal returns from local-off farm work in both the formal and informal sector. Most importantly, the marginal returns from migration now consist of the marginal amount of remittances plus the returns accruing to the household in form of a lower demand for consumption and leisure. As both $p_aX_a + p_mX_m$ and X_l are decreasing in L_m, demand for consumption and leisure decreases with higher levels of migration.

According to these results, the critical points made in the discussion of the treatment of migration in the standard model presented above can be considered to be resolved. First, the model now explicitly accounts for the interactions between the allocation of labour to migration and the consumption side of the household instead of hiding it in the remittances function. This leads to more adequate decision rules. Second, as the benefits, which accrue to the household from lower consumption demand, add to the marginal returns of remittances it is more conceivable that the total marginal returns from migration can equal the marginal returns of a unit of labour supplied to the local labour market or to the farm. Hence, migration becomes 'competitive' with other activities.

4.4. Synthesis: A Nonseparable Household Model with Endogenous Migration Decisions and Feedback to the Consumption Sphere

The extensions of the basic agricultural household model with endogenous migration decisions, which are presented in sections 4.2 and 4.3 have demonstrated how the concerns raised in the discussion of the basic model in section 4.1 can be addressed. This final section of the theoretical chapter pulls the two models together to obtain a unified framework—a nonseparable household model with endogenous migration decisions and feedback to the consumption sphere. After setting up the model and deriving the first order conditions, the insights gained from sections 4.1 - 4.3 are repeated and summarized.

4.4.1. Set-up of the Model and First Order Conditions

In order to allow for the household's consumption of the agricultural good, the manufactured good and leisure to be defined in per adult equivalents while the time allocated to the different activities still is considered in total amounts of time, the combined model features a composite utility formulation. In the composite utility function, total utility consists of two elements; the utility the household gets through its participation in the labour market, which is depicted by a function U^L and the utility, which stems from consumption, captured by a function U^C. Utility generated through U^L is added to the utility from U^C. [6] Correspondingly, the problem of the household becomes

$$max\left[U^C(X_a, X_m, X_l) + U^L(L_f, L_{of}, L_{oi}, L_m)\right] \tag{4.28}$$

w.r.t $X_a, X_m, X_l, L_f, L_{of}, L_{oi}, L_m, V$.

Utility is maximized subject to a production constraint

$$Q_a = f(L_f, V; A), \tag{4.29}$$

a time constraint, in which X_l is scaled to adult equivalents by multiplication with the term $(N - \frac{L_m}{E})$:

$$T = L_f + L_{of} + L_{oi} + L_m + X_l(N - \frac{L_m}{E}), \tag{4.30}$$

and a cash income constraint, where consumption of X_a and X_m is scaled to total amounts consumed through multiplication with $(N - \frac{L_m}{E} + \gamma D)$, where γD is the

[6] This also offers the advantage that both functions and the associated demand systems can be specified independent from each other.

number of dependants scaled to adult equivalents:

$$\begin{aligned} & p_a Q_a + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) \\ = \quad & (N - \frac{L_m}{E} + \gamma D)(p_a X_a + p_m X_m) + vV \equiv I. \end{aligned} \tag{4.31}$$

The cash income constraint (4.31) and the production function (4.29) are collapsed into a single combined constraint

$$\begin{aligned} & p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) \\ = \quad & (N - \frac{L_m}{E} + \gamma D)(p_a X_a + p_m X_m) + vV \equiv I \end{aligned} \tag{4.32}$$

The Lagrangian expression associated with this problem is:

$$\begin{aligned} \mathcal{L} \quad = \quad & U[U^C(X_a, X_m, X_l) + U^L(L_f, L_{of}, L_{oi}, L_m)] + \\ & + \lambda[p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) - \\ & - (N - \frac{L_m}{E} + \gamma D)(p_a X_a + p_m X_m) - vV] + \\ & + \psi[T - L_f - L_{of} - L_{oi} - L_m - X_l(N - \frac{L_m}{E})] \end{aligned} \tag{4.33}$$

Partial differentiation of the Lagrangian leads to the following first order conditions:

$$\frac{\partial \mathcal{L}}{\partial X_a} = \frac{\partial U^C}{\partial X_a} - \lambda p_a (N - \frac{L_m}{E} + \gamma D) = 0 \tag{4.34a}$$

$$\frac{\partial \mathcal{L}}{\partial X_m} = \frac{\partial U^C}{\partial X_m} - \lambda p_m (N - \frac{L_m}{E} + \gamma D) = 0 \tag{4.34b}$$

$$\frac{\partial \mathcal{L}}{\partial X_l} = \frac{\partial U^C}{\partial X_l} - \psi (N - \frac{L_m}{E}) = 0 \tag{4.34c}$$

$$\frac{\partial \mathcal{L}}{\partial L_f} = \frac{\partial U^L}{\partial L_f} + \lambda p_a \frac{\partial f(\cdot)}{\partial L_f} - \psi = 0 \tag{4.34d}$$

$$\frac{\partial \mathcal{L}}{\partial L_{of}} = \frac{\partial U^L}{\partial L_{of}} + \lambda w_{of} - \psi = 0 \tag{4.34e}$$

$$\frac{\partial \mathcal{L}}{\partial L_{oi}} = \frac{\partial U^L}{\partial L_{oi}} + \lambda w_{oi} - \psi = 0 \tag{4.34f}$$

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial L_m} = \frac{\partial U^L}{\partial L_m} + \lambda \frac{\partial r(L_m; w_m)}{\partial L_m} + \\ + \lambda \frac{p_a X_a + p_m X_m}{E} + \psi \frac{X_l}{E} - \psi = 0 \end{aligned} \tag{4.34g}$$

$$\frac{\partial \mathcal{L}}{\partial V} = \lambda p_a \frac{\partial f(\cdot)}{\partial V} - \lambda v = 0 \tag{4.34h}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = p_a f(L_f, V; A) + w_{of} L_{of} + w_{oi} L_{oi} + r(L_m; w_m) - \tag{4.34i}$$
$$- (N - \frac{L_m}{E} + \gamma D)(p_a X_a + p_m X_m) - vV = 0$$

$$\frac{\partial \mathcal{L}}{\partial \psi} = T - L_f - L_{of} - L_{oi} - L_m - X_l(N - \frac{L_m}{E}) = 0 \tag{4.34j}$$

4.4.2. Analytical Results

4.4.2.1. Household Demand

The conditions governing the demand for consumption goods of the household result from (4.34a) and (4.34b).

$$\frac{\partial U}{\partial X_a(N - \frac{L_m}{E} + \gamma D} = \lambda p_a \; ; \; \frac{\partial U}{\partial X_m(N - \frac{L_m}{E} + \gamma D} = \lambda p_m \tag{4.35}$$

Accordingly, the household consumes a product up to the point where the marginal utility of consumption of the good scaled to the household level is equal to the marginal utility of the income spent on the marginal unit consumed. As in the basic model, this is the standard results from demand theory.

Household demand for leisure is given by equation (4.34c). This equation can be rearranged and manipulated to yield:

$$\frac{1}{\lambda} \frac{\partial U}{\partial X_l(N - \frac{L_m}{E})} = \frac{\psi}{\lambda} \tag{4.36}$$

The equation implies that demand for leisure is governed by the household shadow price of labour. Leisure is demanded up to the point where the marginal utility of leisure is equal to its opportunity cost in terms of foregone income.

4.4.2.2. Allocation of Labour to Productive Activities and Migration

The allocation of labour to migration is described by equation (4.34g). The equation can be rearranged to obtain

$$\frac{1}{\lambda} \frac{\partial U}{\partial L_m} + \frac{\partial r(L_m; w_m)}{\partial L_m} + \frac{1}{E}(p_a X_a + p_m X_m + \frac{\psi}{\lambda} X_l) = \frac{\psi}{\lambda} \tag{4.37}$$

Equation (4.37) shows that in order to maximize utility the household allocates labour to migration up to the point where the change of utility due to the engagement in the migration activity expressed in value terms plus the returns from migration in terms of remittances plus the gains (in value terms) from lower demand for consumption and leisure equal the household shadow wage. This analysis can be extended to include the allocation of labour by the household to all productive activities as well as its leisure demand, resulting in a complete picture of labour allocation:

$$\begin{aligned}
\frac{\psi}{\lambda} &= \frac{1}{\lambda}\frac{\partial U}{\partial X_l(N-\frac{L_m}{E})} \\
&= \frac{1}{\lambda}\frac{\partial U}{\partial L_f} + p_a\frac{\partial f(\cdot)}{\partial L_f} \\
&= \frac{1}{\lambda}\frac{\partial U}{\partial L_{of}} + w_{of} \\
&= \frac{1}{\lambda}\frac{\partial U}{\partial L_{oi}} + w_{oi} \\
&= \frac{1}{\lambda}\frac{\partial U}{\partial L_m} + \frac{\partial r(L_m; w_m)}{\partial L_m} + \frac{1}{E}(p_a X_a + p_m X_m + \frac{\psi}{\lambda}X_l) \qquad (4.38)
\end{aligned}$$

Equation (4.38) implies that in the household's optimum, all activities including leisure yield the same marginal returns to the household. These marginal returns include the monetary returns as well as a utility component and are equal to the household shadow wage $\frac{\psi}{\lambda}$. The nonseparable nature of the model becomes evident from the fact that $\frac{\psi}{\lambda}$ is not equal to any of the market wage rates.

4.4.2.3. Factor Demand

The result for the demand for variable inputs is straightforward. From (4.34h) follows

$$p_a\frac{\partial f(\cdot)}{\partial V} = v \qquad (4.39)$$

which implies that a variable input is demanded up to the point where its marginal value product equals the factor price. This, again, is a standard result from production theory.

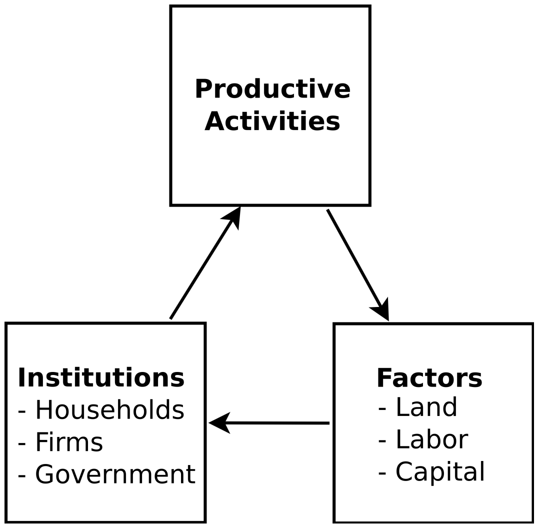
By providing conditions for consumption demand, labour allocation and factor demand, the nonseparable agricultural household model with endogenous migration decisions and feedback to the consumption sphere represents a consistent framework for the analyses carried out in the subsequent parts of this study. In Chapter 5 it is used for the estimation of household shadow wages, a test for nonseparability and the analysis of migration decisions. In Chapter 6 based on this theoretical framework an applied village equilibrium model is constructed, which finally is used for the simulation analyses in Chapter 7.

5. A Village SAM

The crucial initial step of any CGE-modelling exercise is the preparation of a SAM which constitutes the core dataset underlying the model. In principle, a SAM is a square matrix whose entries represent transaction which take place in a given socio-economic system during a particular period of time (Breisinger et al., 2009; Round, 2003; Schneider and Zenios, 1990). In its most simple form, a SAM distinguishes productive activities, production factors like labour and land as well as institutions such as households, firms or the government.[1] Each of these elements of the SAM is represented by an account in the matrix (see Figure 5.1). Value-added generated by production activities flows to the production factors. Returns to factors, in turn, make up the primary income of institutions. Expenditures of institutions on goods and services produced by the activities, finally, complete a circular flow of payments within the system (Schneider and Zenios, 1990; Robinson et al., 2001).

The underlying principle of a SAM is the organisation of double entry accounting in a single entry matrix. This implies that the receipts and expenses of each account must balance or, speaking in matrix terms, that all row and column totals must be equal (Breisinger et al., 2009; King, 1985; Robinson et al., 2001). In the consequence, all incomes and expenditures are taken into account, making the SAM a complete and consistent representation of a given socio-economic system. Supporting the corresponding economic theory, the consistency properties of the SAM framework impose a general equilibrium on the economy depicted. In fact, the double-accounting principle of the SAM guarantees all kind of equalities which are necessary for an economy to be in general equilibrium. The SAM framework,

[1] The usage of the term 'institutions' in a SAM context differs from the meaning usually given in economics. While 'institutions' in the latter case describes the rules according to which an economy functions, in the former case it simply refers to categories of economic actors (compare Taylor and Adelman, 1996).



Source: Adopted from Schneider and Zenios (1990).

Figure 5.1.: Monetary flows in a simplified SAM structure.

for instance, ensures that supply equals demand, that total value-added be equal to final demand or that total factor demand corresponds to total factor supply (Pyatt and Round, 1985a). Having said this, a SAM can be characterized as

> ”a snapshot of the critical variables in a general equilibrium model describing the circular flow of financial transactions in an economy” (Schneider and Zenios, 1990, p.440).

Having a limited temporal coverage—typically a period of one year—a SAM constitutes a static image of a socio-economic system (King, 1985). Depending on the degree of detail present in the SAM, it conveys, however, a great deal of information on the structure of the system and its interdependencies (Round, 2003). By providing a picture of the levels and structure of income and transfers as well as the flows between the elements of the system like firms, factors or institutions, a SAM offers a suitable tool for analysing topics of income distribution and inequality (Dervis et al., 1982). The great strength of the SAM framework thereby is its extension beyond the mere production side of an economy towards the coverage of any kind of institutions, households, socio-economic groups, etc., giving central importance to ”people, not commodities” (Pyatt and Round, 1985a, p.1).

As the preceding discussion already indicates, the design of a SAM in practice is more complicated than the simple activities–factors–institutions structure presented in Figure 5.1. Depending on the actual structure of the economy in focus as well as on the requirements posed by the research problem to be addressed, the accounts which constitute the basic structure can be disaggregated and amended by additional kinds of accounts, such as trade or savings-investment accounts. A village SAM, in this context, has to be adapted to the peculiarities of the detailed depiction of a small economy, which is characterized by a potentially large degree of integration with the rest of the world and the presence of non monetized transactions such as own consumption or the use of family owned production factors in household production activities (see also Taylor and Adelman, 1996).

The village SAM, which constitutes the basic data input for the village equilibrium model, summarizes and illustrates the explicit and implicit (i.e. monetized and non monetized) transactions within the village and between the village and the rest of the world. These transactions comprise the flows of inputs and income between agricultural production and other production activities in the village and the flows of income from production activities to production factors and ultimately to the households of the village. On the expenditure side the village SAM depicts the use of household incomes for consumption, savings and investments and finally, as mentioned above, contains the exchange of goods, services and factors between the village and the outside world (Taylor and Adelman, 1996).

The construction of a village SAM involves a number of work steps to be carried out. Before embarking upon the actual compilation it is necessary to define the representative household groups (RHG), which are represented by the household accounts in the SAM. Although certain formal recommendations have been made, the criteria for the definition of the RHG ultimately derive from the focus of the research and are only limited by the availability of the data (Pyatt and Thorbecke, 1976; Round, 2003). Accordingly, RHG of the SAM for Changtian village are constructed to reflect the focus of the present research on migration, income distribution and poverty. The following Section 5.1.1 is dedicated to this step of the construction of the SAM. A further important issue is associated with the non monetary character of many village transactions mentioned above. The value of the household labour employed in household production activities, for example, is reflected by an unobserved household specific shadow wage. Likewise, the overwhelming part of the village land is used by the households themselves and the rental prices observed on the village rental market do not allow to derive reliable estimates of the value of land. Hence, the estimation of shadow prices for these production factors, which is subject of Section 5.1.2 of this chapter, is a further step to be completed before the compilation of the SAM. Having constructed the RHG and estimated shadow prices, Section 5.2 presents the village SAM for Changtian village. The first part 5.2.1 of that section introduces the SAM in the form of a general overview, followed by a second part 5.2.2 in which the SAM is presented in detail. The chapter is concluded by a section in which some elaborations on the compilation and the balancing of the SAM are provided.

5.1. Preliminary Works

5.1.1. Construction of Representative Household Groups

The actual impact of macroeconomic shocks, such as trade reforms, on households to a large extent depends on the characteristics of the households themselves. The discussions in sections 2.2.1, 2.3.1 and 2.3.2 highlight the relevance of prevailing patterns of household production, consumption, and factor endowments as well as differences in household behaviour for the effects of trade reforms on household poverty and inequality. In SAM based applied equilibrium models this is of particular importance for the construction of representative household groups. In general, there are concerns that the aggregation of households in representative household groups masks the heterogeneity of households with respect to characteristics such as factor endowments, labour supply and consumption behaviour, asset profiles, location, household composition or education, for example, which may lead to misleading results due to the loss of potentially important information (Bourguignon et al., 2003; Cockburn, 2004; de Maio et al., 1999; Winters et al., 2004). Unless further intra-group analyses are added, the use of representative household groups confines the analysis of the distribution of income to a depiction of changes in inequality between groups. Income within groups is assumed to follow an exogenously given distribution which responds to a policy shock only through a change in its first moment. Changes of inequality within representative household groups are neglected although within group inequality may also be affected, depending on the characteristics of individual households (Bourguignon et al., 2003; Cockburn, 2004; Cogneau and Robilliard, 2000; Savard, 2005). Furthermore, aggregating households in representative household groups implies the assumption that the behaviour of the representative agent depicted in the model is identical to the sum of the behaviour of the individual households. Apart from imposing identical behaviour to each household, this assumption does not allow for the dynamic complexity which may arise from individual behaviour (Cogneau and Robilliard, 2000). These different concerns related to the representative household groups approach have prompted the development of macro-micro simulation approaches which allow to fully or partially get rid of the assumption of a representative agent (recall the discussion in Section 2.3.2).

The village model developed in this study maintains the assumption of the representative agent. Hence, households in the village SAM are aggregated in representative household groups. As the focus of the study is on poverty and inequality, households are stratified according to the level of their living standard.[2] Further, as household migration takes centre stage in the analysis, a way is sought to group households in a way that the groups reflect different propensities of the households to send migrants. The result is a number of representative household groups with different migration behaviour which are further subdivided by the level of their living standard. The stratification of households according to their living standard is straightforward. The grouping of households according to their migration behaviour, however, is more challenging. Indeed it might be possible to group households according to observed migration, e.g. the share of migrants in the household. But as observed, migration is subject to the circumstances at the time of the survey, it can be expected to be more accurate to revert to variables which underlie households' migration decisions and ultimately determine the migration behaviour of the households. Consequently, an analysis of household migration with the aim of identifying characteristics of households relevant to their migration decisions is carried out. It is shown that household composition plays a crucial role in explaining households' migration decisions and households consequently are grouped according to the size of the household dependency ratio. As a

[2]The level of expenditure is used as a proxy for the household living standard.

consequence of the stratification by the level of income and the dependency ratio, the final SAM has six representative household groups, consisting of two groups of households with low and high propensities to migrate. Each of the groups is further subdivided into three subgroups with low, middle and high income.

Certainly it can be argued that through the adherence to representative household groups the concerns regarding this concept presented above are not addressed and the critique, hence, remains valid. Households within one particular group still are assumed to exhibit identical behaviour, representative household groups still may consist of household which are heterogeneous with respect to characteristics potentially relevant for the analysis and still only changes in inequality between groups are depicted. Nevertheless, as the SAM and the model only cover one single village, heterogeneity with respect to location remains only of minor importance. Likewise, representative household groups consisting of 30 to 60 households as in the village SAM to be presented are already very small, at least by standards of CGE modelling, and the village model can be considered to be highly disaggregated and to reflect a high degree of detail. Although this does not entirely invalidate the concerns presented above, they are weakened considerably and the level of aggregation chosen and the homogeneity taken into account can be accepted as being sufficient for the analyses to be carried out.

5.1.1.1. Analysis of Households' Migration Decisions

The first step towards the construction of the representative household groups is the identification of household characteristics and other factors which influence households' migration decisions. To this end, potential variables are selected with the help of a review of empirical studies on labour migration which analyse migration as a decision at the household level. This information serves to define the variables and provides support in the formulation of the hypotheses. In addition, the list of variables obtained is amended, taking into account further considerations on the particular situation in Guizhou province. In particular, variables are selected to allow for the investigation of links between household demographics and the health status of grandparents and migration which arise from the division of labour within the households. A logit model of the decision of households to migrate is estimated in order to assess the significance of the variables for the

Guizhou sample and to test some hypothesis on household demographics, health and migration.

The empirical studies reviewed are based on different theoretical models of labour migration, such as the Harris-Todaro model (Harris and Todaro, 1970; Zhao, 1999b), models of household utility maximization (Hoddinott, 1994) and the New Economics of Labour Migration (NELM) (Stark and Bloom, 1985; Taylor et al., 2003; Wouterse and Taylor, 2006). In spite of the different theories used, the determinants of migration that are taken into account are similar. A first determinant of migration considered is household size. The underlying rationale would be that under conditions of imperfect labour markets, larger households would have a higher potential to send migrants (Taylor et al., 2003; Zhao, 1999b). Other household demographics, including the share of dependants, inactive or children, the gender ratio or the share of married persons in the household, are hypothesized to influence migration decisions as well (Hoddinott, 1994; Taylor et al., 2003; Zhao, 1999b). Ethnicity, as taken into account by Zhao (1999b), may also be included into this category. Further, human capital is expected to play a role. This may comprise age variables, work experience, or education (Hoddinott, 1994; Taylor et al., 2003; Zhao, 1999b). Variables of household wealth and productive assets may include the size of land holdings (Hoddinott, 1994; Taylor et al., 2003; Zhao, 1999b) or indicators of household wealth (Taylor et al., 2003; Zhao, 1999b). Taylor et al. (2003) also hypothesize an influence of previous migration experience and the access to migrant networks on the migration decision. Finally, studies which use cross regional data include village characteristics, such as non-farm employment opportunities, village population, transport and communication infrastructure, or geographical characteristics (Taylor et al., 2003; Zhao, 1999b). However, as the villages in Guizhou are very similar and as the SAM is constructed for only one village, this may be neglected for now.

In addition to the variables identified from the literature, there is anecdotal evidence from the villages on a likely interaction between household demographics, health and migration. According to these accounts, migration happens in the context of intra household division of labour. As children require care and supervision, persons in the typical migration age with children (between 16 and 39, according to sample data) are less likely to migrate. However, as soon as the elder parents of the prospective migrants still live in the household, they can provide childcare, allowing their sons and daughters with children to temporarily leave the home village. This may work as long as the migrants' parents[3] have no chronic illness which would prevent them from taking care for children and may make them demand care for themselves, thus again impeding the persons in migration age from migrating. To include this account into the model, dummy variables for the respective constellations of prospective migrants, children, grandparents and their health status are defined and the significance of grandparents' health in explaining the migration decision is tested for.

[3]In the following referred to as "grandparents."

Table 5.1.: Variables used to analyse household labour migration.

Determinant	Variable	Expected effect
Household demographics		
	Household size (number of household members)	+
	Share of married persons in household	-
	Share of males among household members between 16 and 39	+
Demographics and health		
	Household has children, no grandparents (1=yes, 0=no)	-
	Household has children, healthy grandparents (1=yes, 0=no)	0/-
	Household has children, all grandparents are chronically ill (1=yes, 0=no)	-
	Household has no children, healthy grandparents (1=yes, 0=no)	0/-
	Household has no children, all grandparents are chronically ill (1=yes, 0=no)	+/-
Human capital		
	Labour market experience of household head (years)	+
Household wealth		
	Value of durable assets (yuan/capita)	-
	Contract land (mu/capita)	-
Party membership		
	At least one household member is communist party member (1 if yes, 0 otherwise)	-
Ethnicity		
	All household members belong to ethnic minority (1 if yes, 0 otherwise)	+/-
Previous migration experience		
	At least one household household member has migrated members in the past (1 if yes, 0 otherwise)	+

The variables used to explain the household migration decision (1 if at least one household member has migrated in 2006, 0 otherwise) are described in Table 5.1. The variables on household size and the share of married persons are straightforward. The share of males in persons in the migration age (between 16 and 39) takes into account a possible gender bias in possibilities to migrate. The interactions between household demographics and health are captured with the help of a number of dummy variables. The reference case (all dummies zero) is a household with no children and no elder parents, where children are household members below 14 and elder parents are persons older than 60. The dummy “Household has children, no grandparents“ is 1 for all households with children and without grandparents. The expected effect of this variable on migration is negative. A dummy “Household has children, healthy grandparents“ equals 1 for all households with children and at least one healthy part of the grandparents. The hypothesized effect is neutral or at most slightly negative, as the presence of a healthy grandfather or grandmother who can take care for children can compensate for the negative effect of children and also for a potential negative effect of a chronically ill grandfather or grandmother. “Household has children, all grandparents are chronically ill“ is 1 for a household with children in which all grandparents are chronically ill. The expected effect of this dummy is negative. Households without children and with grandparents of which at least one is healthy are captured by a value 1 in the dummy “Household has no children, healthy grandparents“. The hypothesized effect of this variable is neutral or slightly negative, as also healthy parents might require some care or support. Households without children and with only chronically ill grandparents are assigned a 1 in the variable ”Household has no children, all grandparents are chronically ill”. The expected effect is ambiguous, as ill grandparents might require more care, whereas the presence of chronically ill persons in the household may create the need for generating more income through migration. As a human capital variable, the work experience of the household head was selected. Household wealth is captured by the value of durable assets per capita and the per capita area of contract land available to the household. Finally, some variables related to social capital or networks, namely, the membership in the communist party of at least on household member, ethnicity (1 if all household members belong to an ethnic minority) and the previous migration experience of at least one household member are included.

The empirical model is specified and estimated as a logit model (Greene, 2003). The general setup of the model is

$$Prob(Y = 1 \mid \mathbf{x}) = \frac{e^{\mathbf{x'}\beta}}{1 + e^{\mathbf{x'}\beta}} = \Lambda(\mathbf{x'}\beta),$$

with Y being the dummy for the household migration decision and $\mathbf{x}$ being a vector of independent variables as listed in Table 5.1. Different versions of the model are estimated, starting with a model which includes all the variables in Table 5.1. Subsequent likelihood ratio tests are carried out to test hypotheses regarding the links between household demographics, health and migration. Depending on the test results, the original model is re-estimated in a simplified manner. Although this section is already concerned with the SAM for Changtian village, the model is estimated using the full sample of all three villages. Assuming that results can be generalized across villages, this allows to take advantage of the larger sample size. The results of the estimation of the full model which includes all variables confirm the hypotheses on the effects of household size, the share of married persons in the household, the share of males among the household members in migration age as well as the hypotheses on ethnicity and previous migration experience. Household wealth and the communist party membership of household members are found to be not statistically significant (see Table 5.2).

The coefficient on the dummy for households with children but without grandparents indicates that these households are significantly less likely to migrate than households which have neither children nor grandparents. The coefficients on the dummies for households with children and healthy grandparents and for households with children and chronically ill grandparents are both significantly negative. The coefficients on the dummies for households without children are slightly negative but statistically not significant. These results suggest that household demographics play a role for migration decisions insofar as families with children and grandparents are significantly less likely to engage in migration than households without children and elder members. At the same time the higher magnitude of the coefficients on “Children, healthy elderly“ and “Children, all elderly chronically ill“ as compared to “Children, no elderly“ suggests that the combined effect

Table 5.2.: Estimation results, full model.

	Estimate	**Pr($>|z|$)**
Variable		
Intercept	-2.708	0.003**
Household size	0.585	0.000***
Children, no elderly	-1.588	0.000***
Children, healthy elderly	-3.950	0.000***
Children, all elderly chronically ill	-2.407	0.000***
No children, healthy elderly	-0.944	0.186
No children, all elderly chronically ill	-0.427	0.572
Share married	-1.435	0.045**
Share male in migration age	0.910	0.039**
Labour market experience of hh head	0.025	0.039**
Assets per capita	0.000	0.333
Land per capita	0.098	0.523
Communist party member in hh	-0.156	0.770
Ethnic minority household	0.613	0.035**
Migration experience in hh	1.104	0.000***
LR		127.56***
AIC		407.86
McFadden-R^2		0.252

Signif. codes: * sign. at α=10%, ** sign. at α=5%, *** sign. at α=1%.

of children and grandparents in the same household seems to be even stronger than the effect of children alone (“Children, no elderly“). This result is contrary to the hypothesis formulated beforehand which would have expected a coefficient on ”Children, healthy elderly” of lower magnitude than the one on the dummy for households with children alone. In contrast, in households where there are only elder members but no children the effect of the presence of elder in the households on the migration decision appears to be negligible.

Another striking aspect of the results is that households with children and healthy grandparents are even less likely to migrate than households with children and chronically ill grandparents. An explanation could be that while chronically ill parents may require more care, there is also the need to generate more income for medical treatment through migratory employment. Partly, this explanation is also reflected in the differences between the not significant coefficients on the dummies “No children, healthy elderly” and “No children, all elderly chronically ill”.

While the “No children, healthy elderly” and “No children, all elderly chronically ill“ can safely be assumed to be equal (as their are not statistically significant) and the effect of health consequently can be neglected here, it is advisable to formally test for a difference in the coefficients on “Children, healthy elderly“ and “Children, all elderly chronically ill“. First, a test would help to confirm the hypothesis of the previous paragraph. Second, if the respective coefficients are not significantly different from each other the interaction between grandparents' health and migration put forward above would play no role in explaining the migration decision. Hence, it might be possible to neglect health and combine “Children, healthy elderly“ and “Children, all elderly chronically ill“ into a single dummy variable ”Children, elderly” which equals 1 for households with children and grandparents and 0 otherwise. Likewise, “No children, healthy elderly” and “No children, all elderly chronically ill“ could be collapsed into a single variable ”No children, elderly” for households without children but with members older than 60 years. Formally, the equality of the coefficients on “Children, healthy elderly“ (β_3) and “Children, all elderly chronically ill“ (β_4) can be tested using a likelihood ratio test:

- Grandparents' health in households with children does not contribute to explaining the migration decision: H_{01}: $\beta_3 = \beta_4$; H_{A1}: $\beta_3 \neq \beta_4$

The results of the test of the restricted against the unrestricted model is as follows:

- $LR_1 = 3.35 < LR_1^* = 3.84 \rightarrow$ Cannot reject H_{01} with $\alpha = 0.05$ and 1 DF.

According to this result, the probability of households decision to migrate can be explained without taking into consideration the health status of grandparents. The results of the simplified model are presented in Table 5.3. The estimated coefficients on the variables retained from the previous version of the model appear to be robust to the change. The coefficient on households with children and grandparents (”Children, elderly”) is significantly negative and of a magnitude between the values of the coefficients on “Children, healthy elderly“ and “Children, all elderly chronically ill“ in the previous version of the model. The coefficient on households without children but with elder members (”No children, elderly”) is negative but not significant.

The conclusions from this estimation are that children have a negative influence on the probability to migrate. Contrary to the hypothesis stated at the beginning

Table 5.3.: Estimation results logit model, neglecting health.

	Estimate	**Pr(> $|z|$)**
Variable		
Intercept	-2.753	0.003**
Household size	0.587	0.000***
Children, no elderly	-1.578	0.000***
Children, elderly	-3.458	0.000***
No children, elderly	-0.717	0.200
Share married	-1.492	0.035**
Share males in migration age	0.901	0.035**
Labour market experience of hh head	0.026	0.039**
Assets per capita	0.000	0.302
Land per capita	0.095	0.539
Communist party member in hh	-0.162	0.755
Ethnic minority household	0.585	0.042**
Migration experience in hh	1.140	0.000***
LR		123.87***
AIC		407.56
McFadden-R^2		0.245

Signif. codes: * sign. at α=10%, ** sign. at α=5%, *** sign. at α=1%.

this influence is not counteracted by grandparents in these households. Rather, households with children and elder members are even less likely to engage in migration than their peers who have only children or who have neither children nor elder members. Hence, it makes sense to distinguish between these two types of households. Similarly, it is sensible to contemplate households without children but with elder members separately.

The estimations performed up to now help to decide to what extent household demographics as reflected by the presence of children and elder members in the household and their health shall be considered as separate factors influencing the migration decision. In the next step and in order to exploit the potential of the data at hand, the demography dummies included in the last version of the model are replaced by the share of children under 14 and the share of persons older than 60 in the household. Results are presented in Table 5.4.

The coefficients on the variables maintained from the previous version again are robust to the change. The coefficients on the new demography variables are, as expected, negative and significant. Again it is striking that the coefficients on the share of children and the share of elderly persons are of similar magnitude. In case the coefficients are equal it would be possible to collapse the two variables into a single one, namely the household dependency ratio. Hence, a further LR

Table 5.4.: Estimation results: demography dummies replaced by shares.

	Estimate	Pr(> $\|z\|$)
Variable		
Intercept	-1.624	0.156
Household size	0.377	0.000***
Share children	-4.015	4.80E-008***
Share elderly	-4.096	2.70E-004***
Share married	-1.977	0.006**
Share males in migration age	0.854	0.056*
Labour market experience of hh head	0.028	0.026**
Assets per capita	0.000	0.638
Land per capita	-0.213	0.165
Communist party member in hh	-0.251	0.633
Ethnic minority household	0.751	0.011*
Migration experience in hh	1.136	0.00***
LR		125.39***
AIC		404.09
McFadden-R^2		0.248

Signif. codes: * sign. at α=10%, ** sign. at α=5%, *** sign. at α=1%.

Table 5.5.: Estimation results: shares replaced by dependency ratio.

	Estimate	Pr(> $\|z\|$)
Variable		
Intercept	-1.239	0.120
Household size	0.338	0.000***
Dependency ratio	-4.038	0.000***
Share married	-1.984	0.005***
Share males in migration age	0.847	0.049**
Labour market experience of hh head	0.028	0.008***
Assets per capita	0.000	0.641
Land per capita	-0.213	0.164
Communist party member in hh	-0.253	0.633
Ethnic minority household	0.710	0.011**
Migration experience in hh	1.136	0.000***
LR		125.33***
AIC		402.09
McFadden-R^2		0.248

Signif. codes: * sign. at α=10%, ** sign. at α=5%, *** sign. at α=1%.

test on the equality of the coefficients is carried out. The hypothesis to be tested is: The effect of the share of children and of elderly in the household on the migration decision is equal. The two variables can be collapsed into the household dependency ratio: H_{02}: $\beta_2 = \beta_3$; H_{A2}: $\beta_2 \neq \beta_3$.

The LR test statistic is $LR_2 = 0.004$ which is clearly lower than the critical value LR_2^* of 3.84 at $\alpha = 0.05$ with 1 DF. As the null hypothesis cannot be rejected, a final version of the model replacing the share of children and the share of elderly with the dependency ratio is estimated. This final version of the logit model on household migration confirms the insights gained before and shows that the dependency ratio can be used to take into account household composition without loosing information and without worsening the performance of the model (see Table 5.5).

At this point it is possible to make statements about the determinants of households' migration decisions in Guizhou province. Household demographics, including household size, its age structure and the marital status of household members, are found to have a significant influence on the probability of households to engage in migration. Migration decisions also appear to be influenced by human capital, such as the labour market experience of the household head and previous migration experience of the household. Finally, members of ethnic minorities are significantly more likely to migrate. The more complex hypotheses on the interplay between household demographics and health, however, are rejected. Neither taking into account the health status of grandparents nor treating grandparents and children separately contributes to the explanatory power of the model. Rather, the presence of children and grandparents in the household can be dealt with by using a single variable, the dependency ratio.

With respect to the construction of representative household groups, the most ideal way would be to group households based on these variables. In principle, this could be achieved using cluster analysis techniques which would allow to combine households into groups in a way that differences within the groups with respect to the variables in question are minimised while between group differences are maximised. Such groups could be expected to exhibit different migration behaviour which captures the influence of a variety of influencing factors. In this study, however, for the sake of simplicity only a single variable is selected to serve

Table 5.6.: Effect of the omission of single variables on model fit.

Variable excluded	**AIC**
Household size	413.87
Dependency ratio	446.37
Share married in hh	410.82
Share males in migration age	466.80
Labour market experience of hh head	408.69
Ethnic minority household	406.78
Migration experience in hh	421.19

as the base for the construction of the household groups.

The anecdotal evidence on the role of household demographics for migration mentioned above as well as the research interest arising from these accounts makes the dependency ratio an attractive candidate for the variable to be used as the grouping factor. In order to provide further empirical foundation for this choice, an additional set of logit models of household migration are estimated. Starting from the last model (Table 5.5), the variables found to be significant are piecewise omitted and the Akaike Information Criterion (AIC) of the resulting restricted model is computed. As the explanatory power of the model decreases, the omission of single variables causes the AIC to increase. The higher the contribution of a variable to the explanation of households migration decision, the higher is the increase in the AIC.[4] As the results in Table 5.6 show, the dependency ratio causes the second highest loss of explanatory power. Thus, the choice of this variable as the grouping factor for the household migration groups appears to be justified also on an empirical base.

5.1.1.2. Construction and Description of the Representative Household Groups

After having selected the dependency ratio as a core determinant of household migration, households are subdivided into two groups. The first group consists of those households with a dependency ratio larger or equal to the median, which is 0.4. This group of 147 households is assumed to have a comparatively low propensity to migrate. The second group is made up by a number of 134 households with

[4] The AIC is selected here, as it penalizes losses of degrees of freedom due to the inclusion of additional variables into a model.

a dependency ratio lower than the median and which are assumed to have a higher propensity to migrate. In fact, this assumption is confirmed by the comparison of migration activity between the two household groups (see Table 5.7). Households in the low migration group have a lower number of migrants in the household. Accordingly, the share of migrants in the overall household and in the household labour force is lower.[5] In addition, further differences between household groups reflect the insights gained through the previous analysis of household migration decisions. Households in the high migration group tend to be larger and have a higher share of male labourers, which can be regarded as a proxy for the variable of share of males in migration age used in the econometric model. Likewise, the high migration group exhibits a higher average education of household members older than 15, which is akin to the positive effect of the labour market experience of the household head found in the regression. Regarding land endowment, high migration households have a lower area per labourer at their disposal. The only difference at odds with the econometric analysis is the fraction of married in the household, which is higher for high migration households; however, this might be because households are grouped according to the dependency ratio and not to the outcome of the migration decision itself and does not necessarily invalidate the assumption of different migration behaviour of the households in the two groups.

Beyond the expected determinants of households' migration decisions, differences with respect to the economy of the households occur. While gross income per adult equivalent is roughly equal, high migration households have a lower net income. Although the contribution of local off-farm income to total gross income is similar, high migration households derive a larger share of their income from agriculture. The share of income from remittances is slightly higher for the low migration households. As these results appear to be counter-intuitive—one might expect high migration households to participate less in the local off-farm labour market and to have a higher share of remittances income—it should be pointed out again that the grouping of households is made on the basis of a determinant of households' migration decisions and not of the outcome of these decisions themselves. In fact, a comparison of migrant and non-migrant households reveals

[5] As we are dealing with census data, it is not necessary to test for statistical significance of the differences.

Table 5.7.: Characteristics of households by migration group.

Migration group:	Low migration	High migration
N=	147	134
Household demographics and education		
Household size	4.49	4.87
	(2.09)	(1.95)
Labourers	1.87	3.65
	(1.12)	(1.41)
Share male labourers	0.22	0.43
	(0.16)	(0.18)
Share female labourers	0.18	0.36
	(0.13)	(0.15)
Dependency ratio	0.64	0.20
	(0.17)	(0.16)
Migrants	0.54	1.20
	(0.83)	(1.05)
Share migrants	0.11	0.25
	(0.18)	(0.22)
Share migrants in labour force	0.28	0.32
	(0.39)	(0.27)
Share married	0.46	0.48
	(0.25)	(0.23)
Average adult education (years)	2.58	3.98
	(2.07)	(2.13)
Household economy		
Gross income per adult equivalent (yuan/year)	2,047	2,093
	(1,994)	(1,690)
Net income per adult equivalent (yuan/year)	1,590	1,325
	(2,026)	(1,664)
Share agricultural income	0.66	0.72
	(0.39)	(0.35)
Share local off-farm income	0.11	0.13
	(0.20)	(0.22)
Share formal local off-farm income	0.01	0.01
	(0.08)	(0.07)
Share informal local off-farm income	0.10	0.12
	(0.18)	(0.21)
Share remittances	0.14	0.13
	(0.29)	(0.21)
Expenditures per adult equivalent (yuan/year)	2,864	3,344
	(2,616)	(3,090)
Expenditures per adult equivalent, adjusted (yuan/year)	2,560	2,801
	(1,899)	(1,566)
Share food expenditure	0.62	0.52
	(0.22)	(0.20)
Land		
Total contract land	3.50	3.96
	(3.72)	(2.86)
Contract land per adult equivalent	1.35	1.74
	(1.36)	(1.57)
Contract land per labourer	1.85	1.18
	(1.96)	(1.03)
Land in use per labourer	2.22	1.39
	(2.24)	(1.19)

Mean values, standard deviations in parentheses.

that migrants have lower shares of agricultural and remittances income and higher shares of local off-farm income (results not reported). Regarding expenditures, high migration households exhibit higher levels, with respect to both measures used. The apparent inconsistency with the results on income, meanwhile, is due to higher expenditures on housing and big events in the high migration group. These expenses tend to be financed not out of current income, but out of debts or savings. Finally, the differences in the shares of food in total expenditures points to differences in consumption patterns between the household groups.

Following the division into two migration groups, households are further stratified according to their level of living standard. For this second stratification, terciles of adjusted household expenditure per adult equivalent—the indicator chosen for living standard—are calculated[6] and households are assigned to the corresponding tercile. The result are groups with low and high propensity to migrate which each consist of three subgroups of households with high, middle and low living standard (see Table 5.8).

The results of the descriptive statistics on household demographics and land reveal differences between the household groups with respect to factor endowment. More wealthy households tend to have a higher share of labourers, in particular males, and correspondingly a lower dependency ratio. Reflecting returns to human capital, they also have a higher average educational attainment. Likewise, more wealthy households dispose of a higher area of contract land per adult equivalent, albeit not per labourer.[7] Regarding the economy of the households, poorer and households of a medium level of wealth on average derive larger shares of their income from agriculture than more wealthy households. The relatively wealthy households, in turn, exhibit the highest share of remittances income. The differences in the fraction of income derived from remittances corresponds to figures on household migration in the upper part of the table and underline the importance of migration for the household economy and the distribution of income within the village. Apart from wealthy households being virtually exclusively participating in formal activities in the low migration groups, no clear pattern with respect to

[6]The 33% and 66% terciles are at 1,806 yuan and 2,674 yuan, respectively.

[7]This confirms results obtained by Xing et al. (2006) in their study of village inequality in Puding county.

Table 5.8.: Characteristics of households by representative household group.

Migration group:	Low migration			High migration		
Income level:	High	Middle	Low	High	Middle	Low
N=	44	41	62	51	52	31
Household demographics and education						
Household size	4.95	4.41	4.21	4.53	5.02	5.16
	(1.60)	(2.20)	(2.30)	(1.76)	(1.97)	(2.18)
Labourers	2.21	1.80	1.67	3.49	3.63	3.94
	(0.86)	(1.09)	(1.26)	(1.19)	(1.31)	(1.84)
Share male labourers	0.23	0.23	0.21	0.47	0.39	0.41
	(0.10)	(0.15)	(0.19)	(0.18)	(0.16)	(0.21)
Share female labourers	0.22	0.18	0.15	0.34	0.37	0.37
	(0.10)	(0.14)	(0.15)	(0.14)	(0.14)	(0.18)
Dependency ratio	0.58	0.63	0.69	0.17	0.21	0.22
	(0.12)	(0.16)	(0.20)	(0.17)	(0.16)	(0.16)
Migrants	1.00	0.47	0.25	1.39	1.08	1.04
	(0.90)	(0.73)	(0.70)	(0.94)	(1.08)	(1.16)
Share migrants	0.21	0.11	0.05	0.32	0.22	0.19
	(0.20)	(0.18)	(0.14)	(0.23)	(0.22)	(0.21)
Share migrants in labour force	0.48	0.28	0.11	0.40	0.28	0.24
	(0.43)	(0.39)	(0.26)	(0.28)	(0.26)	(0.23)
Share married	0.46	0.43	0.48	0.51	0.46	0.49
	(0.18)	(0.26)	(0.28)	(0.23)	(0.23)	(0.24)
Average adult education (years)	3.54	2.18	2.14	4.61	3.75	3.31
	(2.09)	(1.77)	(2.04)	(2.23)	(1.81)	(2.22)
Household economy						
Gross income per adult equivalent (yuan/year)	3,278	2,103	1,143	3,067	1,777	1,076
	(2,717)	(1,719)	(689)	(2,101)	(1,155)	(559)
Net income per adult equivalent (yuan/year)	2,721	1,556	815	2,083	996	669
	(2,913)	(1,716)	(638)	(2,263)	(1,050)	(634)
Share agricultural income	0.58	0.72	0.69	0.65	0.76	0.76
	(0.43)	(0.39)	(0.34)	(0.37)	(0.34)	(0.36)
Share local off-farm income	0.09	0.10	0.12	0.15	0.10	0.15
	(0.21)	(0.19)	(0.20)	(0.23)	(0.20)	(0.23)
Share formal local off-farm income	0.03	0.00	0.00	0.02	0.00	0.02
	(0.15)	(0.00)	(0.00)	(0.08)	(0.00)	(0.08)
Share informal local off-farm income	0.06	0.10	0.12	0.13	0.10	0.13
	(0.16)	(0.19)	(0.20)	(0.20)	(0.20)	(0.22)
Share remittances	0.26	0.13	0.06	0.18	0.12	0.05
	(0.39)	(0.29)	(0.16)	(0.24)	(0.21)	(0.11)
Expenditures per adult equivalent (yuan/year)	5,600	2,310	1,299	5,023	2,762	1,649
	(3,349)	(544)	(458)	(4,183)	(1,547)	(1,112)
Expenditures per adult equivalent, adjusted	4,713	2,204	1,277	4,284	2,220	1,414
	(2,180)	(274)	(370)	(1,628)	(244)	(352)
Share food expenditure	0.43	0.62	0.76	0.44	0.55	0.63
	(0.20)	(0.14)	(0.16)	(0.18)	(0.19)	(0.20)
Land						
Total contract land	3.54	3.62	3.38	3.88	3.73	4.45
	(2.99)	(2.88)	(4.67)	(3.00)	(2.75)	(2.88)
Contract land per adult equivalent	1.55	1.34	1.22	1.95	1.56	1.69
	(1.41)	(1.00)	(1.53)	(1.88)	(1.43)	(1.23)
Contract land per labourer	1.67	1.97	1.92	1.25	1.08	1.23
	(1.40)	(1.68)	(2.55)	(1.34)	(0.79)	(0.83)
Land in use per labourer	2.27	2.02	2.33	1.43	1.36	1.39
	(2.15)	(1.68)	(2.70)	(1.57)	(0.79)	(1.03)

Mean values, standard deviations in parentheses.

local off-farm employment arises. This suggests that the type of aggregation used blurs a large heterogeneity among the households, which is also reflected in the high variability within the groups, as reflected by the high standard deviations. However, a part of an explanation could be that informal local off-farm employment combines occasional irregular work as well as self-employment, where the latter in single cases generates very high incomes which can drive the results presented in the table. Engel coefficients decrease with increasing wealth, reflecting differences in consumption patterns between the household groups.

In summary, the presentation of the representative household groups to be used in the village SAM shows that the grouping of households according to the dependency ratio and household wealth lays the foundation for a differentiated analysis of the impact of trade liberalisation on income distribution with a special emphasis on the poor. As differences with respect to household demographics, factor endowments and consumption patterns are captured, households in the different household groups can reasonably be assumed to exhibit diverse behavioural responses to changes in the economic environment and to be affected differently by changes in relative prices and wages.

5.1.2. Estimation of Shadow Prices and Test for Nonseparability

Along with considerations regarding imperfections in factor markets (de Janvry and Sadoulet, 2003), the theoretical model introduced in Chapter 4 shows that the implicit price of labour, i.e. the household shadow wage can systematically deviate from prevailing market wages, ultimately leading to nonseparability of production and consumption decisions. A corollary of this observation is that household labour allocated to farm or household production cannot be valued using market wage rates. This poses a particular challenge to the construction of the village SAM, which is set up in value terms and hence requires information not only on quantities but also on prices. Similarly, land is to a large extent non-traded and the land leases which are actually observed take place at a high range of prices, including a considerable number of gratis transactions. In the consequence, it is impossible to derive a meaningful value, such as the mean or the median, which could be used for the valuation of non-traded land. A solution to this problem is offered by approaches to estimating shadow wages and prices which have been originally developed as a preliminary step in the study of labour supply behaviour of rural households. The traditional approach to the estimation of shadow wages has been proposed by Jacoby (1993) and relies on the result derived from theoretical models of farm production that the shadow wage corresponds to the marginal value product of labour (MVP_l) on the farm. Accordingly, the approach involves the estimation of a production function from which the MVP_l is derived as the first partial derivative with respect to labour. The approach has become a sort of standard technique which has been widely applied (see, for example, Abdulai and Regmi, 2000; Cook, 1999; Lambert and Magnac, 1994; Sicular and Zhao, 2004; Skoufias, 1994). Kuiper (2005) has extended the approach towards the inclusion of the estimation of shadow prices for land and other non-traded factors and demonstrated the applicability for the purpose of the construction of a village SAM. Having said that, starting with the paper by Jacoby (1993) a number of issues associated with the approach have been recognized.

A problem related to the estimation of production functions in general is a possible correlation of one or more of the inputs used with the error term. This endogeneity may arise, for example, due to the presence of unobserved inputs such as a farmer's managerial capability, differing land qualities or the anticipation of exogenous random shocks (Jacoby, 1993; Skoufias, 1994; Zellner et al., 1966). In order to avoid the resulting simultaneity bias, authors either apply instrumental variables (IV) techniques (in cross-section data, Jacoby, 1993; Lambert and Magnac, 1994; Le, 2009) or, in case a panel data set is available, estimate fixed effects models thus capturing time-invariant unobserved factors (Skoufias, 1994). Further, less general issues may arise depending on the actual methodology chosen and the data used. In case it is necessary to estimate the model on a sub-sample of households, for instance if, as in our case, a household is only included into the estimation when it carries out own agricultural production, a sample selection bias may occur and can be dealt with through the application of a Heckman-2-step estimation procedure (Heckman, 1979; Jacoby, 1993). In case a Cobb-Douglas production functional form[8] is chosen, instances of zero-input use

[8]Or any other functional form which requires input variables to be expressed in logarithms.

are problematic. The workaround applied in the studies estimating shadow wages is the addition of a small non-zero constant to all the inputs entering the production function (Jacoby, 1993; Kuiper, 2005). However, as Battese (1997) notes, if the zero-observations make up a substantial proportion of the sample this practice can lead to biased parameter estimates. Instead, it is recommended to revert to the use of a technique which introduces a dummy for each explanatory variable with takes the value one in case the variable is zero and the value zero otherwise (see below). Finally, Jacoby (1993) and Le (2009) raise the concern that the use of values instead of quantities in the production function potentially leads to biases in the estimation if the variation in prices in the sample is high; however, as in this case only a single village is dealt with this can safely be assumed to be less relevant.

In parts in response to the issues related to the Jacoby approach to the estimation of household shadow wages, recent works propose alternative methods. Barrett et al. (2008) no longer rely on a production function but rather compute $MVP_l s$ and shadow wages from production frontiers. Le (2009) completely abstains from the estimation of the production technology and recovers shadow wages from a direct estimation of labour supply functions. Although both approaches have their appeals both from a theoretical and empirical point of view, they involve bootstrapping bias correction and general method of moments (GMM) estimation techniques whose application is beyond the scope of this study.

To summarize, sample selection bias, problems of endogeneity in the estimation of the production functions, the choice of a functional form and the occurrence of zero-observations of some inputs can be identified as issues which have to be addressed when estimating shadow prices of rural households. As virtually all households (about 96%) in Changtian village are engaged in agriculture, a selectivity bias can be expected to be very small or even irrelevant and, hence, is neglected. A likely endogeneity bias should be taken more seriously, first due to the reasons discussed above, second due to a variable which for sure has been omitted, as data on exchange labour is not available from the survey. As mentioned above, fixed-effects and IV estimations can be used to tackle this problem. In this study, we revert to IV estimation rather than a fixed-effects model. This choice can be defended given the fact that fixed-effect regressions do not capture time-varying independent variables (Wooldridge, 2006). These are likely to be relevant in the case of agricultural production functions, as the amount of exchange labour most likely does change over time, but also with respect to instances of land degradation or the anticipation of random weather shocks mentioned above. Regarding the choice of the functional form, a Cobb-Douglas production technology is assumed for the sake of consistency with the applied village model[9]. In this context, zero-observations is dealt with by the application of both approaches which can be found in the literature - adding one to each observation (Jacoby, 1993; Kuiper, 2005) and using the dummy variable approach proposed by Battese (1997).

The model to be estimated following this discussion is given in equation 5.1

$$lnY = \alpha + \sum_{i=1}^{M} \beta_m \; lnL_m + \gamma \; lnT + \delta \; lnK + \sum_{i=1}^{K} \varphi_k C_k + \varepsilon \tag{5.1}$$

where Y is the gross value of agricultural production (gross revenue from crop and livestock production), L is the time worked in agriculture by male adults, female adults and elderly and children and T is the total area of land in use. Variable inputs are aggregated in K, which represents the total value of variable inputs including hired labour, seeds, fertilizer, pesticides, livestock replacement, veterinary costs and other expenses on agricultural inputs. C_k contains control variables, namely proxies for managerial capacity and land quality (see Table 5.9). In order to deal with endogeneity, this model is estimated using both OLS and IV (two-step least squares).

The version of the model using the Battese (1997) dummy variable approach is

$$lnY = \alpha + \sum_{i=1}^{M} (\beta_m^D \; D_m^L + \beta_m \; lnL_m^*) + \gamma \; lnT + \delta \; lnK + \sum_{i=1}^{K} \varphi_k C + \varepsilon \tag{5.2}$$

where $D_m^L = 1$ if $L_m = 0$, $D_m^L = 0$ if $L_m > 0$ and $L_m^* = max(L_m, D_m^L)$. As neither land nor variable inputs contain zero observations, dummies are introduced only

[9]In fact, using the P_e test by MacKinnon et al. (1983) the Cobb-Douglas specification has been found to be superior to a linear model. Furthermore, other specification errors of the C-D model could be rejected by a RESET test (Ramsey, 1969).

Table 5.9.: Variables used for the estimation of agricultural production functions.

Variable	Description	Mean (Std.dev.)
Value of agricultural output	Total value of agricultural production (yuan)	2721 (2145)
Male labour	Hours worked by male adults on farm (older than 14 and younger than 61 years)	1716 (1589)
Female labour	Hours worked by female adults on farm	1789 (1404)
Elder/child labour	Hours worked by elderly and children on farm	751 (1682)
Land area	Land area in use (mu)	4.59 (3.80)
Variable inputs	Value of variable inputs (yuan)	1702 (1415)
Perennials	Household cultivates perennial crops (0=No, Yes=1)	0.2 (0.4)
Share irrigated land	Share of irrigated land (%)	6.10 (14.7)
Education of household head	Years of formal education of household head	3.8 (3.1)
Age of household head	Age of household head (years)	46.4 (13.9)

Instrumental variables: Log of household composition variables: Number of male and female adults, children and elderly; Log of prices of maize seeds, urea, chemical fertilizer and rapeseed.

for household labour. This version of the model is estimated using OLS. [10]

Subsequently, the shadow wages of the households are computed as the first partial derivative of the estimated production function with respect to the respective type of labour [11]

$$\hat{w}_{fm} = \hat{\beta_m} \frac{\hat{Y}}{L_m} \tag{5.4}$$

where, following the notation used in Chapter 4, $\hat{w}_{fm}$ is the shadow price implicitly paid to household labour of type m employed the farm, $\hat{\beta_m}$ is the estimated coefficient on labour of type m, $\hat{Y}$ is the fitted value of total agricultural output and L_m are the hours of labour of type m worked on farm by the household. In the same fashion, the shadow price $\hat{\Psi}$ of land is calculated as

$$\hat{\Psi} = \hat{\gamma} \frac{\hat{Y}}{T} \tag{5.5}$$

where $\hat{\gamma}$ is the estimated coefficient on land and T is the area of land in use.

Estimation results are reported in Table 5.10. The estimates of the coefficient on male labour appear to be largely robust to the different versions of the model. The estimate from models OLS I (without dummies for zero-observations) and

[10] In addition to the questions dealt with above, a further theoretical issue deserves to be discussed. Equation 4.38 of the theoretical model presented in Chapter 4 states that the household shadow wage equals the marginal value product of household labour *plus* the marginal utility arising from the engagement in farm labour:

$$\frac{\psi}{\lambda} = \frac{1}{\lambda} \frac{\partial U}{\partial L_f} + p_a \frac{\partial f(\cdot)}{\partial L_f} \tag{5.3}$$

The estimation of the household shadow wage as the partial derivative of the production function, however, would require the assumption that the marginal utility of farm labour be zero. Otherwise, the shadow wage would be different from the estimated marginal value product and the estimation procedure would not be valid. Fortunately, there is evidence available which allows to argue for an assumption of at least being no disutility associated with farm labour: When analysing labour supply behaviour of rural households in China, Sicular and Zhao (2004) find that household supply more (less) labour to the market when a decrease (increase) in the agricultural shadow wage cause a change in the ratio between the agricultural shadow wage and the market wage, but not vice versa. According to the authors, this implies that "high market wages do not 'pull' labour out of agriculture; rather, low marginal returns to work in agriculture 'push' labour into wage employment" (Sicular and Zhao, 2004, p.240). This suggests that agriculture is the preferred activity of households and that it at least does not generate disutility to the households.

[11] The partial derivative can be used directly because the production function is estimated in value terms.

Table 5.10.: Agricultural production functions: estimation results.

	Estimate (Std.dev.)		
Model:	**OLS I**	**OLS II**	**2SLS**
Variable			
Intercept	3.498***	3.111***	3.937***
	(0.289)	(0.596)	(0.440)
Male labour	0.044***	0.077	0.051*
	(0.014)	(0.059)	(0.029)
Female labour	0.001	0.010	-0.005
	(0.015)	(0.070)	(0.026)
Elder/child labour	0.011	0.022	0.048
	(0.013)	(0.051)	(0.031)
Land area	0.203***	0.198 ***	0.123
	(0.074)	(0.075)	(0.088)
Variable inputs	0.489***	0.492***	0.601***
	(0.043)	(0.043)	(0.084)
Perennials	0.135	0.124	0.104
	(0.099)	(0.100)	(0.104)
Share irrigated land	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)
Education of household head	0.016	0.015	0.016
	(0.013)	(0.013)	(0.014)
Age of household head	-0.001	-0.002	-0.005
	(0.003)	(0.003)	(0.004)
Adj. R^2	0.545	0.540	
F-test on model significance (p-value)	0.000***	0.000***	0.000***
Test on heteroskedasticity (p-value)	0.416	0.247	0.982
Over-identification test (p-value)			0.666
F-test on endogeneity (p-value)			0.079

Signif. codes: * sign. at α=10%, ** sign. at α=5%, *** sign. at α=1%.
OLS I: OLS model without dummy variables for zero-observations; OLS II: OLS model with dummy variables; 2SLS: IV estimate of model without dummy variables; Coefficients on dummy variables are not reported.

2SLS are positive and significant. The estimate from model OLS II appears to be slightly larger, but is not significantly different from zero. In fact, the estimates are practically of the same size, with the IV point estimate lying within the 95% confidence interval of the OLS I, and the OLS II estimate within the 90% confidence interval (not reported). The coefficients on female adult labour are slightly positive in case of the OLS models and slightly negative in case of the IV model. The estimation of model OLS II yields a coefficient which is of a higher magnitude. Although the estimates are in no case significantly different from zero, this points to a potential bias due to the addition of one to all zero-observations which is done in case of models OLS I and 2SLS. Likewise, the coefficients on labour of children and elderly are not significantly different from zero, but also differ in size. Both land, with the exception of model 2SLS, and variable input use show a significantly positive effect on the value of agricultural output which in case of the OLS models appears to be robust to the different model specifications. The control variables introduced into the model in neither case show a significant influence on output value. In general, the results, including the low significance of the coefficients on labour, are in line with the results obtained by other studies (Cook, 1999; Kuiper, 2005). All in all, the models have a high overall significance and a moderate fit, explaining around 54% of the variation in the dependent variable. Heteroskedasticity appears not to be a problem and the IV models pass the Hausman (1983) over-identification tests. Interestingly, in spite of the concerns related to problems of endogeneity to be encountered in relation to the estimation of agricultural production function, the corresponding F-test carried out rejects the Null-hypothesis of the exogeneity of all explanatory variables only at a level of significance of 10%. Especially the omission of exchange labour in the production function does not appear to be of much relevance. A likely reason could be that exchange labour does not contribute much to total farm output, a result which was found by Kuiper (2005) who obtains slightly negative and non significant coefficients on exchange labour in the estimation of a production function for a village in Jiangxi province, China.

In particular the results of the tests on model specification facilitate the choice of the model version to be used for the calculation of the household shadow prices. As the IV estimator in small and moderate samples is less efficient than OLS (Greene,

Table 5.11.: Household shadow prices, Changtian village.

	Male adult labour	Female adult labour (yuan/hr)	Elder/child labour	Land (yuan/mu)
Min	0.02	0.00	0.00	37.0
1st Quartile	0.01	0.01	0.02	195.6
Median	0.10	0.01	0.03	286.6
Mean	0.18	0.02	0.12	342.4
3rd Quartile	0.02	0.07	0.10	430.8
Max	1.76	0.31	2.66	1,877.0
Std. Dev.	0.27	0.03	0.39	233.3

2003), the latter should be preferred over the former in case there is no statistical evidence for the presence of endogeneity. Because of this fact, along with the point made by Battese (1997) on a likely bias of the estimates of a production function associated with the practice of adding a small positive constant to each observation, the results from model OLS II in Table 5.10 are used in the following. The lack of significance of the coefficients on labour in this model should not pose an obstacle as the point estimates both from model OLS I and 2SLS lie within the 95% confidence intervals of the estimates obtained from model OLS II. A final point against the use of the results from the IV estimation is the negative coefficient on female adult labour, which would lead to negative shadow wages, a theoretically impossible result.

Table 5.11 presents the summary statistics of the estimated household shadow prices in Changtian village. In case of the different types of labour, the median and mean values as well as the 25% and 50% quantiles of the estimated wages suggest that hourly shadow wages are low on average and for the majority of the households, ranging between virtually 0 and 1.76 yuan/hour in case of male adult labour and 2.66 yuan/hour in case of elder / child labour. Due to some extreme values, the mean values which lie between 0.02 yuan/hour (female adult labour) and 0.18 yuan/hour (male adult labour) differ somewhat from the medians, which range from 0.01 (female adults) to 0.10 (male adults). The comparatively low marginal returns to female adult labour reflect a division of labour along gender lines with women primarily doing homework and work on the farm during the year, while men work off-farm or in migration. This in turn, is related to customs as well

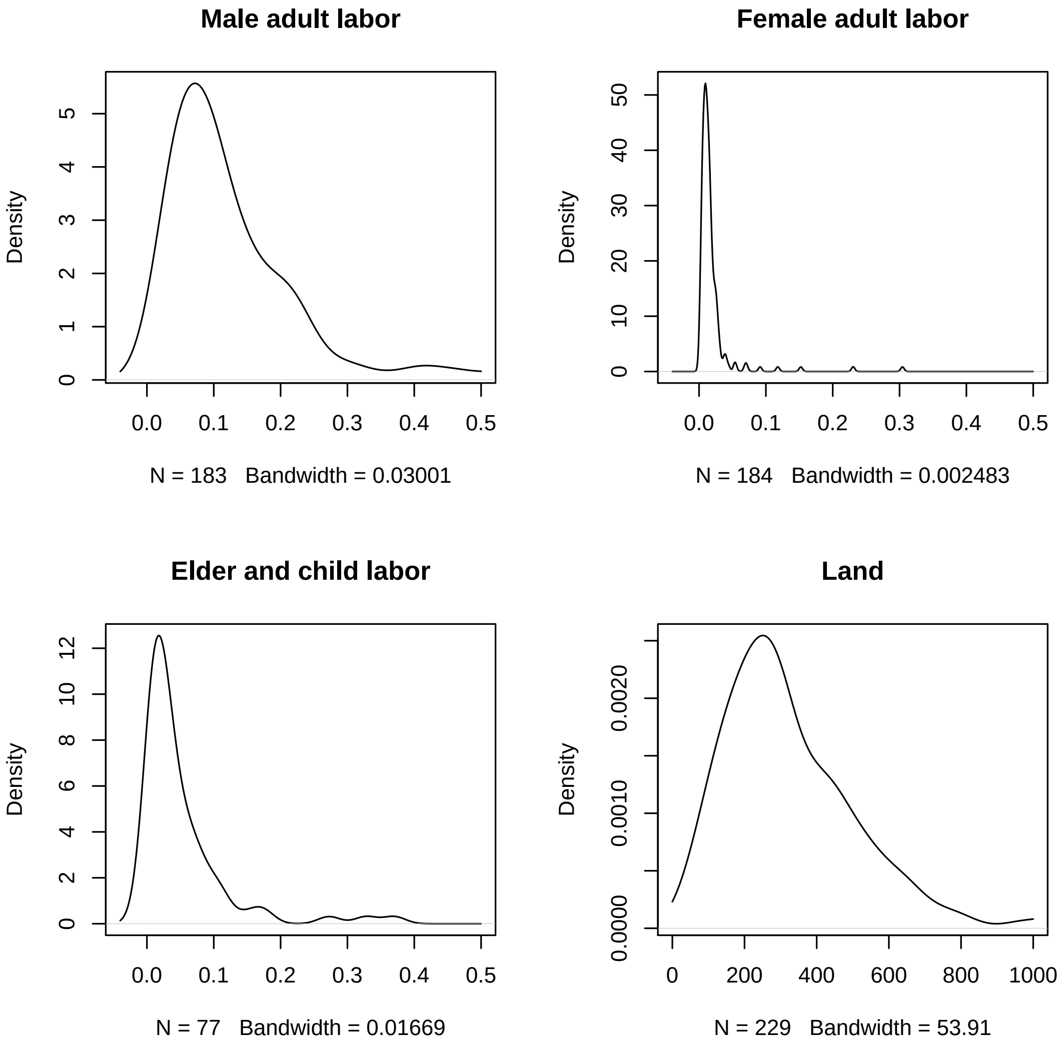


Figure 5.2.: Density estimates of household shadow prices.

as a restricted access for women to local off-farm jobs. The higher shadow wages of elder / child labour as compared to female adult labour may reflect the fact that a number of households only consist of elder persons which may face a relative scarcity of labour, leading to elevated marginal returns. The distributions of the shadow wages are depicted in Figure 5.2[12]. The graphs indicate that, apart from some extreme values in the right tail, the shadow wages follow an approximately normal distribution.

While the relative marginal returns to labour obtained from the estimation can

[12] For a better representation extreme values in the right tail of the distribution have been cut. In case of shadow wages for male adult labour, these have been 13 values and for elder / child labour three values.

be explained, the absolute levels cast some doubt on the validity of the results. Calculated on a daily basis and assuming a working day of seven hours, the mean shadow wages add up to 1.28 yuan for male adults, 0.14 yuan for female adults and 0.87 yuan for elder and child labour. This is far below the average daily local off-farm wage reported by the households in the village, which is 19.31 yuan and substantially lower than the price of family labour of 15.30 yuan/day reported in the official statistics for Guizhou province (Guizhou Statistical Office, 2007).[13] A similar picture arises from a comparison with figures obtained from other estimations of shadow wages for rural China; for a village in Jiangxi province Kuiper (2005) reports a mean agricultural shadow wage of 0.6 yuan per hour, which would be around 4.2 yuan/day. Sicular and Zhao (2004) predict 0.5 yuan per hour or 3.5 yuan/day as the mean value of nine Chinese provinces[14]. An older study by Cook (1999) finds an average marginal value product in agriculture of 1.23 yuan per eight hour day, using data from 16 villages in Shandong province. Assuming the shadow wages have not been underestimated, the results would point to a labour surplus story in which rural households oversupply labour to their farm as a response to a lack of off-farm opportunities. Such an interpretation would support the view maintained by several authors of the presence of surplus labour in rural China (Cook, 1999; Knight and Song, 1995, 2003), at least in land scarce villages (Bowlus and Sicular, 2003). The differences in shadow wages as compared to other provinces could be explained by differences in economic development within China in which Guizhou as one of the poorest provinces is a laggard.

Having said that, the fact that households do have the possibility to work off-farm, either through formal and in particular occasional informal local employment or migration speaks against this interpretation and the assumption that shadow wages have not been underestimated. In particular, in light of the sheer size of the gap between shadow wages and off-farm wages it seems unlikely that households did not respond more to the incentives to shift more labour from farm

[13]The average local off-farm wage includes income from occasional jobs, wage employment and self-employment.

[14]The authors use data from the Chinese Health and Nutrition Survey which covers Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, Guizhou and Liaoning provinces.

to off-farm work, even with a theory as presented in Chapter 4 in mind. An underestimation of the shadow wages, in turn, following equation 5.4, could result from either an underestimation of $\hat{\beta_m}$ or $\hat{Y}$ in the econometric model or from over-reporting of or measurement error in the time of labour dedicated to farm work. An underestimation of $\hat{Y}$ may result from under-reporting of farm revenues by farmers, which is hard to deal with given the lack of information about a systematic bias in the data. An error in the time of labour might stem from the calculation of total hours dedicated to animal production through the multiplication of the daily hours indicated by 365 which lead to very high values in some cases. In the attempt to deal with this particular problem, the models have been re-estimated using only the value of crop output and the inputs including labour allocated to crop production. The estimates of $\hat{\beta_m}$, however, are robust to this modification of the model. In a second modification of the model, only the days worked on farm instead the total hours (the product of daily hours and days reported) have been used, which resulted in negative and non-significant coefficients on labour.

With respect to the construction of the village SAM, given the very low estimates of the shadow wages there are two options which arise. First, one can accept the results and use the low shadow wages to value household labour used on the farm with the consequence that the corresponding entries in the SAM have very low values, as well. The second possibility is to abstain from using the estimation results and instead assume that household shadow wages make up a certain share of the agricultural wages or off-farm wages. The shadow wages estimated by Kuiper (2005), for example, are 18% of the local agricultural wage. Sicular and Zhao (2004) report agricultural shadow wages which are 22% of the employed wage rate. This latter possibility, however, represents a too large deviation from the empirical results. Therefore, the first option is chosen for the construction of the SAM.

With respect to land, marginal returns per standard mu range from 37 to 1,877 yuan, with a median of 287 and a mean of 342 yuan. Again, the shadow prices are lower than those from the only available study dealing with shadow prices for land in China by Kuiper (2005) who estimates 600 yuan/mu for non-irrigated land and 1,721 yuan/mu for irrigated land. Although this difference is still substantial, it is by far not as large as in the case of labour and can be explained by the much poorer land quality in Guizhou as compared to Jiangxi.

A question related to the estimation of household shadow prices is the nonseparability of household decision. In the theoretical model of Chapter 4 household production and consumption decisions are assumed to be nonseparable. Under this assumption household decisions regarding the allocation of labour to productive activities and leisure are governed by household internal shadow wages. An empirical test for nonseparability would allow to verify this assumption. In the literature, different approaches to testing for nonseparability can be found. Lopez (1984) tests the hypothesis of heterogeneity between on- and off-farm labour through the estimation of a separable and nonseparable structural household model. The test for nonseparability is carried out using a test for the comparison of the parameters of two non-nested models (Davidson and MacKinnon, 1981). Benjamin (1992) investigates the presence of labour market constraints and imperfect substitutability of family and hired labour by testing for an influence of household characteristics on on-farm labour supply. In a similar fashion, but extending the approach towards the inclusion of a hypothesis of constrained land rental markets, Carter and Yao (2002) test for nonseparability by checking for an influence of the household land-labour endowment ratio on the labour intensity in agricultural production, highlighting the importance of the households' labour market participation regimes. Further studies using the Benjamin (1992) approach are Bowlus and Sicular (2003) and Sadoulet et al. (1998). A test, finally, which relies on the comparison of household shadow wages with market wages is proposed by Jacoby (1993). Assuming that under perfect markets, the marginal value product of labour, i.e. the household shadow wage, should equal the market wage, the former is compared to the latter through a regression of the estimated MVP_l on observed market wages. The approach accommodates different assumptions regarding the reasons which may lead to nonseparability, including imperfections in the labour market, imperfect substitutability of on-farm and off-farm employment or heterogeneity of family vs. hired labour (Le, 2009; Skoufias, 1994; Sonoda and Maruyama, 1999).

As both estimated marginal returns to labour and market wages are available, this study chooses the approach by Jacoby (1993) to test for nonseparability of

Table 5.12.: Test for nonseparability.

	Estimate (**Std.Dev.**)
Variable	
Intercept	1.278**
	(0.581)
Market wage	0.002
	(0.032)
F-test on $\mathbf{H_0}$ (p-value)	0.000

Signif. code: ** sign. at α=5%.

household decisions. The empirical model to be estimated is

$$MVP_l = \alpha + \beta w + \varepsilon \tag{5.6}$$

where w is the observed wage obtained by an individual in off-farm occupations. The combined Null-hypothesis of equality of shadow and market wages is H_0 : $\alpha = 0$ and $\beta = 1$. For the purpose of estimation, the estimated shadow wage is regressed on the observed wage in local odd jobs. First, because this is the occupation where most data is available, second, because the wage from odd jobs is lowest and henceforth most likely to be closest to the household shadow wage and third, because the labour market for odd jobs is the least constrained by access restrictions. The combined Null-hypothesis is tested using an F-test.[15]

Table 5.12 presents the results of the estimation and the test for nonseparability. Not surprisingly, given the very low estimates of the shadow wages, the intercept term is significantly different from zero. The F-test rejects the combined separability hypothesis at a level of significance of less than 1%. Hence, household decisions can assumed to be nonseparable, albeit subject to the qualifications with respect to the validity of the estimated shadow wages made above.

[15]The model also has been estimated using the average wage in all local off-farm jobs (odd jobs, employed wage work and self-employment) as a regressor. Furthermore, IV estimations have been carried out with age, years of education and the squared terms of each as instruments. In the IV estimations the hypothesis of exogeneity of the regressors could not be rejected and in general the results (not reported) are robust to each of the model variants.

5.2. A SAM for Changtian Village

5.2.1. Outline of the SAM

After the construction of representative household groups and the estimation of household shadow prices it is now possible to construct the SAM for Changtian village. The general outline of the SAM is presented in Tables 5.13 and 5.14. The verbal entries in the SAM outline represent the different sub-matrices which together constitute the village SAM.

Moving column-wise from left to right and row-wise from top to bottom, the SAM distinguishes three different types of commodities: An agricultural commodity produced by the households, village traded commodities and imported commodities. Payments from the produced commodity account to the agricultural activities accounts represent the agricultural output of the village (see details in Table 5.15 below). Receipts of the produced commodity account from households and from outside the village constitute households' own consumption (Table 5.24) and market sales (Table 5.28), respectively. This implies that all products sold by the households are assumed to be exported from the village. Although households also sell products within the village, this simplification is necessary because of the lack of data on the relative quantities traded within and outside the village. However simplifying, as village product markets are assumed to be fully integrated with the outside world the same prices apply for transactions within and outside the village. Hence, a distinction between inside village transactions and exports is not necessary, at least from a modelling point of view. The produced commodity and the agricultural activities represent aggregations of various products, namely rapeseed, maize, rice, other grains, other crops, pigs, cows, poultry, eggs and other animal products as well as forestry and fishery. Incomes from land rentals and processing which make up only a very small fraction of agricultural income ($< 1\%$) reported by the households are included here, as well.

Village traded commodities include commodities households trade among themselves on the village market. As a consequence of the considerations with respect to the produced commodity made above, only land and labour are included here. Land, which is disaggregated into irrigated and non-irrigated land, is the only good which is only traded within the village and not beyond the village borders. Accordingly, the price of this good is determined through equilibrium processes taking place at the village level. The second village traded commodity is labour traded between households for employment in agricultural production activities. As agricultural off-farm labour is also traded beyond village borders it would in principle have been possible to treat village traded labour just as the produced commodity. This would imply to include household supply of labour as exports from and demand by agricultural activities as imports into the village. However, information on the time worked by households in the different off-farm occupations was available disaggregated by location and, for the sake of increasing the information content of the SAM, it was preferable to explicitly include this information. Further, it should also be mentioned that due to the omission of exchange labour, the values of village traded agricultural labour recorded in the SAM omit a part of the total amount of labour traded between the households. In fact, the only feasible way to deal with this type of labour was to assume that each household receives as much exchange labour services as it supplies and leave it out of the SAM.[16]

As the village traded commodities ultimately reflect agricultural production factors supplied by households, the village traded commodity accounts pay to the factor accounts. These payments reflect the returns from village traded factors (see Table 5.25). Due to their use in agricultural production activities, village traded commodities receive payments by the agricultural activity accounts. The corresponding sub-matrix represents the demand by agricultural activities for village traded inputs (Table 5.16).

The third type of commodities comprises commodities imported into the village. These include capital (intermediate) and labour inputs demanded by agricultural production activities as well as commodities consumed by households. The latter consist of food products of plant and animal origin, non-food products and services. All imported commodities pay to the outside village account, thus depicting the value of village imports (Table 5.26). Imported commodities receive payments from the agricultural activity accounts—the intermediate input demand detailed

[16]From a modelling point of view, the contribution of exchange labour to production is captured in the efficiency parameters of the agricultural production functions.

Table 5.13.: Outline of the Changtian village SAM - Part 1.

	Commodities			**Activities**		
	Produced	Village traded	Imported	Agriculture	Off-farm	Blood sales
Commodities						
Produced						
Village traded Land Labour				Village traded input demand		
Imported Intermediates Labour Plant products Animal products Non-food Services				Intermediate input demand		
Activities						
Agriculture	Farm output					
Off-farm Formal local Informal local Migration						
Blood sales						
Factors Labour Male farming Male formal off-farm Male informal off-farm Male migration Male leisure Female farming Female formal off-farm Female informal off-farm Female migration Female leisure Land		Returns from village traded factors		Agricultural value-added to household owned factors	Value-added to household labour from off-farm activities	
Institutions						
Households Low migration, high income Low migration, middle income Low migration, low income High migration, high income High migration, middle income High migration, low income Migrated					Profits from off-farm activities	Income from blood sales
Transfers Savings						
Government						
Outside village			Village imports			

Table 5.14.: Outline of the Changtian village SAM - Part 2.

	Factors		**Institutions**				**Outside village**
	Labor	Land	Households	Transfers	Savings	Government	
Commodities							
Produced			Own cons.				Sales agr. output
Village traded							
Land							
Labour							
Imported							
Intermediates							
Labour							
Plant products			Imported consumption				
Animal products							
Non-food							
Services							
Activities							
Agriculture							
Off-farm							
Formal local							Local off-farm
Informal local							
Migration							Migration
Blood sales							Blood sales
Factors							
Labour							
Male farming							
Male formal							
Male informal							
Male migration							
Male leisure			Leisure				
Female farming							
Female formal							
Female informal							
Female migration							
Female leisure			Leisure				
Land							
Institutions							
Households	Distribution of value-added			Income from transfers & savings			
11							
12							
13							
21							
22							
23							
Migrated							
Transfers			Transfers & savings				
Savings							
Government							
Outside village					Cap. imp.	Gov. transfers	

in Table 5.16—and from the household accounts—the consumption of imported goods and services shown in Table 5.24. Related to the case of the produced agricultural commodity, a further simplifying assumption had to be made here: It is well conceivable that parts of the expenditures on food products reported by households have been made on food produced by other households inside the village. Unfortunately, the data does not allow to distinguish between food products purchased from the village market and those imported from outside. Accordingly, all market purchased food products (as opposed to own-consumption) had to be assumed to be imported. While this assumption may be simplifying, it likewise can fit into an archetype of seasonal agricultural production for self-consumption: in times of high availability farmers consume their own products, in times of scarcity they purchase from the market. As this behaviour is synchronized across the village, it is likely that in any case little exchange of food products inside the village takes place.

The activity accounts include the agricultural activities already discussed, off-farm activities and an activity which represents the donation of blood by the households. The agricultural activities, as already mentioned above, receive payments from the produced commodity and pay their input use to commodity and factor accounts. Apart from village traded and intermediate/capital inputs, agricultural activities employ factors owned by the households who carry out the respective activities themselves. The payments to these factors termed agricultural value-added to household owned factors in Table 5.13 are presented in Table 5.16 along with the payments to village traded and intermediate inputs.

Off-farm activities are divided into formal local off-farm employment, informal local off-farm employment and migration. Formal off-farm activities are all employments with formal work contracts, such as employments as village cadre, teacher, or in state owned or private enterprises. Informal off-farm activities comprise irregular off-farm jobs in which people work as day-labourers or peons, both in agriculture or in the non-farm sector. Furthermore, self-employment and own business activities are considered as informal local off-farm, as well. The distinction between formal and informal local off-farm activities was made due to the differences in the workings of the labour markets in the formal and informal sector. The formal sector is assumed to pay a higher wage rate, and access by the households to this segment is restricted. Rather than being a competitive market, the formal segment is characterised by non-wage rationing mechanisms, such as social networks or kinship (known as *guanxi* in China, see, for example, Bian and Ang, 1997; Zhang and Li, 2003). The informal sector, in contrast, tends to be more like a competitive neoclassical market in which labour supply and demand are matched by a competitive wage rate and which households can access without facing (overly restrictive) entry barriers. Beside the disaggregation of the two segments of the labour market in the SAM, the assumed differences in market functioning later on lead to differences in the modelling of the labour market. The third off-farm activity in the SAM is migration, i.e. all employment taken outside Puding county for a period longer than three months. As the informal sector, migration is assumed to be accessible at a competitive wage rate without particular restrictions to the households.

The associated payment flows in the SAM have the same pattern for all off-farm activities and migration. The activities pay to the factor accounts of the household labour employed and to the household accounts and receive payments from outside the village (Table 5.28). This implies that off-farm activities are modelled as employing household labour to produce a service which is directly exported out of the village. The value of this service corresponds to the total income which accrues to the households' due to the participation in the respective activities.[17] In case of migration, the export assumption is straightforward. In case of the local-off farm activities, again, some simplification is involved as a part of the local-off farm employment takes place within the village. However, as the village market for off-farm labour is assumed to be integrated with the outside world with the same wage rates applying within and outside the village it was easier to assume that all off-farm labour is exported. Furthermore and most importantly, the export assumption reduces the degree of disaggregation of the labour factor accounts (see below), thus limiting the size of the SAM without compromising its usefulness for the modelling of the village economy.

[17] Arguably, the self-employment activity included in informal local off-farm employment may produce other outputs than the mere labour service and likewise may use other inputs than household labour. However, as neither information on the use of other inputs nor on the production of outputs is available from the survey, self-employment is treated as the other local-off farm occupations.

As already noted above, the payments by the off-farm activities are split into payments to the household labour factor accounts and payments made directly to the households. The payments to the labour accounts represent the value-added to household labour from off-farm activities and correspond to the value of labour allocated to the respective activity. The time allocated to each off-farm activity is valued at the household shadow price of labour, thus reflecting the opportunity cost of the households of participating in the activity (see Tables 5.18 and 5.19). As the household shadow wage usually is lower than the marginal returns from off-farm employment, households earn a premium over their opportunity cost. Following other authors who apply this approach in their village SAMs and according to its nature as a markup on factor cost, this premium can be labelled *profits* (see, for example, Kuiper, 2005; Parikh and Thorbecke, 1996; Subramanian and Sadoulet, 1990; Subramanian, 1996). In the context of this research and the theoretical model presented in Chapter 4, however, the premium receives a further interpretation. According to the theory the marginal returns to labour in the different off-farm activities in the optimum must be equal to the household shadow wage and the marginal utility of the participation in the respective activity. Hence, the premium paid by the activities on top of the opportunity cost can be interpreted as an additional compensation for the utility experienced by the household due to its labour market participation. Accordingly, it may be termed *utility compensation*. The payments from the off-farm activity accounts to the household accounts are presented in detail in Table 5.21.

The final activity distinguished in the SAM is the donation of blood for income generating purposes. Although no longer as important as in previous years (see Xing et al., 2009; Brown et al., 2010), blood donation remains an income source which is different from all others and therefore is included separately into the SAM. The activity receives payments from outside the village (included in Table 5.28) and pays the amounts received directly to the households. These amounts appear in Table 5.13 as income from blood sales and are presented in detail in Table 5.21. The major factor input to the activity are household labour. The time dedicated to blood donation, however, has not been recorded separately by the survey and consequently is included in the households' leisure demand. Furthermore, excessive blood donation may come at a cost in the form of health damages which, speaking in economic terms, may reduce the capacity of householders for economic activity (compare Xing et al., 2009). As data on these implications of blood donation is currently not available and as dealing with the issue more in detail goes beyond the scope of this study, blood donation is given the simplified treatment as depicted in the SAM.

Moving further in the SAM, the next group of accounts are the factor accounts. In general, two factors - household labour and land - are distinguished, each of which is further disaggregated. Household labour is divided into male adult labour, male labour of children and elderly as well as female adult and female child and elderly labour. Land consists of two accounts, one for irrigated and another for non-irrigated land. As discussed above the factor accounts receive payments from the village traded commodity accounts and from agricultural and off-farm activities. Furthermore, households pay the value of the leisure (time evaluated at the shadow wage) consumed to the respective labour accounts (see Table 5.24). The income of the factor accounts, i.e. the total factor value-added, is distributed to the household groups according to households' endowments with the respective factors (Table 5.20).

Next to the factor accounts are the institutions accounts, consisting of accounts for households, transfers, savings and the government. Following the construction of representative household groups presented in Section 5.1.1.2, six households are distinguished: Three households with low propensity to migrate, each with high, middle and low income, and three households with high propensity to migrate, again with high, middle and low income. In addition, a seventh, the migrated, household is included into the SAM. The migrated household receives income from rent out land and transfers this income out of the village (find more details below). The transfers accounts cover all kind of transfers made and received by households such as gifts, alms, inter-household cash or in-kind transfers, expenses on big family events like weddings or funerals or transfers made or received in the context of shocks like natural disasters, loss of livestock or thefts. The savings account covers savings and dis-savings and is—as is shown later on—subdivided into a pure savings account and a construction account which captures investments made in house construction.

Most of the receipts of the household accounts are already discussed before:

Households receive profits or utility compensation from off-farm activities, income from blood donations (both in Table 5.21) and value-added from factors employed in the different activities (Table 5.20). It should be noted that the latter include the value of leisure. This implies that leisure is reflected in the SAM as a payment which households make to themselves, thus allowing for the explicit modelling of households' demand for leisure. A final component of household income which has not been discussed, yet, is income from transfers and savings (see Table 5.22), originating from the respective accounts, including the government.

Household expenditures consist of own consumption (payments to the produced commodity accounts), consumption of imported goods and services, consumption of leisure and expenses on transfers and savings. The details are presented in Table 5.24.

The differences between household income from and household payments to the transfers, savings and government accounts leave these accounts unbalanced. The balancing of these accounts is achieved via payments to outside the village. These payments, as is discussed in more detail below (Table 5.27), can become negative and represent the village's capital imports and government transfers to the village as a whole.

5.2.2. The SAM in Detail

Tables 5.15 to 5.28 present the details of the different sub-matrices introduced in the previous section, which together constitute the complete village SAM. In the following, the sub-matrices are discussed in detail in order to give evidence on the dataset used for the model analyses and to provide a comprehensive picture of the village economy. All sub-matrices contain absolute values. For shares, refer to the coefficient matrix which is contained in the electronic annex.[18]

5.2.2.1. Agricultural Activities

Agricultural production is represented in the SAM by the sub-matrices on agricultural output (Table 5.15) and agricultural input use (Table 5.16). The table on agricultural output use contains the payments made by the produced commodity

[18] See Annex A.

Table 5.15.: Agricultural output (yuan).

	Commodities Agricultural
Activities	
Agriculture	
11	293,658
12	193,999
13	209,491
21	338,768
22	381,623
23	136,962
Total	1,554,501

account to the agricultural activities. It should be noted that the commodity account pays only to the agricultural activity accounts,which implies the assumption that each activity produces only a single agricultural output. Thus, the production of by-products, such as straw from rice production, is neglected. However, as no use of such by products in other production activities has been recorded in the survey, this neglect is of minor importance. As the other activities, agricultural production activities are disaggregated by households, which are coded by the numbers 11-13 and 21-23 and correspond to the households introduced in Table 5.13. The need for a household specific definition of activities in the SAM arises from the structure of the village equilibrium model in which production activities are modelled per representative household group, allowing for household group specific changes in shadow wages due to assumed differences in labour allocation. Furthermore, the disaggregation of activities by households offers the advantage of providing additional information on differences in agricultural production between the household groups. High migration households (21-23) tend to produce higher values of output. With respect to the level of wealth, however, no clear pattern arises.

Table 5.16 presents the input use by agricultural activities as in the SAM. For easier interpretation, the absolute values are translated into cost shares in Table 5.17. The table illustrates that in terms of cost shares land, urea and animal feed and livestock replacement are the most important inputs used. On average, land has a cost share of 31%, urea accounts for 18% and animal feed and livestock replacement for 15% and 14%, respectively. Compared to these, labour—which

Table 5.16.: Agricultural input use (yuan).

	Activities Agriculture 11	12	13	21	22	23
Commodities						
Irr. land	0	0	538	634	0	1,063
Nonirr. land	15,760	4,141	2,544	14,519	26,565	4,440
Village labour	233	2,666	2,737	608	3,533	0
Urea	54,993	31,018	42,954	54,771	64,785	27,802
Pesticides	863	237	221	555	161	79
Fertilizer	17,143	8,647	9,091	17,859	19,967	4,706
Seed	10,078	6,129	5,942	9,174	10,478	3,550
Feed	48,866	29,056	27,869	62,993	56,108	13,195
Breed	27,664	30,020	22,046	55,633	62,557	20,525
Veterinary	104	110	76	703	647	241
Machines	3,261	26	10	673	303	219
Hired labour	3,184	2,611	0	2,385	798	438
Water	1,294	211	0	1,330	570	44
Energy	1,294	7	608	3,705	0	22
Factors						
Male adult labour	17,383	11,560	12,277	18,967	25,673	11,288
Male elder & child labour	768	3101	3,175	1,033	944	227
Female adult labour	2,385	1,339	1,425	2,747	3,138	1,213
Female elder & child labour	678	2,421	1,640	1,037	554	1,021
Irr. land	5,316	4,978	7,794	6,066	3,686	2,761
Nonirr. land	82,391	55,721	68,544	83,376	101,156	44,128
Total	293,658	193,999	209,491	338,768	381,623	136,962

Table 5.17.: Cost shares in agricultural input use (%).

	Activities Agriculture 11	12	13	21	22	23	Average
Commodities							
Irr. land	0.0	0.0	0.3	0.2	0.0	0.8	0.2
Nonirr. land	5.4	2.1	1.2	4.3	7.0	3.2	3.9
Village labour	0.1	1.4	1.3	0.2	0.9	0.0	0.6
Urea	18.7	16.0	20.5	16.2	17.0	20.3	18.1
Pesticides	0.3	0.1	0.1	0.2	0.0	0.1	0.1
Fertilizer	5.8	4.5	4.3	5.3	5.2	3.4	4.8
Seed	3.4	3.2	2.8	2.7	2.7	2.6	2.9
Feed	16.6	15.0	13.3	18.6	14.7	9.6	14.6
Breed	9.4	15.5	10.5	16.4	16.4	15.0	13.9
Veterinary	0.0	0.1	0.0	0.2	0.2	0.2	0.1
Machines	1.1	0.0	0.0	0.2	0.1	0.2	0.3
Hired labour	1.1	1.3	0.0	0.7	0.2	0.3	0.6
Water	0.4	0.1	0.0	0.4	0.1	0.0	0.2
Energy	0.4	0.0	0.3	1.1	0.0	0.0	0.3
Factors							
Male adult labour	5.9	6.0	5.9	5.6	6.7	8.2	6.4
Male elder & child labour	0.3	1.6	1.5	0.3	0.2	0.2	0.7
Female adult labour	0.8	0.7	0.7	0.8	0.8	0.9	0.8
Female elder & child labour	0.2	1.2	0.8	0.3	0.1	0.7	0.6
Irr. land	1.8	2.6	3.7	1.8	1.0	2.0	2.1
Nonirr. land	28.1	28.7	32.7	24.6	26.5	32.2	28.8
Total	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Values derived from SAM entries as in Table 5.16.

is further disaggregated in adult labour and labour from children and elderly—accounts only for a smaller value share of total input use (8% on average). These low shares, however, are in parts due to the low shadow wages used to value the labour time dedicated to the activities.[19]

5.2.2.2. Off-farm Activities

The allocation of labour by the households to formal and informal local off-farm activities and to migration is depicted in Tables 5.18 and 5.19, respectively. Table 5.18 shows that the participation in formal local off-farm employments is generally low. The only households with significant receipts to labour from the activity are the high income households of both migration groups. The remaining households either do not work in formal off-farm activities at all or only to a very low extent. Although the general involvement is higher, the picture looks similar in case of informal local off-farm work: The high income households in both migration groups allocate most labour to the activity, whereas the participation of the middle and low income households is lower.

In case of migration, the corresponding sub-matrix (Table 5.19) reveals a clear pattern according to which the high migration households generally allocate more labour to the activity. Furthermore, within each group the high income households work most in migration, followed by the middle and then the low income households. This points to the role of migration as a determinant of income differences within the village (compare Xing et al., 2009).

[19]In order to deliver more information on agricultural production and to model it in a more detailed manner, it would be desirable to further disaggregate agricultural activities in the SAM. Unfortunately, the survey data did not contain information on activity specific use of capital inputs. Therefore, the construction of the SAM would have required the use of strong assumptions on the allocation of inputs between disaggregated agricultural activities and the decision was made to include only one agricultural activity in the SAM.

Table 5.18.: Labour allocation to off-farm activities - Local off-farm work (yuan).

	Activities											
	Formal local off-farm work						Informal local off-farm work					
	11	12	13	21	22	23	11	12	13	21	22	23
Factors												
Formal local off-farm work												
Male adult labour	84	0	0	590	0	0						
Male elder & child labour	518	0	0	0	0	0						
Female adult labour	0	0	0	0	0	0						
Female elder & child labour	0	0	0	0	0	0						
Informal local off-farm work												
Male adult labour							5,086	3555	5895	15,363	4,061	3,606
Male elder & child labour							746	75	8	299	0	0
Female adult labour							13	99	7	470	29	5
Female elder & child labour							756	0	0	0	0	0
Total	30,611	0	0	29,111	0	5,961	56,052	29,697	51,061	112,606	45,684	32,469

Table 5.19.: Labour allocation to off-farm activities - Migration (yuan).

	Activities Migration 11	12	13	21	22	23
Factors						
Migration						
Male adult labour	32,136	12,273	8,878	53,200	40,252	21,104
Male elder & child labour	0	0	2	0	0	0
Female adult labour	3,357	351	348	3,861	6,795	934
Female elder & child labour	0	0	1,635	651	0	0
Total	186,107	60,812	23,048	114,374	79,349	5,136

5.2.2.3. Household Income

The discussion of the outline of the SAM made clear that household income consists of different components, namely factor returns, returns from labour in form of profits or disutility compensation, and income from transfers and savings. Out of the factor returns, depicted in Table 5.20, the larger share of about 55% on average comes from labour (incl. leisure), the remaining part from land. While these figures have to be interpreted with care due to the low valuation of labour with the estimated shadow wages, they reveal information on the differences between household groups with respect to factor endowments. Summing up the values of the two households of each income level, the high income households are also those with the highest endowments of labour and land, low income households have the lowest endowments. The differences are, however, not so clear cut with respect to the migration groups. In the high migration group it is the low income household which derives the highest returns from labour and in the low migration group the returns from land of the middle income household exceed those of the high income household. Nevertheless, the SAM generally reflects the contribution of differences in asset ownership to income differences and therefore is in line with the findings from Xing et al. (2009).

Table 5.20.: Household income - Factor returns (yuan).

	Factors															
	Labour in farming				Labour in formal local off-farm				Labour in informal local off-farm				Labour in migration			
	Male		Female		Male		Female		Male		Female		Male		Female	
	Adult	E&c	Adult	E&c	Adult	E&c	Adult	E&c	Adult	E&c	Adult	E&c	Adult	E&c	Adult	E&c
Institutions																
Households																
11	17,383	768	2,385	678	84	518	0	0	5,086	746	13	756	32,136	0	3,357	0
12	11,560	3,101	1,339	2,421	0	0	0	0	3,555	75	99	0	12,273	0	351	0
13	12,277	3,175	1,425	1,640	0	0	0	0	5,895	8	7	0	8,878	2	348	1,635
21	18,967	1,033	2,747	1,037	590	0	0	0	15,363	299	470	0	53,200	0	3,861	651
22	25,673	944	3,138	554	0	0	0	0	4,061	0	29	0	40,252	0	6,795	0
23	11,288	227	1,213	1021	0	0	0	130	3,606	0	5	0	21,104	0	934	0

	Factors					
	Leisure				Land	
	Male		Female			
	Adult	E&c	Adult	E&c	Irr.	Nonirr.
Institutions						
Households						
11	25,585	1,382	2,998	1,005	5,731	89,489
12	23,216	2,956	2,046	2,700	4,819	60,500
13	25,264	18,864	1,814	18,599	9,166	73,995
21	60,126	14,695	5,973	3,447	6,160	90,408
22	31,948	4,927	5,062	2,073	3,820	109,638
23	22,049	989	2,047	2,978	2,766	47,935
Migrated	0	0	0	0	374	31,320

The differentiation by age groups and gender reveals that female labour generates the smaller share of the returns to labour which accrue to the households. In agriculture, female labour on average accounts for about 16% of the total value of labour employed, reflecting the fact that women are largely responsible for household related tasks such as house-keeping or water gathering. In the off-farm activities it is much lower, ranging between zero percent in formal off-farm work (exception: the high migration, low income household) and 10% on average in migration. It should be noted, however, that the estimated shadow wage for female labour is much lower than the one for male labour, contributing to the low values which appear in the SAM.

The value the work of children and elder contributes to the labour factor returns of the households is about 15% on average. From the table it becomes clear that elder and children mostly work in agriculture, illustrating that at least a part of the persons who are not counted as economically active well do contribute to home production activities. In case of elder and children, leisure time is only valued for individuals who had indicated having worked in any of the activities in the survey.

In addition to the six household groups defined in Section 5.1.1.2 a seventh, migrated, household appears in Table 5.20. The migrated household represents the households which have migrated out of the village but which still hold land there, receiving payments from land leases. These payments, which are calculated as the difference between expenses on and income from land rentals reported by the households in the survey accrue to the migrated household as payments from the land factor accounts. The migrated household, as shown later on, pays the received amount directly out of the village, thus creating a flow from the households still living in the village to those which have been migrated.

Table 5.21.: Household income - Profits (yuan).

	Activities											
	Formal local off-farm work						Informal local off-farm work					
	11	12	13	21	22	23	11	12	13	21	22	23
Institutions												
Households												
Low migration, high income	30,009						49,451					
Low migration, middle income		0						25,968				
Low migration, low income			0						45,151			
High migration, high income				28,521						96,474		
High migration, middle income					0						41,594	
High migration, low income						5,831						28,858

	Activities											
	Migration						Blood sales					
	11	12	13	21	22	23	11	12	13	21	22	23
Institutions												
Households												
Low migration, high income	150,614						32,311					
Low migration, middle income		48,188						11,459				
Low migration, low income			12,185						20,473			
High migration, high income				56,662						18,858		
High migration, middle income					32,302						34,852	
High migration, low income						-16,902						7,726

Table 5.21 contains the income households receive from off-farm activities beyond the factor returns. The entries are calculated as the reported income from the respective activity minus the value of the time allocated to the activity. In all except one case—the payment from migration to the low income household in the high migration group—the payments made by the activities to the households are positive. Following the theory set up in Chapter 4, this implies that households experience a disutility from the participation in the respective labour market segment for which they are compensated by a markup paid over the opportunity cost of labour. The case of the negative entry in cell representing the payment from the migration activity to the low income household of the high migration group, in turn, is also in line with the theory: The households which constitute the group appear to get additional utility from the migration of some family members and hence are satisfied with a monetary return from migration, which is lower than the opportunity cost. Such positive utility can consist of the diversification of income sources, for example. At this, it is no coincidence that the negative value of the utility compensation appears in the migration activity because migrants often send small amounts or even nothing back home.

In case of formal local off-farm employment, pattern observed follows the labour allocation reported in Table 5.18. The high income households in both migration groups receive relatively high payments, the low income household in the low migration group gets a lower amount, reflecting its comparatively low involvement in this activity.

The levels of utility compensation received by the households from informal local off-farm work broadly follows the wealth ranking of the household groups. High income households of the two migration groups together receive the highest payments, the middle and low income households in the sum lie close together, although the utility compensation received by the two low income households is slightly higher in the sum (∼6,000 yuan). Regarding the migration groups, the high migration group jointly benefits from larger receipts than the low migration group (166,926 vs. 120,570 yuan).

A detailed look at the direct returns from the migration activities reveals that the ranking of the amount of the payments follows the wealth ranking of the household groups. High income households get the highest receipts, low income

Table 5.22.: Household income - Transfers and savings (yuan).

	Institutions					
	Transfers and savings				Government	
	Transfers		Savings			
Institutions	Gifts	Shocks	Savings	Construction	Government	Total
Households						
11	37,974	1,380	148,943	0	7,133	647,915
12	26,478	600	28,889	0	15,536	288,129
13	7,211	2,030	10,919	0	16,652	297,613
21	23,360	0	129,307	0	23,059	655,268
22	17,527	0	56,819	0	10,812	432,820
23	4,615	400	21,869	0	4,196	174,885

households the lowest. The utility compensations received by the households of the high migration group are far lower than those received by the low migration group. The low migration group jointly receives 210,987 yuan whereas the receipts of the high migration group add up to 72,062 yuan, although the latter appears to allocate much more labour to migration (see, for example, Table 5.20 for the values). Although this observation does not conform to the standards of a formal empirical analysis it can be considered as a support of the theoretical model developed above: Those households which due to their demographic characteristics are more constrained in their decision to migrate need a higher compensation for the disutility experienced when doing so.

Although being of a somewhat different type than the direct returns from the off-farm activities, the income from blood donations is included into Table 5.21, as well. Here, no clear pattern with respect to the distribution according to income groups can be identified. Likewise the overall sums received by the two migration groups lie close together (64,243 yuan of the low migration group compared to 61,436 yuan of the high migration group).

Household income from transfers and savings is presented in Table 5.22. The institutions columns in the table are subdivided into two groups of accounts, the transfers and savings accounts and the government account. The government account is not further disaggregated. The transfers and savings accounts consist of one account for transfers from gifts and one for transfers which arise due to shocks experienced by the household (see above). The savings accounts comprise one account for savings in general and one account which contains the payment flows associated with house construction. The latter are grouped with the savings accounts, as house construction due to its long-term character can be considered as a saving. As households only pay for houses and do not generate any income from them (house sales are prohibited in Guizhou) no payments from the construction account are recorded in Table 5.22. The simple savings account, in turn, covers all remaining payment flows from or to an existing capital stock. Dis-savings are recorded in Table 5.22, savings in Table 5.24.

As only income from and expenditure on interest payments instead of total amounts of savings and dis-savings have been asked in the survey, however, the entries of the savings account in Table 5.22 represent estimates of households' dis-savings. The estimation of the amounts of dis-savings is based on the observation that around 86% of the households in Changtian stated some form of dis-saving like the use of self-deposit savings, sales of family property or loans as the major source for big expenditures (e.g. house construction, illness, death of a family member or theft). Hence, for SAM construction the simplifying assumption is made that 85% of household expenditures on items which comprise the big expenditures are covered by payments from the savings account.

The result is that of all receipts of the households reported in Table 5.22, those from savings make up the largest share, followed by gifts and government transfers. Transfers made due to shocks (i.e. support received by the households following big family events like funerals, illness, theft or the like) are only of minor importance. The distribution of total income from transfers and savings as before follows the wealth ranking of the household groups. The sums of the receipts of the two migration groups, however, are almost equal (303,745 yuan to the households of the low migration group vs. 291,964 yuan to the households of the high migration group).

Table 5.23.: Composition of household income in the SAM (%).

	Returns from labour					**Profits**			**Returns from land**	**Transfers & savings**
Households	Farming	Formal off-farm	Informal off-farm	Migration	Leisure	Formal off-farm	Informal off-farm	Migration		
11	3.4	0.1	1.1	5.8	5.0	4.9	8.0	24.5	15.5	31.7
12	6.7	0.0	1.3	4.6	11.2	0.0	9.4	17.4	23.6	25.8
13	6.7	0.0	2.1	3.9	23.3	0.0	16.3	4.4	30.0	13.3
21	3.7	0.1	2.5	9.1	13.2	4.5	15.2	8.9	15.2	27.6
22	7.6	0.0	1.0	11.8	11.1	0.0	10.5	8.1	28.5	21.4
23	8.2	0.1	2.2	13.2	16.8	3.5	17.3	-10.1	30.3	18.6

For a number of reasons, the treatment of savings in the context of household income as explained above constitutes a critical part of the SAM. The first point in question is that, as can be seen in Table 5.23, the large payments streams from the savings account cause transfers to make up substantial shares of the households' total income. This is in particular the case for the high income households, where the share of transfers and savings reaches up to 32% and 28%, respectively (the shares of savings alone are 24% and 20%). These values can be considered excessively high and thereby cast doubt on the validity of the assumptions used to generate them. If one bears in mind the average savings rate of rural households in China of around 16% (Kraay, 2000) and accepts the possibility that dis-savings are of a similar scale, the high shares, however, appear to be acceptable.

The in parts high amounts of dis-savings also potentially affect the simulation results obtained from the village model, as they introduce a comparatively large fixed income component into the model.[20] This has the consequence that net income changes as, for example, triggered by trade reform would in the tendency be underestimated, should the income originating from dis-savings really be too high.[21]

The second critical point is that the substantial dis-savings, which for their largest part lack corresponding payments of households to the savings accounts, mean that households run a financial deficit.[22] Thus, households constantly liquidate assets they have saved without replacing them. Further, the village constantly imports capital from the outside world. In the longer run, this situation obviously is unsustainable. On the other hand, Brown et al. (2010) report that social pressure to spend on social events has increased considerably in the village over the past decade. According to the authors, some households in the village, which can afford to do so, appear to set a standard for spending on big events, such as weddings. Others try keeping up with them. In this situation, it would be entirely conceivable that households tend to overspend and that they get indebted

[20]See Section 6.1, in particular Equation 6.7, which states that income from savings is a fixed component of households' net income.

[21]Stylised calculations have shown that the magnitude of underestimation is at around 20% in case of the high income household of the high migration group. A 1.8% increase in income, for instance, which originates from rises in income from farming and off-farm activities would roughly be 2.3% if income from dis-savings were 50% lower than currently assumed in the SAM.

[22]See also Tables 5.24 and 5.27 and the corresponding discussions.

over time. Furthermore, a part of the household income from dis-savings and the associated capital flows into the village can be interpreted as representing income components which have been under-reported in the survey.

An alternative way of dealing with the problem of savings in the SAM would be to assume lower values for the households' dis-savings as those reported in Table 5.22 and thereby seeking to the reduce the financial deficit of the households and the amount of capital imports into the village. In order to reach at the households' income levels needed to cover the reported expenditures, however, this would also require to proportionately inflate the households' income from other sources. Given that, as mentioned above, most households reported to cover big expenditures from the liquidation of assets or loans, however, this also appears to be little realistic. Likewise, for the reasons discussed, a balanced savings account for each household might also be a questionable assumption.

5.2.2.4. Household Expenditure

The detailed sub-matrix of household expenditures is presented in Table 5.24. Household expenditure in the SAM can basically be divided into four broad categories: Own consumption, consumption of purchased goods and services, leisure, and expenditure on transfers and savings. According to the classification criterion applied for the construction of the representative household groups, expenditure on commodities, transfers and savings are highest for the high income households and lowest for the low income households. An notable observation which can be made from the SAM, however, is with increasing income, households rely less on own consumption. Expenses on purchased food exceeds own consumption in case of high income households, while consumption of the own produced commodity is higher in case of the low income households.

Payments from the household accounts to the labour factor accounts represent the consumption of leisure by the households. The value of leisure is calculated as the difference between total endowment of the household with the respective labour type and the time of this labour type allocated to the different occupations (on the farm, off-farm and migration) multiplied with the household shadow wage. It was assumed herein, that the time available to each individual for all activities including leisure was 16 hours per day and that the year consisted of 365 days. As

Table 5.24.: Household expenditure (yuan).

	Institutions Households 11	12	13	21	22	23	Migr.
Commodities							
Own consumption	91,247	73,878	90,444	128,673	115,855	45,112	
Purchased							
Food							
Grains	59,813	44,055	42,871	52,752	53,837	22,356	
FFV	25,986	12,408	14,425	19,605	18,962	5,682	
Processed food	31,431	14,405	12,521	27,242	20,853	7,183	
Animals	20,545	11,188	6,252	11,569	5,049	4,690	
Non-food							
Durables	36,895	8,459	4,415	24,106	16,081	2,489	
Stimulants	20,825	12,042	13,957	14,024	10,005	4,500	
Other	5,477	986	664	1,749	2,812	128	
Services							
Water	55	30	0	610	249	40	
Energy	18,305	11,224	6,586	20,290	10,098	3,469	
Transport	50,358	10,106	6,461	30,572	14,100	6,523	
Household services	3,200	1,149	1,169	3,540	1,411	611	
Health	84,964	13,500	7,941	58,044	15,863	7,182	
Education	25,895	6,479	7,804	41,162	23,376	4,838	
Factors							
Leisure							
Male							
Adult	25,585	23,216	25,264	60,126	31,948	22,049	
E&c	1,382	2,956	18,864	14,695	4,927	989	
Female							
Adult	2,998	2,046	1,814	5,973	5,062	2,047	
E&c	1,005	2,700	18,599	3,447	2,073	2,978	
Institutions							
Transfers							
Gifts	36,390	12,135	8,553	33,810	18,592	7,685	
Shocks	25,444	1,374	4,271	18,225	17,371	5,424	
Savings							
Construction	64,818	19,113	633	75,857	35,975	13,122	
Savings	15,297	4,680	4,105	9,197	8,321	5,788	
Outside village							31,694
Total	631,790	276,270	284,350	647,519	410,350	162,800	302,39

mentioned above, leisure consumption of children and elder is only included into the SAM in cases an individual reported time worked in any of the occupations. This means that most children and elder, except those who had reported some activity, are considered as economically inactive and without demand for leisure. As leisure includes also time dedicated to housework, the values in the SAM by trend underestimate the contribution of elder or children who exclusively perform tasks dedicated to the household or the family. As the value of leisure depends on the time endowment of the household rather than on its level of wealth, no clear pattern arises with respect to this factor. In general, the effect of the inclusion of leisure in the SAM is that the ranking of total household expenditure in the last line of the table no longer fully corresponds to the wealth ranking of the households. Rather than having the lowest expenditure in the low migration group, the low income household exhibits total expenditures slightly higher than the middle income household. Nevertheless, as noted above and most important for the model analyses the ranking is maintained with respect to households' total expenditure on consumption of commodities and services as well as on transfers and savings.

The final expenditure category are transfers and savings. The missing government account reflects the fact that there are no taxes households in the village have to pay to the government. The construction account, as noted above, contains expenses on house construction, which are considered as savings in the SAM. The values recorded as household payments to the savings account are the interest payments reported by the households in the survey. Accordingly, the only actual savings of households considered in the SAM are household expenditures on construction and—as savings in a broader sense—expenses on durable goods (the durables commodity in the table). As already mentioned above, the receipts of the savings account are far lower than the payments which originate from it (Table 5.22). In order to balance the account, a negative payment from the savings account to outside the village which corresponds to the difference between the payments received and the expenses is introduced. This assumption can be maintained as households in order to cover big expenditures either sell assets or take loans. The latter can safely be assumed to originate from outside the village, while assets can be sold to outside the village. The implication is that the village is a capital importer. Rooted in the scarce availability of data and as already discussed above, the described treatment of savings and investment in the SAM for sure is provisional. As the depiction of the village capital market, however, is not at the focus of this study, it can be considered to be sufficient for the present purpose.

Payments of the migrated household to outside the village constitute the last element of Table 5.24. As discussed above, the migrated household receives the expenses on village traded land, which are not matched by rental incomes reported by the households. These receipts are transferred out of the village, indicating that migrated households still receive rents from the contract land they have been allocated.[23]

5.2.2.5. Village Trade

The sub-matrices of the SAM, which describe the trade which takes place within the village and between the village and the outside world are shown in Tables 5.25 - 5.28. The returns from village traded labour are received by the informal off-farm activity (Table 5.25). As in other instances before, no clear pattern with respect to the wealth ranking of the households arises. A careful interpretation, however, would be that the households of the low migration group appear to seek employment in agriculture in the village to a larger extent than those of the high migration group. The amounts paid from the land commodity accounts to the respective factor accounts illustrate that the major part of land traded in the village is non-irrigated. This reflects the lower availability of irrigated land in the village, but also the tendency of households who own irrigated land to farm it by themselves.

The sub-matrix on village imports (Table 5.26; transposed SAM excerpt) shows the imports of the different commodities and services demanded by and imported into the village. The payments made by the commodity accounts to outside the village correspond to their total receipts, i.e. it is assumed that none of these commodities is produced within the village. With respect to the food commodities—

[23] An alternative assumption would be that households have an incentive to under-report income from land rentals as this activity is not legally sanctioned. Given the current practice that migrated households formally remain the owners of the contract land they have been allocated the approach chosen in the SAM appears to be preferable (Zhang, 2010).

Table 5.25.: Returns from village traded factors (trade within village) (yuan).

	Commodities		
	Irrigated land	Non-irrigated land	Village traded labour
Activities			
Informal off-farm			
11			233
12			2,666
13			2,737
21			608
22			3,533
23			0
Factors			
Irrigated land	2,235		
Non-irrigated land		67,969	
Total	2,235	67,696	9,777

which arguably may be produced in the village, as well—this assumption can be defended with the arguments stated in Section 5.2.1. In case of most purchased goods and services and the intermediate inputs the assumption is entirely plausible. Exceptions are the transport, health and other services demanded by the households which at least in parts are supplied by households located inside the village and traded on a village market. The labour time allocated to these activities as well as the income generated with them are recorded in the context of the informal local off-farm activities, which include the relevant types of self-employment. The survey data, however, did not provide sufficiently detailed information on the location of the sales of these services by the households. But again, the simplifying assumption that all services demanded by the households are imported to and all services supplied are exported from the village is in line with the assumption of the village market for goods and services being perfectly integrated with the outside world.

Regarding the values contained in Table 5.26, urea, animal feed and livestock for replacement are the most important intermediate inputs which are imported into the village. Among the consumed commodities, grains make up the largest share, followed by processed food. Taken together, food products account for around 44% of all consumption goods and services imported into the village.

The sub-matrix of the village SAM shown in Table 5.27 depicts the payments made by the institutions accounts to the rest of the world. The values of this

Table 5.26.: Village imports (yuan).

	Outside village	**Total**
Commodities		
Intermediate inputs		
Urea	276,323	276,323
Pesticides	2,116	2,116
Fertilizer	77,413	77,413
Seed	45,351	45,351
Feed	238,087	238,087
Breed	218,445	218,445
Veterinary	1,881	1,881
Machines	4,492	4,492
Labour		
Hired labour	9,416	9,416
Food		
Grains	275,684	275,684
FFV	97,068	97,068
Processed food	113,635	113,635
Animal products	58,724	58,724
Non-food		
Durables	93,014	93,014
Stimulants	75,353	75,353
Other	11,816	11,816
Services		
Water	4433	4433
Energy	75,608	75,608
Transport	118,120	118,120
Household	11,080	11,080
Health	187,494	187,494
Education	109,554	109,554

Transposed version of the SAM entries.

Table 5.27.: Imports by institutions (yuan).

	Institutions				
	Transfers		Savings		Government
	Transfers	Shocks	Construction	Savings	Government
Outside village	0	67,699	209,518	-349,358	-77,388
Total	117,165	72,109	209,518	47,388	0

matrix have mainly been generated by the need to balance the SAM and are to a large extent assumption driven. The zero entry in the cell of the transfers account reflects the assumption that transfers between households (i.e. gifts and local intra-household transfers) are balanced within the village. As income from and expenses on transfers did not balance in the original data, this assumption has been introduced during the SAM balancing process. It rests on the consideration that there is *a priori* no reason to believe why the village should be a net payer or recipient of gifts or intra-household transfers. That said, the village well is a net recipient of remittances (see Table 5.28). Most of the expenses related to shocks and big family events (the shocks account in the table) are assumed to flow out of the village, as well. In fact, the small share remaining in the village corresponds to the shock related income reported by the households in the survey. A great part of the expenses on shocks involves outlays for festivities (weddings or funerals). These can be assumed to consist of goods and services originating from outside the village, hence creating a payment flow as represented in Table 5.27. According to the entry in the savings-construction account, all expenses made on house construction go to the rest of the world. The payments reflect the purchase of construction material and labour services, which have not been reported separately in the survey. It is possible that some double counting is involved with respect to the hired labour commodity account, but as the value of hired labour imports is comparatively low, it can be neglected (compare Table 5.26). The strongly negative entry of the savings-savings account accounts for the difference between household receipts from savings (i.e. dis-savings) and the rather low savings reported by the households. As discussed above, the entry represents the net imports of capital into the village. Similarly, the government account has a negative payment to the rest of the world which corresponds to the payments of the account to the households. Accordingly, the village is a net recipient of government transfers, an obvious observation in a situation in which no taxes are paid to the government.

The sub-matrix of village exports is presented in Table 5.28. Of the produced commodity, exports are made up of the share of village production which is not consumed by the households themselves. Here again, all trade which might take place inside the village is included into the export accounts (recall the discussions

Table 5.28.: Village exports (yuan).

	Outside village	**Total**
Commodities		
Agricultural	1,009,292	1,554,501
Activities		
Formal local off-farm work		
11	30,611	30,611
12	0	0
13	0	0
21	29,111	29,111
22	0	0
23	5,961	5,961
Informal local off-farm work		
11	55,819	56,052
12	27,031	29,697
13	48,324	51,061
21	111,998	112,606
22	42,151	45,684
23	32,469	32,469
Migration		
11	186,107	186,107
12	60,812	60,812
13	23,048	23,048
21	114,374	114,374
22	79,349	79,349
23	5,136	5,136
Blood sales		
11	32,311	32,311
12	11,459	11,459
13	20,473	20,473
21	18,858	18,858
22	34,852	34,852
23	7,726	7,726

above).

As described before, income generated from local off-farm activities is assumed to originate almost in its entirety—except for the comparatively small amounts of agricultural labour traded inside the village—from the outside world. This is reflected in the payments from the outside village account to the respective off-farm work accounts. The receipts of each account represent the full income earned by each household specific activity, which later on is split into payments to the labour factor accounts and payments which go directly to the households in the form of utility compensations.

The receipts of the local off-farm labour accounts at a glance provide a picture of the distribution of the corresponding income between the households. By far the largest share of formal off-farm income is earned by the high income households. Of the remaining households, only the low income household in the high migration group receives income from this activity at all. The situation is more balanced in case of informal local off-farm work in which all household groups participate. Nonetheless, the income flowing to the accounts of the informal local off-farm activities of the high income households still exceed the joint receipts of the accounts of the middle and low income households.

Unlike in local off-farm work from which the full income earned accrues to the activity accounts and thereby to the households, the payments received by the migration activities from outside the village only reflect the value of remittances sent by the migrants. The receipts of the migration activity accounts show that the high income households receive the highest amounts of remittances and the low income households the lowest. Comparing the migration groups, the joint receipts of the low migration group (269,967 yuan) exceed those of the high migration group (198,859 yuan). The explanation would be that due to the higher share of dependants in the families, migrants from the low migration group have a stronger incentive to remit.[24]

Blood is the final export good of the village. As the receipts of the activities are directly paid to the household accounts, the details are discussed in relation

[24]The larger population size of the low migration group does not play a role here. The receipts per household in the low migration group are 1,791 yuan, compared to 1,442 yuan of the high migration group.

to Table 5.20.

Comparing the shares of the different categories, produced commodities constitute the most important export of the village, accounting for 51% of the total export value. Local off-farm activities account for a minor share of 19% (formal local off-farm work: 3%; informal local off-farm work: 16%) which is exceeded by the contribution of migration of 24%. Blood donations add up to a share of 6% of total village exports.

5.2.3. SAM Construction and Balancing

The present section provides some more technical details regarding the construction and, in particular, the balancing of the SAM. The disclosure of the main choices made are supposed to facilitate the assessment of the reliability of the SAM, given that the matrix represents an estimated snapshot of the village economy during the year 2006 whose entries deviate in parts considerably from the survey data.[25]

Regarding the balancing of a SAM, in general, one can distinguish manual balancing and balancing based on some sort of algorithms implemented in the form of a computer program. The most popular examples for algorithm based balancing procedures are cross-entropy methods, versions of the RAS method or the so called *Stone-Byron Method* (see, for example Round, 2003; Schneider and Zenios, 1990; Fofana et al., 2002; Robinson et al., 2001; McDougall, 1999). Among CGE modellers, the cross-entropy method has assumed particularly high popularity (Robinson et al., 2001; Round, 2003). Although convenient to apply, the disadvantages of algorithm based balancing are that they constitute a 'black box' in which changes of SAM entries made by the algorithm in order to achieve a balanced SAM cannot be traced (Kuiper, 2005). This is of particular concern in instances, where due to large discrepancies in the original data—as is the case with respect to incomes and expenditures in the household data in this study—substantial adjustments have to be made in the SAM. Making some bold decisions regarding SAM adjustments may be preferable in this situation to applying an

[25] The intention of the section is to give an insight into the SAM construction and balancing process. For more details, see the code written for carrying out the operations in R (R Development Core Team, 2009) in the electronic annex (Filename: 'samcompile_ prof_ hhdisagg_ actagg_ agragg.r').

algorithm which may change values within the SAM in an uncontrollable manner. In general, some authors recommend to make careful use of SAM balancing algorithms and better compile SAMs based on judgement and manual data manipulation rather than some mechanical method (Fofana et al., 2002; Round, 2003). Hence, the decision was made to manually balance the Changtian village SAM.

In the construction and the balancing of the SAM, two major problems had to be overcome. First, the values of agricultural input use as reported in the survey and as calculated with the estimated shadow wages did not exhaust the receipts of the agricultural activities. Second, the survey data suffered the common problem experienced by household surveys in developing countries that reported expenditures exceed reported incomes to a substantial degree.[26] Both problems had to be dealt with during the balancing of the SAM. Due to the linkages between the SAM accounts, both problems required a number of adjustments of the entire matrix, leading to considerable changes in the values of the SAM entries. In the following, the main choices made with respect to the compilation and the balancing of the SAM are outlined and a rough comparison of some core characteristics of the initial unbalanced SAM and the balanced SAM is presented.

5.2.3.1. Balancing the SAM

Bearing in mind the average surplus of the accounts, the approach to balance the agricultural activity accounts considered initially, but not pursued, was to increase the household shadow wage, which, as had been repeatedly discussed above, have been estimated at rather low values. Yet, the reduction of the accounts' surpluses would have required an about ten-fold increase in the household shadow wages. This would have constituted an extreme and no longer justifiable deviation from the empirical estimates. Instead, the input values of the agricultural activity of each household have been scaled proportionally using household group specific scaling factors to match payments and receipts of the activity accounts. The

[26]Referring to one of the rounds of the Ghana Living Standards Survey carried out by the Ghana Statistical Service in cooperation with the World Bank in the 1990s, Round (2003), for example reports that depending on the definition of income, household income was between 32% and 41% lower than expenditures. This discrepancy is of the magnitude of the differences found in the data for the Guizhou villages. More generally Haughton and Khandker (2009) elaborate on the problems associated in particular with the accuracy of household income data and Fofana et al. (2002) appreciate the problem in a context of SAM construction.

scaling factors applied in this initial step were 1.16 on average, ranging between 0.98 and 1.57. This means that the accounts have been scaled to new values which account for between 98% and 157% of the initial ones.

Obviously, the scaling of the payments by the agricultural activities lead to new imbalances in the intermediate commodity and factor accounts due to a net increase in input use. In case of intermediate commodities the balancing has been straightforward by simply defining the value of imports (i.e. payments from the commodity accounts to the rest of the world) as the sum of the receipts of the respective accounts. Increases in the receipts of the land and labour factor accounts had to be matched by higher payments from the factors to the households. This procedure increased household income on average by 17%, thus contributing to the reduction of the gap between incomes and expenditures. Via the commodity account for village traded labour, the adjustment of agricultural input use has also changed the amount of village labour employed. In the consequence this required a change in the receipts and payments to and from the informal local off-farm activities. In order to do so, the SAM has been programmed in a way that payments from the the village traded labour account to the informal local off-farm activity automatically adjust to changes in the use of village labour in agriculture. Payments from informal local off-farm work to households, however, have not been changed. This implied that changes in agricultural input use did not affect income of households from informal local off-farm work but rather the composition of income from this activity with respect to the two different income sources—local off-farm work inside and outside the village—combined in this activity. Thus, income from village traded labour increases, income from the other sources agricultural and non-agricultural informal employment outside the village and self-employment must decrease. This can be considered acceptable, as all informal off-farm income sources are treated as a single activity with a single wage rate in the model.

Following the balancing of agricultural input use and the completion of the adjustments triggered by this first big balancing step, household incomes still accounted for only 62-75% of household expenditures. In order to reduce the difference between receipts and payments of the household accounts, household income has been scaled up proportionally by multiplication with a household specific scaling factor. This proportional scaling, however, was preceded by scaling of the transfers-gifts account. In the unbalanced SAM, with a surplus of about 25% this account was the most unbalanced one which consequently could accept a large part of the adjustment. Assuming that household expenses on and receipts from gifts and local intra-household transfers are balanced within the village and further assuming that households receive gifts and local transfers according to the proportions reported in the survey, the receipts by all households have been scaled proportionally by the multiplication with a uniform scaling factor.

As in case of agricultural input use, the adjustments of household income created the need for readjusting all other accounts. In case of the off-farm activities, increased expenses by factors and the activities themselves have been matched by a multiplication of the corresponding SAM entries with activity and household specific scaling factors. The receipts of the activity accounts from outside the village have been scaled accordingly. Due to the simultaneous use of family labour and land, the adjustments of the agricultural activity accounts was not as straightforward. To achieve the best possible balancing, payments made by the agricultural activities together have been scaled for each household to minimize the sum of squared differences between receipts and payments of the agricultural labour factor accounts and the land factor accounts. The resulting changes in the receipts of the commodity accounts of the intermediate inputs used in agriculture have been accommodated automatically by defining the corresponding amounts of imports as the sum of the receipts of the respective accounts.

As a further consequence, the change in the agricultural activities accounts caused new imbalances in the corresponding commodity accounts. As this would leave the households' consumption patterns unchanged, an elegant way to balance the accounts would be to scale up only the payments from the rest of the world to the corresponding commodities. However, due to the high share of self-consumption, this would require to scale up receipts from outside the village disproportionately. This would distort the ratio of sales and self-consumption of the households. Scaling self-consumption of the households by the same factor, in turn, would distort the relative budget shares of the self-consumed vs. purchased commodities. The choice made here is scale the payments from outside the village disproportionally higher, thus somewhat distorting both shares but each one less than when scaling either only payments from outside the village or both payments from outside the village and self-consumption by the same factor.

The final group of accounts which have been directly affected by the adjustments of household income have been the blood donation accounts. In order to match receipts and balances of these accounts, receipts from outside the village have been expressed as the sum of the payments of the accounts.

An effect of the adjustments of the receipts of the agricultural commodity accounts was a new deficit of the households due to increased self-consumption. This deficit, however, has been much lower than the one in the initial situation. As a correction step to address these imbalances the assumption was made that expenses on everything except self-consumption and leisure have been too high. Accordingly, expenses of households except self-consumption and leisure have been scaled down to balance the household accounts. This constituted a further move in the direction of increasing self-consumption at the cost of purchased consumption goods.

The outcome of the operations undertaken up to that point was a SAM from which the major imbalances due to agricultural input use and discrepancies in household incomes and expenditures have been purged. Seven accounts, namely the agricultural labour accounts, the land accounts and the outside village accounted remained unbalanced. The remaining fine-tuning of the SAM has been done through a sequence of smaller scaling operations related to the farm labour accounts, the land accounts and household expenditures.

The explanations regarding the construction and balancing of the SAM made in this section illustrate that due to the characteristics of the underlying household data substantial data manipulation have to be carried out. Inevitably, this has lead to considerable changes both in the levels of the payments recorded in the SAM and in the proportions of the values of the SAM entries relative to each other. Focusing on the latter—which are more relevant from a modelling point of view—the following section presents some figures which shall help to assess the magnitude of the changes the SAM has experienced during the balancing process.

5.2.3.2. Assessment of the Balanced SAM

Table 5.29 contains a selection of income and expenditure shares which provide a general picture of the composition of the SAM. Regarding the share of agricultural income in the total gross income of the village (excluding transfers) the figures indicate that the balancing process has caused an increase in the share of agricultural income. With an increase from a 58% share in total village income to 61%, this increase is only of minor magnitude.[27] Somewhat larger changes have occurred in the composition of non-agricultural income. Due to the disproportionately higher scaling of all income sources except transfers and gifts, the latters' contribution to non-agricultural income has decreased in favour of increases in the shares of the other off-farm income sources, including blood sales. The most pronounced change has taken place in migration, with an increase from 24% to 30%. The distribution of income among the different household groups, again, has remained largely unchanged.

On the expenditure side, the share of food products in the consumption expenditure of the village has increased in the balanced SAM from 38% to 44%. This increase stems from increases of the food expenditure of all household groups which in turn have been caused by the increase in the relative importance of self-consumption. The shares of self-consumption in total consumption of the different household groups have conserved their initial ranking, but relatively high changes have occurred here. The shares of self-consumption increased by margins of between eight and 14 percentage points, where the highest changes have taken place in the expenditures of the low-income households of both migration groups. Although the adjustments made here are in parts substantial, they constitute an unavoidable trade-off related to the need of matching incomes and expenditures which differed considerably in the original survey data.

Summarizing the considerations on the compilation and the balancing of the SAM, it becomes apparent that the consistency requirements inherent to the SAM structure required a high degree of data manipulation. Due to extensive inconsistencies present in the original dataset, the preferred way of doing so has been a

[27]It should be noted that due to the use of different aggregations and definitions the shares presented in Table 5.29 are not directly comparable to the figures presented in Chapter 3. They rather serve to uncover changes in the composition of the SAM which have occurred during the balancing process.

Table 5.29.: Key characteristics of the balanced and unbalanced SAM.

SAM version:	**Unbalanced**	**Balanced**
Income		
Shares in total income		
Agricultural	0.58	0.61
Non-agricultural	0.42	0.39
Shares in non-agricultural income		
Formal local off-farm	0.03	0.04
Informal local off-farm	0.18	0.22
Migration	0.24	0.31
Blood donations	0.07	0.08
Transfers/gifts	0.48	0.34
Shares of household groups in total village income		
11	0.24	0.26
12	0.12	0.12
13	0.12	0.12
21	0.29	0.31
22	0.16	0.17
23	0.07	0.07
Expenditures		
Share of food products in consumption expenditure		
Village level	0.38	0.44
Household level		
11	0.31	0.35
12	0.48	0.54
13	0.50	0.56
21	0.30	0.37
22	0.42	0.50
23	0.42	049
Share of self-consumption in consumption expenditure		
Village level	0.15	0.27
Household level		
11	0.10	0.18
12	0.17	0.29
13	0.19	0.32
21	0.14	0.25
22	0.19	0.33
23	0.20	0.34

manual balancing procedure, as this approach allowed to consciously manage and trace the adjustments that had to be made. Yet, the comparison of the balanced with the unbalanced SAM shows that the basic characteristics of the SAM regarding income and expenditure structure could be preserved. However, in particular with respect to the shares of self-consumption in total consumption expenditures it has not been possible to avoid non-trivial changes in expenditure patterns.

6. An Applied Village Equilibrium Model

Following the development of the theoretical model of household behaviour in Chapter 4 and the construction of the village SAM in Chapter 5, this chapter is dedicated to the presentation of an applied village equilibrium model. In the following section, the theoretical household model is translated into a village CGE format.[1] Choices regarding the specification of functional forms for utility functions, remittances functions and production functions are made explicit. Furthermore, assumptions regarding the tradability of commodities and factors which are already outlined during the construction of the village SAM are incorporated into the model. The resulting village equilibrium model is presented in its algebraic representation in this section.

In Section 6.2, a number of simulations are carried out in order to illustrate the workings of the model and to demonstrate the high degree of flexibility it offers for the depiction of the labour market behaviour of rural households. Using a simple version of the model, a migration wage shock is analysed under different values for the parameters of the functions which govern the labour allocation by the households. Results on key variables are presented and discussed.

6.1. The Village Equilibrium Model

As mentioned above, the translation of the theoretical household model of Chapter 4 into a village equilibrium model which can be used to carry out simulation analyses requires the specification of functional forms for the utility functions, the

[1] Section 6.1 in parts draws on Kleinwechter (2010), where a stylized version of the village equilibrium model has been presented.

remittances function and the agricultural production function. Furthermore, assumptions have to be made regarding the tradability of commodities and factors. A village equilibrium framework which accommodates these assumptions needs to be constructed. In the final model, the activities of the households which constitute the village community take place within this framework. This section starts with the assumptions on the functional forms of household utility, remittances and production as well as the tradability of products and factors.

6.1.1. Assumptions on Functional Forms and Tradability of Products and Factors

As becomes clear in Chapter 4, the allocation of labour to migration, other productive activities and leisure is largely determined by utility considerations of the households: The households derive utility from the consumption of leisure and their level of utility is affected by participation in different productive activities. Accordingly, the composite utility function proposed (recall Chapter 4) consists of a part reflecting consumption utility and a part generating utility from labour market participation. Due to the necessity of capturing the effects of changes in household consumption demand which arise following changes in migration, the consumption utility function U^C is specified as a per capita expenditure system. As a compromise between keeping matters simple and achieving a realistic depiction of household behaviour, a per adult equivalent Stone-Geary utility function is chosen to represent consumption demand (see Kuiper, 2005, for a former application of this approach). The labour market participation component U^L of the composite utility function in this illustrative application is assumed to exhibit negative marginal utility (i.e., disutility) of labour allocated to the different activities. Furthermore, it is assumed that the marginal disutility increases with the amount of labour allocated to a particular activity. This implies that households experience a certain degree of disutility from participation in any income generating activity which increases with the amount of labour. A simple sum of power functions is proposed here. To avoid undue complexity of the model, remittances and agricultural production are dealt with using rather simple functional forms. Remittances are assumed to be a linear function of the product of time allocated to migration and the wage rate. A nested Cobb-Douglas (C-D) production technology is used to model agricultural production. Non-farm production technologies are a one-to-one mapping of the labour allocated to the respective activity into a labour service commodity to be traded on the market.

Assumptions regarding the tradability of products and factors determine the mechanisms of price formation and lead to the general equilibrium framework of the model. Generally, three levels of tradability are distinguished in the model. Agricultural output commodities, purchased consumption goods and the purchased inputs to agricultural production are assumed to be traded outside the village. Following Taylor and Adelman (1996), these goods, which can be exported and imported at prices given by the outside world, are denoted village tradables. Within this group, the model further differentiates between commodities which are exported from the village (agricultural output) and imported into the village (purchased consumption goods and inputs). The next level of tradability is represented by land, which is assumed to be traded inside the village. This gives rise to a village rental market in which the rental rate for land is determined by supply and demand within the village. Goods or factors, such as land in this model, which are traded among households within the village and not with the outside world are referred to as household tradables (Taylor and Adelman, 1996). Family labour, finally, takes a special position. While labour is also traded outside the village, different wage rates including the household shadow wages apply. The wage rate in off-farm activities is fixed outside the village. The household shadow wages, however, which ultimately govern the time allocation of the households are determined within the households. Furthermore, the assumption that labour cannot be purchased by households plays a role in defining the households' balance of family labour (see below).

Before beginning the presentation of the village equilibrium model, some aspects regarding notation should be mentioned. Unlike in Chapter 4, the notation in this chapter is adapted to the representation used in GAMS.[2] This refers to variable names as well as sets. As this chapter is intended to be the core part of the documentation of the model, comparison with the GAMS code is facilitated.[3] A

[2]For the GAMS code a notation along the lines of the GLOBE global CGE model (McDonald et al., 2007) and the IFPRI standard model (Löfgren et al., 2002) has been chosen.

[3]The interested reader might wish to refer to Kleinwechter (2010) for a representation of (a

complete list of set nomenclature and parameter and variable names can be found in Annexes C and D, respectively.

6.1.2. Household Utility

Following the considerations made above, the composite utility function is

$$\begin{aligned} U_h &= U_h^C + U_h^L = \\ &= \prod_{c \in CD} \left(QD_{ch} - \sigma_{ch}\right)^{\gamma_{ch}} \\ &\quad + \sum_{a \in AO} \left(-\varepsilon_{ah} FDD_{fah}^{\delta_{ah}}\right) \qquad \forall\, h \in H \;\wedge\; f \in FU. \end{aligned} \tag{6.1}$$

The first term on the right hand side (the second line) is the consumption utility function U^C in which all QD_{ch} are defined per adult equivalent. σ_{ch} describes the fixed committed (or subsistence) consumption quantities and γ_{ch} are the marginal expenditure shares (Sadoulet and de Janvry, 1995). The consumption utility function is defined over all commodities consumed by the households h, entering a set CD.

The second term of the composite utility function constitutes the utility function for labour market participation U^L. Time worked in the different activities is expressed in terms of a factor demand variable FDD_{fah}. The set FU contains the 'utility' factors, i.e. the production factors which bear a utility connotation.[4] The parameters ε_{ah} and δ_{ah} determine how the time allocated to a particular activity translates into utility. The negative sign which precedes ε_{ah} ensures that the households experience a disutility from labour market participation. Note that only time worked in off-farm activities, represented by the set AO, is included into the labour utility function. The omission of own-farm work implicitly incorporates the assumption that no utility considerations are attached to work on the own farm. This means that households have a neutral attitude towards this kind of work. As will be shown later, this has the effect that labour allocation to agriculture is driven by the choices made by households regarding work in off-farm activities. So, the allocation of labour to own-farm work cannot be directly

stylized version of) the model in the notation of the theoretical model of Chapter 4.

[4] This set in the current model only contains labour. It allows, however, for further disaggregation, e.g. by gender.

influenced by the modeller and the flexibility of the modelling of labour allocation behaviour is reduced by a certain degree. An inclusion of own-farm work into the labour utility function, however, would have required to make assumptions on the size of a utility term which drives a wedge between the marginal returns to labour in agriculture and the households shadow wage. Such an assumption would be difficult to make, given that the shadow wage by definition is unobservable. Furthermore, it would be incompatible with the assumptions regarding the equality of the marginal value product and the marginal cost of labour used in the estimation of the household shadow wages [5]

6.1.3. Household Expenditure

Constrained maximization of the utility function (6.1) with respect to consumption goods and leisure leads to a per capita linear expenditure system (LES) (Sadoulet and de Janvry, 1995; Kuiper, 2005). In the LES, household demand is described by

$$QD_{ch} = \frac{PD_{ch} * \sigma_{ch} + \gamma_{ch} * (HEXPCP_h - \sum_{c \in CD} PD_{ch} * \sigma_{ch})}{PD_{ch}} \qquad \forall \ \in CD \wedge \ h \in H \tag{6.2}$$

where PD_{ch} is the consumer price of good c and $HEXPCP_h$ is the per adult equivalent consumption expenditure of household h. PD_{ch} is exogenously given for almost all consumption goods and thus the same for all households, The exception is the case of leisure, where the consumer price is the household specific endogenous shadow wage. The great advantage of the LES is its simplicity, reflected in particular in the fact that it requires a very limited number of parameters and that its calibration only requires prior knowledge of income elasticities of the goods included into the system. Although the LES fulfils the restrictions of additivity, homogeneity and symmetry commonly imposed on demand systems (Stone, 1954), its simplicity also entails a number of weaknesses. First, Engel curves are assumed to be linear with a slope which is equal to the marginal expenditure share γ_{ch}. This linear nature of the Engel curves implies that predictions made with

[5] Recall Equation 4.38 in Chapter 4 and the discussion in Footnote 10 in Chapter 5.

the system are only accurate over a limited range of variation in income. Second, the expenditure (or income) elasticity of each commodity in the system is larger than zero, meaning that inferior commodities are not allowed for. Third, the own price elasticities following in an LES always lie between -1 and 0, thus there is only inelastic demand for all goods. Finally, all cross-price elasticities are smaller than zero, so that all goods are gross complements (de Boer, 2009; Sadoulet and de Janvry, 1995).

In principle, the weaknesses of the LES can be overcome by the use of more flexible specifications of the demand system which would resemble observed consumption behaviour more closely. Examples for more flexible specifications which are also commonly used in CGE analyses would be the Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980) or demand systems based on Constant Difference of Elasticities (CDE) or Constant Elasticity of Substitution (CES) functions (Martin, 1997). As the focus of the present analysis is on household labour market behaviour, however, the depiction of the demand side is kept comparatively simple.

Apart from the consumption of the goods covered by the LES, households spend their income on several other items, comprising house construction, gifts, expenditure on shocks and big family events and household savings and interest payments. Of these, the only item which is modelled endogenously to the model is expenditure on construction $HEXPCONS_h$. Assuming a fixed expenditure share which is expressed as a share of total household income YH_h, expenditure on construction is given by

$$HEXPCONS_h = hoexpconssh_h * YH_h \tag{6.3}$$

The remaining expenditure items are assumed to be fixed and included into the income constraints of the households (see Equation 6.22). The main reason for this simplifying assumption lies in the appearance of the items on the income and on the expenditure side. Due to the design of the model as a nonlinear maximization problem in which total village income is maximized, the modelling of gifts, shocks or savings as fixed expenditure shares, for instance, would create a circular flow of income within the village through which household incomes are maximized to infinity. This would render the model insolvable. A further argument is given by the results of a study by Brown et al. (2010) on the same villages in Guizhou. The authors find that social spending, i.e. expenditure on big family events and gifts, is motivated by status concerns and may follow a pattern of herding behaviour. This suggests that the proper modelling of households' expenditure on the items mentioned would require a much more detailed approach. Simplifying assumptions, such as fixed expenditure shares in any case would fall short of the more complex reality. Although an incorporation of the findings by Brown et al. (2010) into the model not only from a methodological point of view would constitute a highly interesting aspect, it is clearly beyond the scope of this study.

The definition of quantities and consumption expenditure in per adult equivalent terms in Equations 6.2 and the fact that in the remaining parts of the model total quantities and values per household are used requires the establishment of a relationship which scales the variables expressed as per adult equivalents to total quantities and values. The scaling function for per adult equivalent consumption is:

$$QDT_{ch} = QD_{ch} * HS_h \qquad \forall\, c \in CD \ \wedge \ h \in H \tag{6.4}$$

Likewise, per adult equivalent consumption expenditure is scaled to total household consumption expenditure by

$$HEXPC_h = HEXPCP_h * HS_h \qquad \forall\, h \in H. \tag{6.5}$$

The variable HS_h which appears in the two scaling equations is the endogenous household size and defined by Equation 6.24 below.

Equations 6.2 to 6.5 together constitute the expenditure block of the village equilibrium model comprising demand for consumption commodities, leisure and housing. As a result of the expenditure system being defined on a per adult equivalent basis, the time dedicated to migration (i.e. the time spent by a migrant outside the household) exerts a direct influence on consumption demand via Equations 6.4 and 6.5 and the endogenous household size Equation 6.24. This establishes the feedback between migration and household consumption.

6.1.4. Household Income

Turning from the expenditure to the income side of the households, the model contains two equations for each household which describe its income. For the remittances function 6.6 a simple linear specification has been chosen:

$$YR_h = \sum_{a \in HAOM} \kappa_h * PA_{ah} * QA_{ah} \qquad \forall\, h \in H \tag{6.6}$$

According to this equation, migrants send a constant fraction κ_h of their income in form of remittances YR_h back home. Migrant income, in turn, is expressed as the product of the price of the migration activity PA_{ah}, i.e. the wage rate at the destination, and the amount of the labour service commodity QA_{ah} supplied. The amount of the labour service commodity is the time worked in migration (see Equation 6.9). Returns from migration are summed over a set $HAOM$ which contains the household specific migration activities as elements.[6] This formulation offers the possibility of a further disaggregation of migration, e.g. by sector or by region.

The simple and linear form of the remittances function again is a pragmatic choice. First, it implies the assumption that the remitting behaviour of migrants' captured by the parameter κ_h is constant over time and invariant to economic developments in the village community. It thereby ignores the complexity of the motivations to remit (Lucas and Stark, 1985). Furthermore, the linearity of remittances in migration time and wage, i.e. the constant marginal rate of remittances, rules out the possibility that the share of income remitted may change with the time worked in migration or with changes in wages. A study by Cai (2003), for example, finds that migrants become more likely to remit (although not to remit more) up to a certain duration of migration but that this likelihood declines with the migration spell extending further. Such observations might suggest the existence of nonlinear remittances functions. Having said that, the linear form chosen

[6] As will be explained below, activities in the model are household specific. That is, each household disposes of an own set of functions associated with the different production activities. Sets as $HAOM$ are cross-sets defined from the household set H and the activity set A (or its subsets) and map each single activity to the corresponding household.

may be a considered a first order approximation to any remittances function and can be expected to be sufficiently precise over the comparatively small range of changes in migration wages and time to be analysed with the present model.

Remittances, however, form only one component of the full income of the households which is given by Equation 6.7:

$$\begin{aligned} YH_h = &\sum_{f \in FU} \sum_{a \in HAC} WF_{fh} * FDC_{fah} + \sum_{f \in FU} \sum_{a \in HAOL} PA_{ah} * FDD_{fah} + YR_h \\ &+ \sum_{f \in FN} FSH_{fh} * WF_{fh} \\ &+ hogiftconst(h) + hogovconst(h) + hoshoconst(h) \\ &+ hosiconst(h) + hobloodconst(h) \\ &+ \sum_{c \in CN} PD_{ch} * QDT_{ch} \qquad \forall\ h \in H \end{aligned} \tag{6.7}$$

According to Equation 6.7, households derive income from labour employed in farm production, local off-farm activities and migration (in form of remittances). The time spent in agricultural production, which makes up the set HAC of household C-D activities, is FDC_{fah}. THe household time spent in local off-farm activities, all members of the set $HAOL$, is FDD_{fah}. Time spent in farm production is evaluated at the household shadow wage WF_{fh}, time worked in local off-farm activities at the respective activity price PA_{ah}, which corresponds to the market wage rate. Please note that the market wage rates can be decomposed again into the shadow wage and the marginal disutility compensation.

Apart from labour, households receive factor returns from contract land they dispose of. This income component enters the income equation as the households' endowment with land FSH_{fh} evaluated at the household shadow price for land. The definition of the sum over the set FN containing the 'nonutility' factors which have no utility connotation attached ensures that only the members of this set are taken into account.

Next to factor returns comes a group of exogenously fixed values which represent other income earned by the households. This income consists of transfers in form of gifts, government transfers and transfers received in the context of adverse shocks as well as income from savings and blood donations. For the different income elements different reasons suggested to abstain from a behavioural modelling of the respective element. In case of gifts, shocks and savings, the same argumentation as brought forward in context of the expenditure block applies. In case of government transfers, the lack of an institution representing the government in the village and the lack of a modelling of taxes (as households do not have to pay any) makes it difficult to make assumption on an endogenous change in this kind of payments. Keeping government transfers exogenously fixed, however, is a closure rule chosen in many CGE applications, such as the models by Löfgren et al. (2002) or McDonald et al. (2007), for example.[7] As regards to income from blood donations, the observation that blood donations constitute an important livelihood strategy for people in the village living close to the poverty line (Xing et al., 2009) hints to a more complex pattern underlying blood donation behaviour. Exploring this and incorporating it into a village model again would be a worthwhile endeavour, but goes beyond the scope of this work.

The last line of Equation 6.7 counts the value of leisure as income. This is necessary because leisure is included into the model as a consumption good and implies that households purchase amounts of leisure they consume from themselves.

Equations 6.6 and 6.7 together calculate the total income of the households. A final equation, which completes the income block, is an equation for total village income YT:

$$YT = \sum_{h \in H} YH_h \tag{6.8}$$

Apart from representing a rough indicator of total village welfare, YT constitutes the maximand (or minimand) of the nonlinear optimization problem the village equilibrium model is cast as.

6.1.5. Non-farm Activities

Ultimately, the factor returns which constitute a great part of household income are generated in the productive activities of the households. The model broadly distinguishes two types of activities, agricultural production and non-farm ac-

[7] In the IFPRI standard model, government transfers are indexed on the consumer price index (Löfgren et al., 2002). The GLOBE model (McDonald et al., 2007) has exogenously fixed government expenditures.

tivities. The two types of activities differ with respect to the specification of the production technologies and the associated factor allocation functions. As already indicated above, any kind of off-farm employment is treated as a production activity and the output of this activity is a commodity sold to the labour market. Consequently, a simple production function directly maps the amount of labour by the household into an output of the respective activity.

$$QA_{ah} = \sum_{f \in FU} FDD_{fah} \qquad \forall\ A \in HAO\ \wedge\ h \in H. \tag{6.9}$$

As already noted, the output QA_{ah} of non-farm activities can be considered as a labour service commodity which is traded on the market.

The level of non-farm production is governed by the first order conditions obtained from the constrained maximization of the utility function and take the form

$$\begin{aligned}\kappa_h * PA_{ah} =& WF_{fh} + \frac{1}{\lambda_h} * \varepsilon_{ah} * \delta_{ah} * FDD_{fah}^{(\delta_{ah}-1)} \\ & - pcscal_h * \sum_{c \in CD} QD_{ch} * PD_{ch} \\ & \forall\ a \in HAOM,\ f \in FU,\ h \in H\end{aligned} \tag{6.10}$$

for migration and for local off-farm activities the form

$$PA_{ah} = WF_{fh} + \frac{1}{\lambda_h} * \varepsilon_{ah} * \delta_{ah} * FDD_{fah}^{(\delta_{ah}-1)} \quad \forall\ a \in HAOL,\ f \in FU. \tag{6.11}$$

The two equations play the role of factor allocation functions for the non-farm activities and therefore in the following are denoted as such.[8]

In case of migration Equation 6.10 states, as in the theoretical model presented

[8] In fact, these functions as well as the functions for input demand of the agricultural activities represent the conditions for optimal factor allocation by the household. While the analogues of these functions are called factor or input demand functions in the CGE literature (Löfgren et al., 2002, p.34) this denotation is less clear for the present model. In case of labour the functions represent both the demand for labour by the respective productive activities carried out by the households and the supply of labour of the households to these activities. Hence, the more general terms "factor allocation functions" or "labour allocation functions" are adopted in this study. In case of the functions derived from the Leontief C-D production technology assumed for agriculture the convention introduced by Löfgren et al. (2002) is followed and the functions are called "input demand functions" and "factor demand functions", respectively.

above, that in the optimum the households equate marginal returns from migration with marginal costs. The marginal returns are the activity prices, or the wage rates at the destination, multiplied with the remittance factor κ_h. The marginal costs consist of three components. The first component is the household specific shadow wage WF_{fh}, i.e. the opportunity cost of the factor. The second component $\frac{1}{\lambda_h} * \varepsilon_{ah} * \delta_{ah} * FDD_{fah}^{(\delta_{ah}-1)}$, which will be discussed in detail below, reflects the disutility arising from migration to the specific household. This generates a markup to the shadow wage and, equivalently, diminishes the value of the returns from migration. The third component ($pcscal_h * \sum_{c \in CD} QD_{ch} * PD_{ch}$) emerges due to the definition of a per capita LES. As this third component takes a positive value, it works contrary to the disutility component and increases the marginal returns from migration. This latter component represents the second part of the feedback between migration and the consumption sphere. During the work with the model it turned out that an unforeseen effect of this component is that an increase in any of the local off-farm wage rates may lead to a positive migration response. This happens because an increase in income has the same effect on per capita consumption as a decrease in household size, thus offering an additional incentive to migrate. In order to reduce the magnitude of this (counterintuitive) effect, an additional parameter $pcscal_h$ has been introduced into the equation. This parameter scales the total value of the per capita consumption to a value significantly smaller than the household shadow wage.[9]

The mechanics of Equation 6.10 are best illustrated through the effect a supposed increase in PA_{ah}. First of all, a rising PA_{ah} requires that the right hand side of the equation increases, too. This raises the household shadow wage and the time allocated to migration. However, both movements are counteracted by an increase in the term ($pcscal_h * \sum_{c \in CD} QD_{ch} * PD_{ch}$). This increase happens due to the higher shadow wage, a higher income and, as a consequence of the latter and a smaller household size, an increase in per capita consumption quantities. Ultimately, a new equilibrium—which also involves second round effects through changes in income and quantities consumed—with a higher level of migration is

[9] For the simulations, a value of 15% of the shadow wage has been chosen, incorporating the assumption that the effect of migration on per-capita consumption subtracts 15% from the opportunity cost of labour in the base situation.

established.

At this juncture the overall behaviour of the equation and, in particular, the amount of labour shifted to migration as a response to the wage shock, hinges on the calibration of the parameters λ_h, ε_{ah} and δ_{ah}. First of all, the initial values of all terms other than the disutility component are determined a priori through the data used in the SAM which underlies the village equilibrium model. Likewise, the initial amount of time FDD_{fah} dedicated to migration is also given. This implies that λ_h, ε_{ah} and δ_{ah} have to be calibrated in a way that the value of the disutility component allows the equation to be true. In other words, the value of the disutility component must equal the difference between the marginal returns from migration and the shadow wage minus the value of per capita household consumption. In addition, the values of λ_h, ε_{ah} and δ_{ah} determine how fast the disutility component changes from a change in migration, i.e. how much labour has to be shifted to migration to achieve a given change in marginal disutility. The less labour is necessary for a given change in disutility, the faster the equilibrium is established and the weaker is the migration response of the household. Consequently, Equation 6.10 represents a utility function based implementation of different migration responses of agricultural households, allowing to account for supply side factors in a theoretically consistent manner.

In case of local off-farm activities, Equation 6.11 ensures that the wage earned equals the household shadow wage minus a utility component which reflects the disutility generated through the participation in the activity. As in case of migration, the disutility component drives a wedge between the shadow wage and the market wage rate. The points made above about the calibration of the parameters λ_h, ε_{ah} and δ_{ah} apply. Again, rooted in the utility concept it is possible to incorporate assumptions which exert an influence on the strength of the households' responses to changes in the market wage rate.

6.1.6. Agricultural Production

Following the approach by Löfgren et al. (2002), agricultural production activities are modelled as a nested technology in which the activity level is a Leontief function of the quantities of value-added and intermediate input use. In this nested technology, aggregate intermediate input demand $QINTA_{ah}$ and the level of value-added QVA_{ah} are expressed as fixed shares of the level of the activity QA_{ah}

$$QINTA_{ah} = inta_{ah} * QA_{ah} \qquad \forall\ a \in HAC,\ h \in H \tag{6.12}$$

and

$$QVA_{ah} = ivash_{ah} * QA_{ah} \qquad \forall\ a \in HAC,\ h \in H. \tag{6.13}$$

The demand for each individual intermediate input commodity $QINT_{ach}$, each a member of a set CI, is derived as a fixed share of the aggregate intermediate input demand

$$QINT_{ach} = ica_{ach} * QINTA_{ah} \qquad \forall\ a \in HAC,\ c \in CI,\ h \in H. \tag{6.14}$$

Agricultural value-added is assumed to be produced of the available factor inputs (land and labour in case of this application) using a C-D production technology:

$$QVA_{ah} = \alpha_{ah} * \prod_{f \in F} FDC_{fah}^{\beta_{fah}} \qquad \forall\ a \in HAC,\ h \in H \tag{6.15}$$

As usual, the α_{ah} are efficiency parameters while the parameters β_{fah} represent the cost shares of the respective inputs. From the first order conditions for profit maximization follow the factor demand functions

$$FDC_{fah} = \frac{\beta_{fah} * QVA_{ah} * PA_{ah}}{WF_{fh}} \qquad \forall\ a \in HAC,\ h \in H. \tag{6.16}$$

Unlike the factor allocation functions for the non-farm activities, these are standard functions which do not include a disutility component.

As the LES used to depict household consumption, the C-D technology assumed for agricultural production exhibits a number of shortcomings. These are mainly rooted in its restrictiveness and inflexibility. In fact, in the C-D production function substitution elasticities between factors are restricted to unity (Feger, 2000).

Further, the C-D technology incorporates the assumption of constant returns to scale (as the β_{fah} sum up to 1). Again, it would be possible to model agricultural production assuming more flexible production functions. Several functional forms which are less restrictive and which offer a higher degree of flexibility are available and commonly used. Examples include, for instance, generalizations of the C-D function, such as the Constant Elasticity of Substitution (CES), the Generalized Leontief, the translog or the Constant Ratio Elasticity of Substitution Homothetic (CRESH) production function (Christensen et al., 1973; Diewert, 1971; Fuss et al., 1978; Hanslow, 2001). The great advantage of the C-D assumption, however, again is its simplicity. In particular due to the function's parsimony in parameters—all parameters can be calibrated directly from the SAM—the choice has been made in favour of this function in this analysis. Along with its ease of interpretation and computational tractability it fulfills a number of criteria put forward for the choice of functional forms (Fuss et al., 1978).[10] Nonetheless, further developments of the present model could well seek to test for the effects of different technologies for agricultural production.

The output produced by each of the activities is sold by the households on the market. Accordingly, it is necessary to convert the output quantities which are defined over the activities into output commodities QQ_{ch}. This is done via a commodity production function:[11]

$$QQ_{ch} = \sum_{a \in A} ioqqqa_{ach} * QA_{ah} \qquad \forall\ c \in CQ,\ h \in H. \tag{6.17}$$

The formulation of Equation 6.17 not only allows to match activity output with the commodity prices (which are defined over the set C), but in principle also offers the possibility of introducing multiple outputs per activity. As mentioned above, however, in the present application each activity produces only one output, which

[10] Apart from parsimony in parameters, ease of interpretation, computational ease these criteria include interpolative and extrapolative robustness. These demand that within and outside the range of observed data the function should be well-behaved, i.e. display consistency with stated hypotheses such as the behaviour of marginal products or convexity (Fuss et al., 1978). As the C-D function exhibits a diminishing positive marginal product and as the range of data over which experiments are carried out is sufficiently small, the robustness criteria can also be considered to be at least approximately fulfilled.

[11] Just as the entire system of agricultural production, this approach is also borrowed from Löfgren et al. (2002).

means that the parameter $ioqqqa_{ach}$ (the yield of output c per unit of activity a) only takes the values 0 or 1.

Equations 6.9 to 6.17 constitute the production block of the model. Together with the expenditure block, these equations describe the behaviour of the households in the village. The final and still missing elements to complete the household modules of the model are the different constraints at the household level.

6.1.7. Household Level Balances

The household level constraints consist of the different balances which in their entirety define the equilibrium conditions for the households. These comprise balances for commodities and factors, including labour time, as well as income constraints and resemble the constraints of the theoretical model.

The first set of household level constraints involves the household level commodity balances. These balances cover all commodities households trade on the market, be it through sales or purchases. In the general form, the commodity balances (Equation 6.18) state that the quantity of household production plus purchases (QP_{ch}) must be equal to the total amount consumed plus sales:

$$QQ_{ch} + QP_{ch} = QDT_{ch} + QS_{ch} \qquad \forall\ c \in CM,\ h \in H \tag{6.18}$$

In practice, different categories of market traded commodities are distinguished in the model. The first category are commodities the households produce by themselves, consume and sell. For these commodities, the variable for commodity purchases is fixed to a level of zero. In this case, equation 6.18 ensures that households' own consumption and sales together must exhaust total household production of the respective commodity. Put differently, (net) sales of households are expressed as the residual of household production and own-consumption.

The second category includes commodities households consume and purchase but do not produce by themselves. Here, commodity output and sales are fixed to zero and total household consumption is directly translated into commodity purchases by Equation 6.18.

The third category is made up of commodities which are produced and sold but not consumed by households. These are the labour service commodities (off-farm work and migration). For these commodities total consumption and purchases are fixed at zero and the commodity output is converted into commodity sales by Equation 6.18.

The first one of the factor balances of the households is the household time constraint. This constraint requires the use of household time in the different productive activities and leisure consumption to be equal to the household's total time endowment:

$$FSH_{fh} = \sum_{a \in A} FDC_{fah} + \sum_{a \in A} FDD_{fah} + QDT_{\text{"}cleis\text{"},h} \qquad \forall\, f \in FU,\ h \in H. \tag{6.19}$$

In case of land, rentals by households from and to the village market are possible. This implies that for each household the sum of land used by the agricultural activities and the net rentals $QR_{\text{"}clnd\text{"},h}$ must equal the land endowment of each household:

$$\sum_{a \in A} FDC_{fah} = FSH_{fh} + QR(\text{"}clnd\text{"}, h) \qquad \forall\, f \in FN,\ h\ \in H \tag{6.20}$$

From Equation 6.20, net land rentals are defined as the residual from household land endowments and land use by the specific household. Net land rentals among households, in principle, should sum up to zero. As the land rental data from the survey, however, exhibited large differences between expenses on and income from land rentals, a migrated household has been introduced into the model (recall the discussion in Chapter 5 on this issue). This household is represented by an own land balance

$$QRM_c = -\sum_{h \in H} QR(\text{"}clnd\text{"}, h) \qquad \forall\, c \in CVNT,\ h\ \in H. \tag{6.21}$$

which is defined over a set of village non-traded commodities $CVNT$. In this land balance, a variable QRM_c accounts for the difference between land rent in and land rent out within the village. This variable is fixed and adds to the total land endowment of the village. Equations 6.20 and 6.21 together demand that the total amount of land used by the villagers does not exceed the land endowment of the households residing in the village and those that already have left. Thereby, the equations also represent the village level land balance and thus the equilibrium condition for the village land rental market.

Following the commodity and factor balances, a household income constraint ensures that households cannot spend more income than they earn:

$$\begin{aligned} YH_h = & HEXPC_h + HEXPCONS_h \\ & + hexpgift_h + hexpshock_h + hexpsi_h \qquad \forall\ h\ \in H \end{aligned} \tag{6.22}$$

Here, the exogenously fixed parameters for expenditures on gifts, shocks and savings and investment are added to expenses on consumption and construction. Note also that, unlike in the budget constraint of the theoretical model, leisure is now explicitly included. Furthermore, (net) expenses on variable inputs and land rentals are neglected because the income Equation 6.7 states net household income.[12]

As the expenditure system which describes consumption demand is defined with a variable for consumption expenditure, an equation has been added to make sure that total consumption expenditure be equal to the consumption values of the individual consumption items:

$$HEXPC_h = \sum_{c \in CD} QDT_{ch} * PD_{ch} + WALRAS_h \qquad \forall\ h \in H \tag{6.23}$$

The expenditure system, however, already causes Equation 6.23 to hold. Hence, the equation can be considered redundant in the model and in principle could be dropped. An alternative to the removal of the equation, however, is to introduce a slack variable which takes a value of zero for all households in case the model solves correctly. Thereby, this variable provides a consistency check for the model. Following common practice in general equilibrium modelling, the variable is denoted $WALRAS_h$ in honour of the economist who has put forward the notion that if in general equilibrium all but one markets are in equilibrium, the remaining market would be in equilibrium, as well.[13]

[12] That is, instead of gross revenues only factor returns are taken into account.

[13] Please note how the fact that the slack variable is defined over all households highlights the conceptual parallel of the present village equilibrium model with a multi-region CGE model (compare, for example, the GLOBE model by McDonald et al., 2007, which features a slack

A last equation included into the block of household constraints is an equation which calculates the number of consumers present in the household in per adult equivalent terms:

$$\begin{aligned} HS_h = & hadults_h - \frac{\sum_{a \in HAOM} FDD(f,a)}{tp} \\ & + hdepscal * hdeps_h \qquad\qquad \forall f \in FU, \;\; h \in H \end{aligned} \tag{6.24}$$

According to Equation 6.24, total household size is calculated as the number of adults in the household, captured by the parameter $hadults_h$ from which the number of migrants are subtracted and to which the adult equivalents of the number of children ($hdeps_h$) are added. The subtraction of the number of migrants establishes the link between the level of migration and the consumption sphere of the household. The parameter tp in the relevant term represents the duration of the period under consideration by the model (recall the theoretical model in Chapter 4). According to the unit of labour used for the construction of the SAM it is set to 365 days. Due to the normalization of prices, however, the unit of the quantities of labour and therefore the unit of tp no longer corresponds to days or any other unit commonly used for measuring time periods. However, working with the chosen value yields values for the household size HS_h which are close to those observed in the survey. In any case, as tp is a fixed constant, its precise value is of minor relevance for the results obtained by the model.

The numbers of children are scaled to adult equivalents by multiplication with a scaling factor *hdepscal*. This factor takes a value of 0.5. It is taken from Glewwe and Twum-Baah (1991) (cited from Haughton and Khandker (2009)) who used it for children aged 13-17 in the context of World Bank Living Standards Measurement Surveys (LSMS) in Côte d'Ivoire, Ghana and Peru. Arguably, the approach chosen can be considered a comparatively simple way of scaling to per adult equivalents. Indeed, there are more accurate ways available which also take into account, for example, economies of scale which play a role with increasing household sizes (see, for example, Burniaux et al., 1998). Again, the choice made here was to keep matters simple.

variable for each single region). As they carry out their own production activities and dispose of their own commodity, factor market and income balances, households in a village take the position of the regions in such a model.

6.1.8. Village Level Balances

Following the household level balances, village level balances constitute the second set of system constraints in the model. The village level balances define the village equilibrium framework. In case of goods which are exported from the village, amounts produced by the households less own consumption make up the exported quantities:

$$QVX_c = \sum_{h \in H} QQ_{ch} - \sum_{h \in H} QDT_{ch} \qquad \forall\, c \in CVX,\ h \in H \tag{6.25}$$

Exported goods, included into a set CVX, comprise agricultural products as well as the labour service commodities for off-farm work. In case of the latter, household consumption always takes a value of zero and the entire output of the household is exported.

Commodities imported into the village include capital and labour inputs for agricultural production as well as market purchased goods consumed by the households. The balance for imported commodities is

$$QVM_c = \sum_{h \in H} QP_{ch} + \sum_{h \in H} \sum_{a \in A} QINT_{cah} \quad \forall\, c \in CVM,\ a \in A,\ h \in H \tag{6.26}$$

Similar to the previous equation, the variable QP_{ch} always takes a value of zero for imported inputs and the variable $QINT_{cah}$ is always zero for goods consumed by the household.[14]

In addition to the balance for imported and exported commodities, three types of balances could still be added to the model. First, a balance for household labour would ensure that the total amount of family labour used by the households for productive activities and consumed in form of leisure does not exceed the village's overall time endowment. As household labour is not traded between households and due to the assumption of family labour and purchased labour being imperfect substitutes, however, it is sufficient to formulate balances at the household level. Second, a village level land balance would ensure the village market for land to be in equilibrium. This equilibrium is already guaranteed by Equations 6.20 and

[14] Exceptions are the water and energy services commodities which are both used as inputs and consumed by households.

6.21. In fact, the land balance of the migrated household can be regarded as the equivalent of the village level land balance. Third and finally, a balance of payments for the village would ensure that all flows of payments out of the village are financed by corresponding inflows. Given the absence of village institutions other than households, this condition is fulfilled by the household level income constraints as captured by Equation 6.22.

Again, there would be scope to leave one or more of the redundant village level balances in the model and add a slack variable for each redundant equation in order to incorporate additional consistency checks. Due to the comparatively simple structure of the model, however, this variable instead of providing additional information would merely replicate the information contained in the household level slack variables.[15]

6.1.9. Prices

The final block of equations is a price block which establishes the price relationships in the model. In general, due to the lack of indirect taxes, trade taxes and transaction or transport costs, price relationships are straightforward. Consumer prices and prices for household produced farm output are assumed to be equal to the market prices which prevail outside the village. Likewise, wages, which are included as activity prices for off-farm activities, are given by the wage rates on the outside village labour market. In all cases, the village is assumed to be a price taker in the respective markets. The identity of village prices with prices of the outside world is established by a number of equations which fix the corresponding prices of the model:

$$\begin{aligned} PA_{ah} &= \overline{PA_{ah}} && \forall\, a \in A,\ h \in H \\ PD_{ch} &= \overline{PD_{ch}} && \forall\, c \in CP,\ h \in H \\ PI_{ch} &= \overline{PI_{ch}} && \forall\, c \in CI,\ \ h \in H \end{aligned} \tag{6.27}$$

Exceptions to this rule are given by the non-traded factor household labour, the village traded factor land and some prices which are artificial constructs inherent

[15] Such an approach is taken by McDonald et al. (2007) who include a variable for a global balance of payments into their multi-regional CGE model. This variable always has to take a value of zero.

to the production system. The prices inherent to the production system require separate definitions. These prices are the price of value-added PVA_{ah} and the activity specific price of the aggregate intermediate input PIA_{ah}. The price of value-added is calculated from the condition that for each activity total revenue has to be exhausted by payments for value-added and intermediate inputs (Löfgren et al., 2002).

$$PVA_{ah} = \frac{PA_{ah} * QA_{ah} - QINTA_{ah} * PIA_{ah}}{QVA_{ah}} \qquad \forall\ a \in HAC,\ h \in H \quad (6.28)$$

The aggregate intermediate input price is the weighted average of the price of the single intermediate input commodities used by activity a:

$$PIA_{ah} = \sum_{c \in C} PI_{ch} * ica_{cah} \qquad \forall\ c \in CI,\ a \in HAC,\ h \in H \quad (6.29)$$

The weighting factor ica_{cah} is the quantity of intermediate input c used per unit of the activity specific aggregated intermediate input (Löfgren et al., 2002).

In case of the non-traded factor household labour, which is used both as a factor in household production and as a consumption good, the household shadow wage defines the household specific consumer price of leisure:

$$PD_{ch} = WF_{fh} \qquad \forall\ c \in CN,\ f \in FU, h \in H \quad (6.30)$$

As regards to land, as soon as land is traded on the village land rental market, the shadow prices of the households are equalized across the village and a common village land rental rate arises:

$$WF_{fh} = WFV \qquad \forall\ f \in FN,\ h \in H \quad (6.31)$$

Equation 6.31 forms part of the village equilibrium framework for the land rental market and is only included in a version of the model in which the households are connected via the village land market. For the model version without a land market, the equation is removed and a land market equilibrium is established within each household. In this case, the equality between land supply and demand is achieved through adjustments of the household specific shadow price for land.

6.1.10. Model closure

The price block completes the equation system of the model. Yet, achieving a fully determined model still requires to fix a number of variables, i.e. to 'close' the model. Apart from this purely mathematical notion—to obtain a model, which consist of an equal number of equations and endogenous variables—the choice of the closure by determining which variables are exogenous and endogenous also introduces a portion of theoretical judgement into the model (Thissen, 1998). This theoretical judgement concerns, in particular, the assumptions of the workings of factor and commodity markets.[16] Hence, closure rules are of crucial importance for the behaviour of the model and, accordingly, deserve a more detailed discussion.

In a broader sense, Equations 6.27 of the price block represent the first set of model closures. The fact that the greatest part of the prices for consumption goods, inputs and outputs (including wages) are exogenously fixed implies that the village, as mentioned earlier, is a price taker in the respective markets. The village economy takes the prices as given and adjusts in response to price changes. The village itself, in turn, does not exert any influence on the prices in the rest of the country. Furthermore, all supply of village imported and demand for village exported goods (i.e. those for which the village is a price taker) is infinitely elastic. Given that the village makes only an evanescent contribution to the economy of the province, let alone the country, this assumption appears to be justified.[17]

The next set of closure rules concerns the factor markets, that is the market for household labour and for land. For both markets, total supply of the factor is fixed at the initial level

$$FSH_{fh} = \overline{FSH_{fh}} \qquad \forall f \in F,\ h \in H. \tag{6.32}$$

As the model is built up from the household level, the factor supply variable FSH_{fh} is defined at the household level, as well. It represents the households'

[16]In country-level and multi-region CGE models, further important choices concern macroeconomic features of the model, such as savings and investments (the famous distinction between neoclassical and Keynesian closures), the exchange rate regime or the fiscal balance of the government (Mitra-Kahn, 2008). As the village equilibrium model lacks exchange rates and treats savings and investments as well as the government only in a rudimentary way, however, these so called 'macro-closures' do not have to be applied here.

[17]If one had the possibility to represent the whole rural China by a large number of interlinked village equilibrium models the situation, of course, would be different.

endowment with time and land, respectively. For both markets, the assumption made by the choice of this closure is one of full factor employment. Given beliefs of a huge amount of surplus labour Chinas' rural areas are characterized by (Knight and Song, 2003; Cook, 1999), in case of household labour this could be considered unrealistic. Having said that, more recent studies find growing evidence of increasing labour shortages in China (Zhang et al., 2010), at least in certain localities (Bowlus and Sicular, 2003). Regardless of the outcome of this ongoing debate, the crucial issue in this model is that for household labour the assumption of full employment implies that the households' time endowment is fully exhausted by the time worked in the different activities and by the consumption of leisure. It is the effect of Equation 6.32 that the total time endowment cannot change and that a household internal equilibrium is achieved in which the shadow wage adjusts to clear the equivalent of a household internal labour market. At this, due to the inclusion of leisure and a flexible household shadow wage, the model can accommodate both a situation of labour surplus or one of labour scarcity.

In case of land, additional factor market closures are added to allow for two different land rental market regimes. As mentioned above, Equation 6.32 implies that land is fully employed, an assumption which is entirely realistic given the general observation that land is a relatively scarce resource in China (Li and Zahniser, 2002; Shi et al., 2007; Wu et al., 2005). The question is, however, via which mechanisms this scarce resource is allocated, not only to its different uses but also among the different users. The present model allows for two different possibilities. The first one assumes that land is nontradable at the household level. Under this assumption, households can only use the amount of land they had in use at the time of the survey. In this case, net land rentals are fixed at the level observed in the survey:

$$QR_{ch} = \overline{QR_{ch}} \qquad \forall c \in CVNT,\ h \in H. \tag{6.33}$$

Furthermore, the village market price for land has to be fixed

$$WFV = \overline{WFV} \tag{6.34}$$

Equations 6.33 and 6.34 along with Equation 6.32 ensure that each household internally balances supply and demand via adjustments in the shadow price of land while the possibility to leave land fallow or to draw additional land in production is ruled out. Lacking village markets for other village traded goods or factors, Equation 6.33 essentially reduces the village model to a number of agricultural household models which are solved in parallel. In order to fully implement this land market closure, Equation 6.31 is dropped from the model.

The second possible mechanism to allocate land in the village is to allow for a village land rental market. In this case, Equation 6.31 is included into the model and the land rentals by the migrated household have to be fixed at their initial level:

$$QRM_c = \overline{QRM_c} \qquad \forall c \in CVNT. \tag{6.35}$$

With the village market price for land and the households' shadow price as well as net land rentals being flexible, supply and demand for land are reconciled within the village with a land rental rate which clears the village market. Under this regime, due to Equation 6.31 household shadow prices for land are always the same across households.

Of course, compared to the reality in the Guizhou villages, the assumptions brought forward by the land market closures of the model are extremely simplifying. In the villages, land transactions take place, but within an institutional framework which prevents a land rental market which at least approximately could be labelled perfect from emerging. This institutional framework is characterized by the collective ownership of land under which rights of control and income are granted to households for 30 years (Huang et al., 2008). This system entails that farmers cannot sell land and that land can be subject to reallocations through village authorities (Dollar, 2007; Fleisher and Yang, 2006). Although such reallocations have not taken place in the Guizhou villages since the early 1980s, the mere possibility and lack of legal sanction of land rentals leads to tenure insecurity and shallow land markets (Gulati et al., 2005; Krusekopf, 2002; Xing et al., 2009). This is also reflected in the wide variation in the value of rent paid for land which can be observed instead of a relatively uniform village land rental rate (recall

Chapter 5). Hence, rather than taking place in one of the two market regimes—the complete absence of a land market as assumed by the first version of the land market closure or the neoclassical ideal of a perfect market[18] depicted with the second one—land transactions follow more complicated arrangements which are driven by the institutional framework of China's land tenure regime. The land market regimes of the model can be considered to represent the extreme ends of a gradient on which the reality lies somewhere in between: land transactions take place, but not at a scale which would be possible with a perfect land market. Accordingly, the model version with a village land market should be regarded to depict a situation *as if* the land markets were perfect in the neoclassical sense.[19]

The closure rules for the land market complete the equilibrium model for Changtian village. Due to the emphasis on the households' labour market behaviour, the remaining components of the model are kept comparatively simple. Agricultural production is depicted with a nested Leontief-Cobb-Douglas technology. Consumption demand is modelled with a per-capita LES, other components of household expenditure are included either as fixed shares of total expenditure or assumed to be exogenously fixed.

The model features price formation at different trading domains. Household labour is nontraded at the household level and its allocation to the different uses is governed by a shadow wage which is endogenous to the households. Agricultural land can be treated either as a household nontradable or as a village nontradable. In the latter case, supply and demand are matched through land rental transactions on a village land rental market. This market is characterized by endogenous price formation at the village level. The remaining commodities covered by the model, such as market purchased consumption commodities and purchased inputs for agricultural production as well as farm output and the labour service commodities produced by the households are assumed to be tradable beyond the village borders. In case of these commodities the village is a price taker and prices are determined by the outside world and introduced into the model in form

[18]This refers to the notion of the neoclassical full employment factor market closure under which a market under perfect competition ensures the respective factor to be fully employed under a competitive wage rate (Bruno, 1979).

[19]Certainly, the exploration how land markets in the village actually work and their accurate depiction in the village equilibrium model constitute a highly interesting field of work for the future.

of exogenous parameters.

As argued above, the contribution of the present model is the innovative depiction of the labour market behaviour of the households. The inclusion of the utility term into the factor allocation functions of off-farm employment offers a highly flexible way of modelling households' labour allocation in response to exogenous price or wage shocks, including the possibility to closely reproduce observed behaviour. In order to give insights into the functionality of the model and especially to illustrate the mentioned flexibility, in the following section a simplified version of the model is used to run a first simulation analysing a simple migration wage shock. The effects of different choices of key parameters in the off-farm labour allocation functions on a selected number of key variables are presented.

6.2. Illustrating the Depiction of Households' Labour Market Behaviour in the Model

The purpose of the present section is to illustrate the flexibility of the village equilibrium model developed in Section 6.1 in the depiction of the labour market behaviour of agricultural households. To this end, a basic version of the model is used to simulate a migration wage shock under different values for the parameters δ_{ah} in the factor allocation functions for local off-farm work (Equation 6.10) and migration (Equation 6.11).

The basic structure of the model is as presented in the previous section. Based on a simplified and highly aggregated version of the village SAM, the model covers only one household, two consumption goods, one intermediate input good, three activities and two production factors. The consumption goods are the own produced agricultural good and a purchased manufactured good. The three activities distinguish farm production, local off-farm work and migration. The production factors are household labour and land. As there is only one household, there is no village market for land, which is nontradable at the household level. The government as well as transfers and savings are neglected. Although simple, this very stylized version of the model which in its level of detail corresponds to the theoretical model of Section 4.4 is sufficient to serve the purpose of illustrating the basic mechanisms at work in the depiction of households' labour allocation following an exogenous wage shock.

The wage shock analysed is a 1% increase in the migration wage rate, i.e. of variable PA_{ah} in Equation 6.10. In order to analyse the effect of different choices of δ_{ah} on the simulation results, different values for both off-farm activities are chosen. The parameter δ_{ah} in the factor allocation function for migration (Equation 6.10) takes thirteen different values, ranging from -2 to 4, increasing by steps of 0.5. These thirteen simulations are repeated with different values of δ_{ah} in the factor allocation function for local off-farm work (Equation 6.11). The values chosen are 0.1, 1, 1.01, 1.05 and 1.1.[20] This results in a total number of $13 \times 5 = 65$ simulations which cover the different possible combinations of δ_{ah} in the two factor allocation functions.

As Equations 6.10 and 6.11 apart from δ_{ah} contain the share parameter of the remittances function κ_h, the marginal utility of income λ_h and an activity specific shift parameter ε_{ah}, a few words need to be spent on the calibration of the equations. In general, for each equation the parameters have to be chosen in a way that the equations, given the values of the prices and quantities present in them, hold. In principle, for each equation there is an indefinite number of possible combinations of the two, respectively three, parameters which fulfil this condition. However, the values of the parameters cannot be chosen independently of each other. At the same time, the calibrated combination of δ_{ah}, λ_h and ε_{ah} determines the magnitude of the increase in the disutility components of the equations with increasing time spent in the respective activities. This, in turn, defines the magnitude of the labour supply response to a given wage shock. Thereby, although they do not directly represent them, the parameters together determine the different labour supply elasticities of the households.

The calibration is carried out in four steps. First, given the normalized prices, the quantities in the equations and in case of the labour allocation function for migration κ_h are calculated from the SAM.[21] Second, λ_h is set equal to 1, leaving ε_{ah} as the only undetermined shift parameter. Third, a value of δ_{ah} is chosen.

[20] In fact, instead of 1 a value very close to one (1.000001) is used, as with $\delta_{ah} = 1$ the model does not arrive at a unique solution when a shock is applied.

[21] Find more details on the calibration in Section 7.2.3.

Finally, the equation is solved for ε_{ah} to calibrate this parameter.

If this calibration procedure is followed, the value of δ_{ah} drives the reaction of the utility term to an exogenous shock. If δ_{ah} is close to 1, a change in the differential between WF_h and PA_{ah} triggers a very strong (read: perfectly elastic) response in the amount of labour FDD_{fah} allocated to the respective activity and correspondingly the labour supply response of the household. The farther away δ_{ah} moves from 1, the smaller becomes the change in labour demand by the activity and the less elastic the labour supply response. Whereas for $\delta_{ah} > 1$ the supply response to a rise in the own wage is positive, it becomes negative for $\delta_{ah} < 1$.

Figure 6.1 illustrates selected results of a simulation of a 1% increase in the migration wage rate with the values of δ_{ah} presented above. Panel a) shows the own price response, i.e. the change in the level of migration. Along the abscissa, δ_{ah} in the labour allocation function for migration increases successively. The ordinate describes the %-change in the amount of labour allocated to migration. As a 1% change in the migration wage is simulated, this corresponds to the own-wage elasticity of migration. The general course of the lines confirms what was said about the behaviour of the function above: if δ_{ah} comes closer to 1, the reaction becomes more elastic. It is positive for values larger than 1 and negative for values smaller than 1. The broad range of the own-wage elasticities of migration highlights that virtually any desired response can be achieved. Thereby, the layered arrangement of the single lines shows that the precise magnitude of the own-wage reaction is not independent of the value of δ_{ah} chosen for the factor allocation function for local off-farm labour. The farther δ_{ah} for local off-farm work departs from 1, i.e. the less elastic the reaction in this activity becomes (see panel b) of the graph), the weaker gets the migration response. The explanation lies in the way a new equilibrium in the household internal labour market is established. If more labour is supplied to the migration activity, it has to be drawn from other uses. At the same time, the household shadow wage increases (see panel d) of the graph). This increase curbs the incentive to allocate more labour to migration. At this, the relative size of the price (shadow wage) and the quantity (local off-farm labour supply) adjustment depends on the cross-price elasticity of local off-farm labour supply. If the cross-price reaction of this activity is elastic, the quantity adjustment is large and the change in the shadow wage small. With a decreasing cross-price elasticity of local off-farm labour supply, the quantity adjustment gets weaker and the change in the shadow wage more pronounced. This, in turn, acts contrary to the migration wage effect in the labour allocation function for migration and leads to a relatively weaker migration response.

The cross-price responses of local off-farm labour supply are depicted in panel b) of Figure 6.1. In most of the cases considered, local off-farm work is a substitute for migration: if households migrate more, they work less in local off-farm activities. The magnitude of this cross-price relationship, as discussed, can be determined by the value of δ_{ah} in the labour allocation function for local off-farm work. The depiction of the relationship between the two activities, however, is not limited to substitutability. In cases the δ_{ah} for local off-farm work becomes smaller than 1 (here exemplarily considered with a value of 0.1) the direction of the labour supply response in local off-farm work corresponds to that in migration. The two activities from the household's point of view become complements.

In the current set-up of the model, such flexibility is not possible for the agricultural activity (see panel c) in the graph). Rather, supply of family labour to farm production is driven by the reactions of the other two activities. Through the C-D factor demand Equation 6.16 agriculture adjusts following a change in the shadow wage. In cases the shadow wage decreases due to a negative migration response, farm labour demand increases. Increases in the shadow wage due to a positive migration response, in turn, trigger a decrease in time worked in agriculture. As argued above, the magnitude of the change in the shadow wage and in the consequence also of the adjustment reaction in the agricultural activity depends on the cross-price elasticity of labour supply by the local off-farm activity. With an elastic reaction in off-farm work, the labour demand effect in agriculture is weaker. With an inelastic reaction, the change in the shadow wage is larger and the adjustments in farm labour demand become stronger.[22]

Of course, the version of the model used in this section is a very simple one. In particular, the number of activities per household is of importance for the depiction of the labour allocation of the households. With an increase in the

[22]Of course, demand for leisure also plays a role here. With the LES, leisure demand decreases with a rising shadow wage and increases with rising income. However, this does not change the pattern of labour allocation presented here and hence is left out of the discussion.

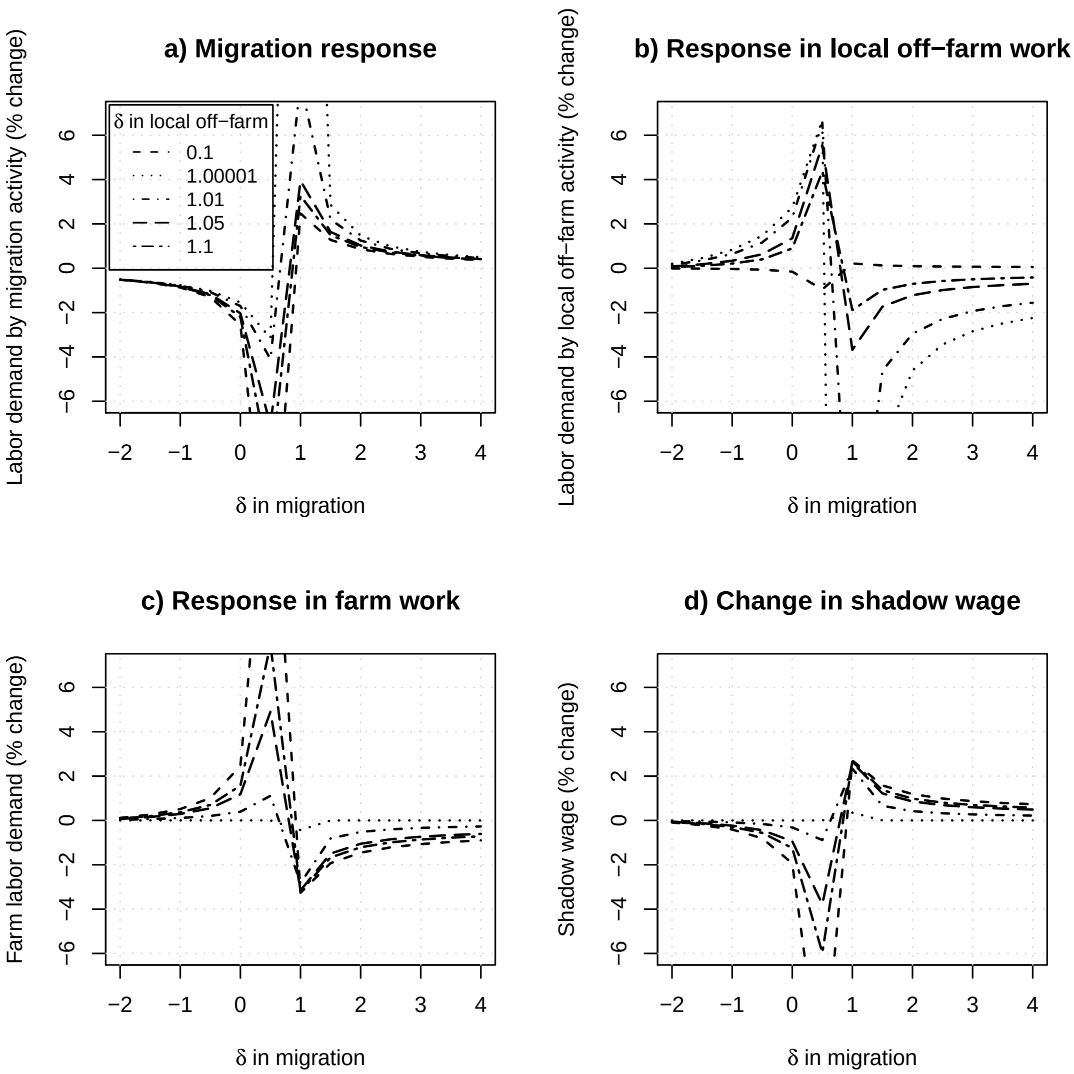


Figure 6.1.: Impact of a 1% increase in the migration wage rate on key variables under different values of δ_{ah}.

number of off-farm activities, the basic mechanisms of the model and thereby the mechanisms of labour allocation remain the same as outlined above and the same degree of flexibility is given. A first crucial aspect, however, is the behaviour of the shadow wage. In case there are more than two off-farm activities per household, the relative change in the shadow wage due to an external shock is driven by the most elastic change in labour supply. So, if there is, for example, one local off-farm activity with a very elastic response and a second one with a relatively inelastic response it is the first one which determines the magnitude of the change of the shadow wage, regardless of the values of the δ_{ah} of the other activities. The reason underlying this behaviour of the model is as above: the most elastic response determines how easily labour can be drawn out of a particular activity and made available for alternative uses. The more elastic it is, the less the shadow wage has to be changed in order to achieve a new intra-household equilibrium.

A second aspect concerns the calibration of the labour allocation functions. The critical influence of the least elastic labour supply response on the shadow wage causes that the wage elasticities depend on the relative magnitude of the strength of the responses in the individual activities (as this affects the change in the shadow wage). Assume, as a hypothetical example, a situation of three off-farm activities in which a wage increase in one of the activities by 1% causes a labour supply response of + 0.5% in this activity. Also assume that in this initial situation the calibration of the δ_{ah} is such that labour supply to the second activity decreases by 0.8%, to the third one by 0.2% and the shadow wage increases by 0.3%. Holding everything else constant, a change in the calibration of the labour allocation function of the third activity might reduce the response in this activity to 0.1%. As labour now is less easily available, the shadow wage increases a bit more, say by 0.4%. This alteration of the change in the shadow wage exerts an influence on the labour allocation function of the first and the second activity. The response of both activities will be reduced due to the counteracting influence of the increase in the shadow wage. Regarding the calibration of the model, this implies that the labour supply responses of the different activities cannot be calibrated independent from each other. Along with the fact that the δ_{ah} of the labour allocation functions possess no direct real-world equivalent which would allow for an empirical estimation, the calibration involves an iterative search procedure to find parameter values which yield labour supply responses of households which might be considered realistic by the modeller. Thereby, the modelling exercise most ideally would be accompanied by econometric work to analyse household labour supply responses to changes in relative wage rates (see, for example, Skoufias, 1994; Sicular and Zhao, 2004). The parameters in the factor allocation functions would be calibrated to match the findings of this empirical work. This approach would offer the perspective of obtaining results which have a better empirical foundation.

A limitation of the model in its current setup is that it is not possible to further disaggregate the agricultural activity. As no utility component is incorporated into the C - D labour demand function, the household has the possibility to, for example, satisfy the increased labour demand due to an increase in an off-farm wage by a mere reallocation of labour from a more to a less labour intensive agricultural activity. In case there are more than one of such activities (which 'follow' the adjustments of the other activities), the labour supply response takes place only within these activities.

Overall, the discussion of the stylized version of the village equilibrium model in this section shows the merits of the approach taken towards the modelling of households' labour allocation decisions. Rooted in a sound theoretical framework, the consideration of utility considerations in an agricultural household model offers a substantial degree of flexibility in the modelling of the labour market behaviour of rural households. Scope for the assumption of a broad range of labour supply elasticities is given. Various labour supply patterns such as the different segments of the S-shaped labour supply curve described and estimated by Dessing (2002) can be modelled.[23] Likewise, complementarity of different production activities can now be easily dealt with in a village equilibrium model. Although somewhat counter-intuitive at the first sight, such behaviour has, for example, been found in an empirical study of the labour market behaviour of rural households in China by Sicular and Zhao (2004). In fact, the authors provide evidence of complementarity

[23] In this context, studies by Miracle and Fetter (1970) and Miracle (1976) should be mentioned. The authors explain the downward sloping shape of the labour supply curves of African migrant workers in the copper belt of colonial-era Zaire and Zambia with the (expected) hardships associated with the work, such as the risk of disease, the hardships of the journey, the deficient quality and quantity of food and housing or the brutal treatment of workers. This explanation would fit well into the utility based framework applied here.

between non-agricultural household production and wage employment.

A further important feature of the model worth emphasizing is that households are able to be engaged in several income generating activities simultaneously. This happens without the necessity of reverting to analytical constructs, such as the introduction of profits into off-farm activities or the imposition of quantitative restrictions on off-farm employment. Instead, an equilibrium situation is achieved in which households allocate certain amounts of labour to different activities. This equilibrium depends on the preferences of households, on the one hand, and on the market environment—demand for labour reflected in a particular wage rate—on the other hand.

7. Analysing the Impact of Trade Liberalisation on Migration, Poverty and Inequality

In the previous chapter, the village equilibrium model is presented. A number of simulations are carried out with a simplified and highly aggregated version of the model. The basic mechanisms of the depiction of the labour market behaviour of the households which constitute the village economy are illustrated and the merits of the approach are demonstrated. In the present chapter, the model is used to analyse the impact of trade liberalisation on migration, poverty and inequality in Changtian village. The chapter proceeds with a first section which provides details on the set-up of the model used for the simulations as well as on the level of aggregation. In a second section, details on the calibration of the model are provided, comprising the calibration of the agricultural production system, the LES and the labour market behaviour of the households. This part is followed by a section on the scenarios to be analysed. In that section, the trade liberalisation scenario is described and information is given on the sources of this scenario. Furthermore, the alternative assumptions regarding the village land market and the labour market behaviour are summarized. The fourth and final section of this chapter presents the simulation results, along with an interpretation and discussion.

7.1. Set-up of the Model and Aggregation

In general, the village equilibrium model used for the simulation is the full model presented in Chapter 6. Households are involved in farm production and off-farm activities, including migration. Apart from returns from the productive activities, they receive income in the form of gifts and transfers, from savings and from blood donations. This income is spent on own consumption, a range of purchased consumption goods and leisure. Consumption expenditure is modelled with a LES. Beyond this, household expenditures include spending on housing (construction), gifts, unforeseen events (shocks) and savings. While the village is a price taker for most goods, households have the possibility to interact via a village land rental market on which a uniform rental rate is determined to reconcile supply and demand. In order to assess the impact of a land rental market, two versions of the model are applied. The first version does not allow for village trade in land. In this version, the model is equivalent to a number of agricultural household models which are solved in parallel. The second version of the model allows for a village land rental market on which land can be redistributed among the households via the market mechanism. As described in Section 6.1, the two versions are distinguished by the land market closure and the number of equations which are included. All simulations are carried out twice, once using the model version without a land market and once with the version, which allows for such a market.

The rationale for distinguishing the two land market regimes in the simulation not least is given by the lively public debate about the issue (see, for example, The Economist, 2008). While the current land regime is often seen as an obstacle to improving competitiveness of agricultural production, proponents of privatisation of land and the introduction of a land market regime argue that such reform may allow for the consolidation of fragmented land, foster the expansion of farm sizes and thereby lead to increases in productivity (Carter et al., 2009; Huang et al., 2008; Zhang et al., 2010). As the tenure insecurity which stems from the present arrangements constitutes a barrier to migration, land reform also may facilitate the transfer of labour from rural to urban areas and thereby reduce the rural-urban income gap and enhance economic growth (Zhai and Hertel, 2010). Another expectation is that a well-functioning land market in some instances might mitigate the problem of rural inequality, which may be influenced by an unequal distribution of land under the current regime (Xing et al., 2009). The opponents' view, in contrast, is shaped by the social insurance function which land possesses in China. The concern is that land reform may jeopardise this function and hence pose a threat to social stability (Huang et al., 2008). Others argue that the potential impact of land reform is possibly overstated (Carter et al., 2009). Regardless of where the truth lies in this debate, modelling a land market, albeit in a very stylised way, and contrasting it with a situation without a land market can contribute a new village-level perspective to the current discussion.

In order to allow for analyses of the impact of trade liberalisation on poverty and inequality, a module which allows to compute and update these measures for each single household group is added.[1] The procedure for the calculation of the poverty and inequality measures is simple: For the base situation, the measures are calculated from the data on per capita expenditure for the individual households of each representative household group (recall Chapter 3). Following a simulation run, the percentage changes in total household expenditure and in household size are mapped to the household data. Using this data, the household data on per-capita expenditure is updated and the measures of poverty and inequality are computed anew. In order to take into account changes in consumer prices following trade liberalisation and to avoid over- or underestimation of the poverty impacts, the poverty lines are updated by multiplication with a consumer price index calculated from the model.

Apart from the set-up of the model, the aggregation scheme chosen is of importance. Unlike the stylized version of the model which is used for the simulations of Section 6.2, the model now distinguishes four activities which can be carried out by each of the households. Agricultural production and migration are as before. Local off-farm work is now disaggregated into formal and informal local off-farm work, thus taking full advantage of the level of detail offered by the village SAM. Likewise, all six household groups from the SAM are represented in the model.

In case of intermediate inputs used in agricultural production and purchased goods consumed by the households, higher levels of aggregation as offered by the SAM are chosen. This choice is because further disaggregation in the scope of the analysis to be carried out would not have yielded important additional insights.[2] All in all, three commodities are modelled: a capital intermediate input

[1] Unlike the main part of the model, this module is programmed in R (R Development Core Team, 2009).

[2] Due to the fixed-shares specification of intermediate input use, percentage changes in input

commodity includes fertilizers and pesticides, seed, feedstuffs, veterinary services as well as machinery. A services commodity represents the aggregate of water and energy used in agricultural production. Only hired labour has not been added to any aggregate and is kept separate as a labour input commodity. This inclusion of hired labour into the set of intermediate input commodities effectively implements the assumption that hired labour and family labour are imperfect substitutes.

Regarding the production factors owned by the households, a higher aggregation than in the SAM is chosen. In the SAM, household labour is differentiated by gender and by age groups. In the model, all household labour is aggregated into a single factor. Likewise, land is treated as a single factor. No distinction is made between irrigated and non-irrigated land.

In case of purchased consumption goods, four aggregate commodities are distinguished. Purchased food products of plant origin include grains and fruits & vegetables. Other purchased food products are an aggregate of animal products and processed food. Furthermore, stimulants like alcohol and tobacco are included here. A non-food commodity represents durable consumption goods. Finally, households purchase a services commodity, which is made up by water, energy, transport, health, education and other services consumed.

7.2. Model Calibration

When used in the context of CGE modelling, the term 'calibration' refers to the calculation of intercepts and other parameters of the mathematical functions of a CGE model. The primary goal of the calibration is that the model parameters are set such that the base SAM is replicated as a solution to the equilibrium problem (Reinert and Roland-Holst, 1997). Where possible, the calibration shall be based on exogenously given behavioural elasticities or, in case this is not applicable, allow the model to replicate observed behaviour. As Mitra-Kahn (2008) rightly states, the calibration of the parameters does not necessarily lead to a good empirical foundation of the model. Rather, the calibration process allows for a certain margin of error in the parameter values and involves a certain portion of judgement

demand resulting from the simulations are identical for for all items (see, for example, Table 7.14).

by the modeller. Given the potential influence of the parameter choices on model results, this section is dedicated to provide at least some transparency on the calibration process, which is carried out.

In the present model, the calibration task basically involves three sets of equations: the production functions for agricultural production, the functions of the LES and the labour allocation functions of the off-farm activities, which lie at the core of the households' labour market behaviour. In the following, the calibration of the three sets of equations will be dealt with in a stepwise manner, starting with the production functions for the agricultural activities, proceeding with the LES and concluding with the functions governing the households' labour market behaviour.

7.2.1. Calibration of the Agricultural Production Block

At the current level of aggregation, the nested Leontief-C-D structure which is used to model agricultural production consists of a function for aggregate intermediate input demand (Equation 6.12), a demand function for aggregate value-added (6.13), a set of three functions for intermediate input demand (6.14), a C-D production function for value-added (6.15) and two factor demand functions (6.16). Together these functions contain eight parameters to be calibrated. As the production equations are defined at the household level, the parameters have to be set for each household group separately, leading to a total number of 48 parameters. In this context it should be noted that the household specific definition of agricultural production incorporates the assumption that the households use different production technologies. This assumption could be criticized on the grounds that it appears unrealistic to expect households in a village as small as Changtian to have access to different technologies. As the general modelling approach, however, required the depiction of household specific off-farm activities (to allow for the depiction of differences in labour market behaviour) it was also necessary to model farm production at the household level. In any case, the differences in parameter values between household groups are small and can be considered to reflect differences in factors, such as soil fertility or the farmers' knowledge, or mere data errors (see Table 7.1).

Table 7.1.: Calibrated parameters of the agricultural production block.

Migration group:	Low migration			High migration		
Income level:	High	Middle	Low	High	Middle	Low
Parameter						
$inta_{ah}$	0.58	0.57	0.53	0.62	0.58	0.52
$ivash_{ah}$	0.42	0.43	0.47	0.38	0.42	0.48
ica_{cah}						
Capital	0.96	0.95	0.97	0.96	0.98	0.99
Labour	0.02	0.05	0.02	0.01	0.02	0.01
Services	0.02	0.00	0.01	0.02	0.00	0.00
α_{ah}	1.58	1.70	1.62	1.61	1.62	1.67
β_{fah}						
Labour	0.17	0.22	0.19	0.19	0.19	0.21
Land	0.83	0.78	0.81	0.81	0.81	0.79

Given the simple functional forms chosen, the calibration of the agricultural production system is straightforward. All parameters can be directly calibrated from the SAM. The Leontief parameters for demand for aggregate intermediate inputs by the household specific agricultural activities, $inta_{ah}$, are the household quotients of the quantities of aggregate intermediate input demands $QINTA_{ah}$ and the outputs of the agricultural activities QA_{ah}. Being the complementary to these values, the value-added coefficients of the agricultural activities $ivash_{ah}$ are calculated from the quantities of value added QVA_{ah} and the quantities of agricultural output. As Table 7.1 shows, the calibrated values of $inta_{ah}$ range from 0.52 to 0.62 and those of $ivash_{ah}$ from 0.38 to 0.48. The pattern arises that poorer households rely more on production factors owned by themselves rather than purchased inputs. This would correspond to prior expectations that poorer households are more cash constrained and tend to save on purchased inputs. Likewise, the high migration households appear to use higher shares of intermediate inputs which both could reflect the better access to cash of these households and the higher scarcity of labour.[3]

The calibrated values of ica_{cah}, the shares of each intermediate input commodity in the quantity of the aggregate input, highlight the strong role of capital inputs (fertilizer, pesticides, seeds, feed, etc.). By far the largest share ($> 95\%$) of the

[3]This observation points to hypotheses of the New Economics of Labour Migration which state that migration can help to loosen credit constraints by providing cash one the one hand, but leads to lost labour effects in agricultural production on the other hand (Stark, 1991; Taylor and Martin, 2001). For rural China, the hypotheses have been confirmed in a study by Rozelle et al. (1999).

aggregate intermediate input is made up by this aggregate commodity. Hired labour and energy and water, in turn, play only a minor role.[4] Again, there is some minor variation between the households, but no clear pattern arises.

Just as the parameters discussed up to now, the parameters of the C-D production functions are computed directly from the SAM. The share parameters β_{fah} are calculated as the share of the respective factor in the total value of value-added. Once the values for β_{fah} are determined, the efficiency parameters can be computed by solving the C-D production function for α_{ah}. In general, land makes up a much larger cost share, accounting for a share between 78 and 81%. It should, however, be borne in mind that this result also reflects the low shadow wage used for the valuation of household labour. Again, differences in the calibrated values among households are not large (see Table 7.1).

7.2.2. Calibration of the LES

While the LES is a comparatively simple specification of a demand system, its calibration is not as straightforward as that of the agricultural production system. In principle, it would be possible to estimate the entire LES as a system of equations applying an iterative estimation procedure based on OLS or using full-information maximum likelihood techniques (Sadoulet and de Janvry, 1995). For the current purpose, however, a simpler approach is chosen. This approach consists of the calibration of the system based on committed consumption quantities calculated from income elasticities which can be estimated from the household data. This calibration procedure resembles that of Kuiper (2005) who follows approaches put forward by Keller (1980) and Dellink (2003). Basically, as indicated, the calibration procedure consists of three steps: the estimation of income elasticities, the calculation of committed consumption quantities based on these elasticities and, finally, the calculation of the marginal budget shares of the LES. In the following, the second and third step of the procedure are described, followed by a presentation of the estimation of income elasticities from the household data.

According to Keller (1980), committed consumption quantities can be calcu-

[4] Given that prices of intermediate inputs are normalized to 1 in the model, the quantity shares also reflect the value shares.

lated from income elasticities η_{ch} and total quantities consumed:

$$\sigma_{ch} = (1 - \eta_{ch})QD_{ch} \qquad h \in H, c \in CD. \tag{7.1}$$

Based on this knowledge of σ_{ch}, the marginal budget shares γ_{ch} can be computed by solving the demand functions (6.2) of the LES for these parameters.

In this context, the Engel equation, which forms part of the set of requirements for a theoretically consistent demand system, reads

$$\sum_{c \in CD} \omega_{ch}\eta_{ch} = 1 \qquad h \in H. \tag{7.2}$$

where ω_{ch} is the budget share of commodity c in household h (Kuiper, 2005; Sadoulet and de Janvry, 1995). In order to obtain income elasticities which obey the properties of the LES, Equation (7.2) is imposed as a constraint on the parameters in the estimation of the elasticities (see below).

Kuiper (2005), however, notes that a calibration following Equation (7.1) would result in negative subsistence quantities for commodities which have an income elasticity larger than one. As an alternative, she applies a transformation of the income elasticities which circumvents this problem while preserving the reproduction of the income elasticities by the LES. This transformation consists of the normalization of the elasticities by division with the maximum income elasticity (Dellink, 2003) and results in a modified version of Equation (7.1):

$$\sigma_{ch} = (1 - \frac{\eta_{ch}}{\max(\eta_{ch})})QD_{ch} \qquad h \in H, c \in CD. \tag{7.3}$$

Income elasticities are obtained from estimates of Engel curves for each of the consumption goods under consideration. The estimation requires the specification of a functional form for the Engel curves. This specification determines the properties of the Engel curves, such as the behaviour of the income elasticities over the observed range of income. Several functional forms are available. The most commonly used comprise linear, semi-logarithmic or double-logarithmic Engel curves. While the linear one is the only Engel curve which per se satisfies the Engel equation, it only gives relatively poor fits when estimated. The semi-logarithmic or double logarithmic perform better from an empirical point of view, but lack

Table 7.2.: Variables used for estimation of income elasticities.

Variable	Description	Mean (Std.dev.)
Income	Income available for consumption (yuan)	3406.5 (2133.0)
Own produced	Consumption value of own produced goods (yuan)	463.1 (310.2)
Plant products	Expenditure on purchased plant products (yuan)	769.7 (337.6)
Other food	Expenditure on other food products (yuan) (234.3)	175.6
Non-food	Expenditure on non-food items (yuan)	654.0 (823.8)
Services	Expenditure on services (yuan)	882.2 (1270.0)
Leisure	Value of leisure consumption (yuan)	460.8 (878.1)

theoretical plausibility (Sadoulet and de Janvry, 1995). For the present study, a double-logarithmic specification is chosen, due to its empirical properties. Furthermore, it is the only specification which yields constant elasticities (Sadoulet and de Janvry, 1995) which can be taken directly from the estimated parameter values. Theoretical plausibility is achieved by a restriction of the parameter values in the estimation (see below). The corresponding econometric model to be estimated is

$$\ln(QD_{ch} * PD_{ch}) = \rho_c + \eta_c \ln(y_{ch}) + \mu_{ch} \qquad h \in H, c \in CD \quad (7.4)$$

where the index c indicates that a system of six equations (one for each consumption commodity c) will be estimated. Due to the income constraint, which is common to all the equations, disturbances of this system of equations can be expected to be correlated. In this case, an OLS procedure which would estimate each equation individually would result in biased parameter estimates. In order to deal with this problem, a seemingly unrelated regression (SUR) model which relies on a generalized least squares estimation is applied (Greene, 2003). Furthermore, in order to obtain a system of Engel equations, which are consistent with economic theory, Equation 7.2 is imposed as a restriction on the parameters in the model. The variables used in the estimation of income elasticities are presented in Table 7.2. The budget shares introduced into the model to restrict the

Table 7.3.: Budget shares used for estimation and adjustment of income elasticities.

Migration group:	Low migration			High migration			Village
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**	
Commodity							
Own produced	0.180	0.295	0.323	0.248	0.329	0.316	0.266
Purchased plant products	0.232	0.283	0.249	0.192	0.266	0.247	0.237
Other purchased food	0.041	0.045	0.022	0.022	0.014	0.033	0.029
Non-food	0.125	0.086	0.068	0.077	0.082	0.050	0.088
Services	0.361	0.169	0.107	0.298	0.185	0.159	0.242
Leisure	0.061	0.123	0.230	0.163	0.125	0.196	0.138

parameter estimates are calculated from the village SAM in its aggregation used for the modelling exercise (see Table 7.3).[5]

Most ideally, income elasticities would be estimated separately for each representative household group. Due to the small sizes of the household groups, however, no meaningful results can be obtained. Instead, the estimation is carried out for the village as a whole. Income elasticities for each single representative household group are obtained based on this set of village level parameters. The village level elasticities are reweighed with the household group specific budget shares and scaled proportionately to obey Equation 7.2. The scaling factors which are applied are presented in the bottom line of Table 7.4. The household group specific budget shares, which again are calculated from the SAM can be found in Table 7.3.

Table 7.4 contains the results of the SUR estimation for the village as a whole and the adjusted values for the household groups specific income elasticities derived from the estimates. According to the village level estimates in the second column of the table, all food products are necessities to the households. Given that the staple maize accounts for the largest share of this aggregate, it is, however, surprising that own produced food has an income elasticity which is higher than that of purchased food. Nonetheless, it is in line with expectations that purchased plant products have an income elasticity which is lower than that of other purchased food, which include a large share of food of animal origin.

The estimated income elasticities for non-food items and services are both larger than 1, classifying them as luxuries to the households. This result again is in

[5]The estimation has been carried out using the R 'systemfit' package (Henningsen and Hamann, 2010).

Table 7.4.: Estimated and adjusted income elasticities.

	Village	Low migration			High migration		
		High	Middle	Low	High	Middle	Low
Commodity							
Own produced	0.818*** (0.068)	0.764	0.877	0.877	0.778	0.861	0.867
Purchased plant products	0.549*** (0.057)	0.513	0.589	0.589	0.522	0.578	0.582
Other purchased food	0.647*** (0.166)	0.604	0.694	0.694	0.615	0.680	0.686
Non-food	1.363*** (0.118)	1.275	1.463	1.463	1.297	1.435	1.447
Services	1.459*** (0.095)	1.364	1.565	1.565	1.388	1.536	1.548
Leisure	1.163*** (0.143)	1.087	1.247	1.247	1.106	1.224	1.234
McElroy-R^2	0.490						
Scaling factor		0.935	1.073	1.073	0.951	1.052	1.061

Estimation is carried out for the village level only. Elasticities for households are derived from the village level estimates. Signif. codes: * sign. at α=10%, ** sing. at α=5%, *** sign. at α=1%; standard errors in parentheses.

accordance with *a priori* expectations. Likewise, leisure is a luxury good, implying that a comparatively strong income effect on leisure consumption can be expected in the model simulations.

The system-wide goodness-of-fit of the model as indicated by the McElroy-R^2 of 0.490 is relatively modest. The underlying equation specific adjusted R^2 range from 0.089 in case of the Engel curve for other purchased food to 0.515 in case of services. A possible explanation for the generally low explanatory power of the model is that income in general only is one of the determinants of households' consumption decision. Accounting for own- and cross-price effects would certainly improve the model fit.

The results obtained are broadly in line with other studies on demand of rural households in China. Using the same SUR approach, Kuiper (2005) reports estimates for the income elasticities of demand for own produced food of around 0.6. Her income elasticities of demand for leisure are also similar to the one obtained here, moving around a level of 1.3. Differences occur, however, in case of purchased food and non-food products, for which the author presents values of around 1.2 and 0.6, respectively. Given theoretical considerations that food can be expected to be a necessity and non-food products luxuries, the results of the present estimation appear to be more acceptable. This is also confirmed by Fan and Wailes (1995), who after estimating a LES-AIDS model arrive at expenditure elasticities of 0.7 for food.

The remaining columns of Table 7.4 present the adjusted income elasticities for each representative household group of the village equilibrium model. As the figures show, adjustments are minor. The actual calibration procedure of the LES as outlined above are included directly into the program code of the model. The income elasticities of Table 7.4 are read into the model and committed consumption quantities and marginal budget shares of the LES are calculated from these values. This approach offers a flexible way of calibration which allows for quick changes in income elasticities, if deemed necessary.

7.2.3. Calibration of Households' Labour Market Behaviour

The basic approach towards the calibration of the functions governing the labour allocation by the households is already presented in Section 6.2. It is highlighted that the calibration of the households' labour market behaviour involves a search procedure rather than a straightforward calibration as in case of the agricultural production block or the demand system. The underlying reasons are the fact that the parameters of the off-farm labour allocation functions have no real-world equivalent, hence cannot be directly observed, as well as the cross-effects the parameters of one labour allocation equation unfold on the behaviour of another. In this context, the crucial role of the most elastic supply response for the overall labour supply behaviour is emphasized.

Unlike the stylized model of Section 6.2, which covers only one household and three activities, the model used for the policy simulations comprises six households and four activities, the latter of which consist of one agricultural and three off-farm activities. Both the number of households and the quantity of the activities add to the complexity of the calibration process. It is now necessary to calibrate the labour allocation behaviour of each single household over each single household specific activity. As the parameters of the labour allocation functions lack a direct interpretation (e.g. in elasticity terms) and as households in principle can be expected to exhibit differing labour market behaviour, the challenge here is to benchmark the households' labour allocation reactions against each other. Following the argumentation presented above, the best way to calibrate the households' labour allocation behaviour would be to back the calibration by econometric studies. Such studies most ideally would provide estimates of wage and/or cross-wage elasticities for each representative household group and thereby offer an empirical foundation for the calibration which would take into account differences in the behaviour which might exist between the groups.

Lacking the resources to carry out an own study, for the current modelling effort a more pragmatic approach is chosen. In general, two sets of behavioural assumptions are made. Under the first set of assumptions, all households are assumed to behave according to the same underlying own-wage elasticities for all off-farm activities. Under the second set of assumptions, the own-wage elasticities of migration are assumed to differ between the households of the low migration group and those of the high migration group, with the latter exhibiting stronger responses to a given migration wage shock. In order to explore the effect of different migration responses, the policy simulations are carried out for both sets of assumptions, thus simulating two different migration scenarios.

This pragmatic approach, however, does not absolve from obtaining at least some reference against which to benchmark the calibration. Such a benchmark is provided by a study by Sicular and Zhao (2004) (SZ) who estimate labour supply functions for rural households in China. Although the study differs with respect to the activities under consideration from the present village model—the authors distinguish agricultural production, non-agricultural self-employment and off-farm work—it at least provides an indication, which can be used for the calibration of the labour allocation functions in the model. Out of the wealth of detailed insights the SZ–study provides into the labour market behaviour of rural households in China, the piece of information used for our purposes is the own-wage elasticity of off-farm labour supply. Depending on the specification of the econometric model, the authors estimate it at values of 0.555 and 0.485 (Sicular and Zhao, 2004, p.256).

In order to arrive at assumptions for the labour supply responses of the households in the model, the elasticity estimated by SZ (actually, its approximate average) is taken as a benchmark relative to which the remaining elasticities are calibrated. More precisely, to integrate the result of SZ into the model, it is assumed that all households exhibit an own-wage elasticity of labour supply to the informal local off-farm activity of 0.5. The rationale for this choice is that informal local off-farm employment is assumed to be accessible to the households without major market entrance barriers. In contrast, access to formal local off-farm employment is more restricted and determined through non-wage rationing mechanisms (recall the discussion in Section 5.2). Due to the restricted access to formal off-farm jobs and the comparatively high remuneration, the own-wage response of households in this activity is assumed to be inelastic. The own-wage elasticity for formal local off-farm employment is calibrated to a value of (close to) zero. That means, even if changes in the formal local off-farm wage occur, households do not change the amount of labour allocated to this activity, both because the characteristics of the respective segment of the labour market make it difficult to increase employment in case of rising wages and because the wages paid are so high that it is unattractive to leave even if they decline slightly.[6]

The final activity that still lacks an assumption on the own-wage elasticity of the labour supply response is migration. Here, the elasticity for informal local off-farm wage are also taken as a reference. Finding employment in migration and arranging the journey to the destination is much more difficult than obtaining a job in the local informal sector. Moreover, migration is often associated with physical and psychological hardships (Zhao, 1999a).[7] Following these considerations, the own-wage response in migration can be expected to be considerably lower than the one in informal local off-farm work. Accordingly, the own wage elasticity of migration labour supply are calibrated to a value of 0.25 in case of the first migration scenario, which assumes equal migration responses of all households. In the second migration scenario, which introduces different migration responses, the own wage elasticity in migration is calibrated to a value of 0.35 for the households of the high migration group and to 0.15 for those of the low migration group. Table 7.5 summarizes the preceding discussion and presents the calibrated values of the own-wage elasticities by migration group and by migration scenario.

[6]In fact, the wage changes applied in the simulation to follow can be characterized as ”slight” without any hesitation.
[7]For a further discussion, also see Kleinwechter (2009).

Table 7.5.: Calibrated own-wage elasticities by migration scenario and household group.

Calibration:	Equal migration responses		Different migration responses	
Migration group:	High mig.	Low mig.	High mig.	Low mig.
Activity				
Informal local off-farm	0.50	0.50	0.50	0.50
Formal local off-farm	0.01	0.01	0.01	0.01
Migration	0.25	0.25	0.35	0.15

As described in Section 6.2, the calibration is carried out in four steps. First, the quantities in the labour allocation equations and the parameter κ_h in case of migration are calculated from the SAM entries, the shadow wage and the off-farm wages. In this context, in case of migration the assumption is made that all households earn the same wage. This causes κ_h to differ among households.[8] In case of local off-farm activities, wage rates differ among households, depending on the total returns and the time worked in the respective activity. Second, as above the marginal utility of income λ_h is set equal to 1, leaving ε_{ah} as the only undetermined shift parameter. Third, a value for δ_{ah} is chosen. Finally, the equation is solved for ε_{ah} to calibrate this parameter.

The choice of the values for δ_{ah}, in turn, involves a search procedure. This search procedure again consists of a number of steps which are iterated until the desired own-price elasticities are obtained. These calibration steps are:

1. Given values for wages, labour quantities, λ_h and κ_h (if applicable), start with perfectly elastic responses for all off-farm activities of all households. This is achieved by setting all $\delta_{ah} = 1.00000001$.[9]
2. Simulate a 1% change in the migration wage and adjust δ_{ah} in the households' labour allocation functions for migration to arrive at migration wage elasticities of migration supply of 0.25.
3. Simulate a 1% change in formal local off-farm wage and adjust δ_{ah} in the households' labour allocation functions for formal local off-farm work to

[8] The assumed uniform wage rate is 35 yuan per unit of labour employed in migration. This relates to a shadow wage of 1 yuan, informal local off-farm wages between 7 and 11 yuan and formal local off-farm wages between 45 and 55 yuan.

[9] As discussed above, δ_{ah} cannot be exactly equal to 1 because this would render the model insolvable. In principle, of course, virtually any value can be chosen as a starting value from which to depart.

Table 7.6.: Calibrated parameter values of off farm labour allocation functions.

Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Migration						
κ_h	0.15	0.14	0.06	0.06	0.05	0.01
δ_{ah}	5.40	5.57	7.16	6.70	7.50	0.51
ε_{ah}	1.23E-007	6.61E-006	7.38E-008	1.54E-011	1.50E-012	-5.65
Disutility	4.39	3.97	1.27	1.13	0.84	-0.62
Informal local off-farm						
δ_{ah}	3.22	3.23	3.15	3.21	3.16	3.20
ε_{ah}	0.04	0.11	0.05	3.93E-003	0.15	0.15
Disutility	7.49	6.96	7.64	5.98	10.17	7.99
Formal local off-farm						
δ_{ah}	100.00			100.00		100.00
ε_{ah}	3.29E+021			2.34E+022		2.35E+087
Disutility	49.85			48.34		44.85

achieve a reaction of labour supply to this activity as inelastic as possible.

4. Simulate a 1% change in informal local off-farm wage and adjust δ_{ah} in the households' labour allocation functions for informal local off-farm work to arrive at own wage elasticities of labour supply to this activity close to the envisaged value of 0.5.
5. Due to the cross-effects of discussed above, the adjustments of δ_{ah} in one activity may have affected the responses in others. Hence, steps 2–4 are repeated until the desired own-wage elasticities are obtained for all activities.

The calibration process is carried out with the model version without a village land rental market, so the calibrated own-wage elasticities of labour supply take the stated values for the disconnected household models. The calibration for the second migration scenario works identically, only the target values for the own-wage elasticities in migration are modified.

In order to provide more insights into the calibration, a number of detailed figures related to the calibrated household labour market behaviour are presented in Tables 7.6 and 7.7. Table 7.6 contains the values of the parameters in the equations of the off-farm labour allocation functions (6.10) and (6.11) as well as the values of the utility terms. Table 7.7 gives an overview of the households' labour supply responses following 1% shocks in the different activity prices., i.e. the own- and cross-price elasticities of labour supply which result from the calibration.

Table 7.6 is divided into three blocks which consist of the parameter and disutility values of the different off-farm activities. In case of migration, the parameters which appear in the labour allocation functions are κ_h, δ_{ah} and ε_{ah}. The parameter κ_h moves between 0.01 for the low income high migration household to 0.15 for the high income low migration household, indicating that migrants send home between 1% and 15% of their earnings. Empirical studies on remittance behaviour of rural-urban migrants in China speak of migrants remitting on average around 30% of their income (Du et al., 2005; Wang and Cai, 2007). Compared to these figures, the calibrated values of κ_h appear to be low. It should be noted, however, that the value of κ_h is sensitive to the assumptions made on the wage rate in migration. The value of 35 yuan assumed for the model is chosen based on plausibility considerations rather than empirical foundations: it should be higher than the wage rate in informal local off-farm employment and lower than that in formal local off-farm jobs (the latter being mainly village cadres and teachers, which can be considered to receive higher remunerations than factory workers). In case the actual migration wage rate is lower than the one used here, κ_h would increase and move closer to the 30% mentioned. The pattern, which arises in the values of κ_h, however, appears to be very plausible. Low migration households, that is, those households with higher dependency ratios, receive higher shares of the migrants' income. This may be due to the potentially higher needs of the families back home for income support. This notion is also reflected by the size of the disutility compensations: households with higher dependency ratios have higher disutility compensations and exhibit higher κ_h. The sizes of the disutility compensations also show that households of the low migration group indeed appear to experience higher disutilities than those of the high migration group (of which the low income household even has a positive marginal utility of migration).

The calibrated values of δ_{ah} range between 5.40 and 7.50, with δ_{ah} being considerably lower for the low migration low income households, at 0.51. The ε_{ah}, which are calculated with given δ_{ah} to solve the labour allocation equations, are close to zero for all except the household mentioned, which has a value of -5.65. According to the mere mathematics of the labour allocation equation for migration, one might expect that the parameter δ_{ah} would follow a clear pattern, as well. As with increasing κ_h the transmission of the migration wage shock to the household becomes stronger, with equal δ_{ah} households also should have increasing own-wage elasticities in migration. Put differently, in order to achieve the same migration response, households with higher κ_h should require higher δ_{ah} and vice versa. Given the positive correlation between κ_h and the disutility components, households with higher disutility compensations also should have higher values of δ_{ah}. The influence of other factors, such as the relative quantities of labour supplied to the different activities, the differences in levels of activity returns or the cross-effects of labour supply responses in the other activities (via effects on the shadow wage), however, blurs the theoretical correlation between κ_h and δ_{ah}. Hence, the pattern described cannot be found in the parameters presented in Table 7.6.

The second block of the table presents the parameters of the labour allocation functions for the informal local off-farm activity. The values of δ_{ah} for all households lie close together, ranging between 3.15 and 3.23. The corresponding ε_{ah} are slightly positive, taking values from 0.0004 to 0.15. Unlike in case of migration, the differences in returns from the activity to the households are not captured by a share parameter like κ_h, but by differences in activity prices. The a priori expectation regarding the patterns in δ_{ah} would be that households which earn higher wages have higher own-wage elasticities with equal δ_{ah}. The underlying rationale is as above: with higher wages, a given wage shock translates into a higher marginal increase in the left-hand side of the labour allocation equation in informal off-farm work. This would trigger a stronger labour supply response. Hence, in order to arrive at equal own-wage responses in the activity, δ_{ah} should be lower for households with higher wages. The wages, which are not reported in the table, in turn, are strongly and positively correlated with the disutility compensations. Indeed, the calibrated values of δ_{ah} tend to be lower for those households with higher disutility compensations. The correlation, however, is not perfect. Just as in case of migration, other factors play a role and obfuscate the pattern.

As only three out of the six households in the model engage in formal local off-farm work at all, parameters are only set for this group. The values are presented in the third block of Table 7.6. In order to achieve own-wage responses as inelastic as possible, the δ_{ah} are set to a high value of 100 for each household. Going beyond this point would make labour supply responses only asymptotically lower.[10] The corresponding ε_{ah} are substantially higher than in case of migration and the informal off-farm activity, owing to the higher values of δ_{ah}, as well as to the higher formal off-farm wages.

A final point worth noting is the relative size of the disutility terms between the three activities. Disutility compensation appears to be highest in formal local off-farm work and lowest in migration. Arguably, the potentially higher burden and the comparatively good working conditions in formal off-farm work would lead to the expectation that the pattern goes the other way round. At the current stage of investigation, the difference between the observed pattern and intuitive expectations can be explained only by the higher difference between shadow wages and market wages in case of formal off-farm employment. It has, however, to be pointed out that the current model, by including only the utility considerations of the households is far from complete. In fact, what is included into the disutility term here in reality consists of many other components than the mere disutility compensations. These components may comprise any kind of transactions costs[11] or simply rents which accrue to job holders in a labour market with restricted access to particular market segments. Certainly, further research is indicated here.

Following the presentation of the calibrated parameter values, Table 7.7 provides details of the labour supply responses to different activity price shocks. Each of the four blocks of the table depicts the percentage change in labour supply to the different activities as well as the percentage change in the shadow wage following a 1% wage (price) shock in each of the activities—migration, informal and formal off-farm work and agriculture.

Of primary interest in the context of this study is the migration behaviour of the households. The own- and cross-wage responses in the migration activities of each household are presented in the first line of each of the four blocks. The own-wage response of each household is the value which is used as the target for the calibration: 0.25. The cross-price responses differ among households. The cross-wage elasticities of migration labour supply to the informal off-farm wage

[10]Furthermore, beyond certain values the model becomes insolvable, due to the limited ability of the computer to handle very small numbers.

[11]These are dealt with, for example, in the de Janvry et al. (1991) model.

Table 7.7.: Labour supply responses to different activity price shocks (% change).

Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
1% increase in migration wage						
Migration	0.25	0.25	0.25	0.25	0.25	0.25
Informal local off-farm	-0.03	-0.02	-0.01	-0.03	-0.02	-0.01
Formal local off-farm	0.00			0.00		0.00
Agriculture	-0.54	-0.39	-0.21	-0.49	-0.44	-0.20
Shadow wage	0.45	0.30	0.17	0.40	0.36	0.16
1% increase in informal local off-farm wage						
Migration	-0.01	-0.01	-0.04	-0.05	-0.02	-0.36
Informal local off-farm	0.50	0.50	0.50	0.50	0.50	0.50
Formal local off-farm	0.00			0.00		0.00
Agriculture	-0.19	-0.23	-0.48	-0.44	-0.19	-0.21
Shadow wage	0.16	0.18	0.40	0.36	0.15	0.17
1% increase in formal local off-farm wage						
Migration	0.00			-0.01		-0.04
Informal local off-farm	0.00			0.00		0.00
Formal local off-farm	0.01			0.01		0.01
Agriculture	-0.04			-0.06		-0.02
Shadow wage	0.04			0.05		0.02
1% increase in activity price for agricultural output						
Migration	-0.07	-0.09	-0.21	-0.19	-0.30	-2.02
Informal local off-farm	-0.09	-0.12	-0.11	-0.10	-0.08	-0.05
Formal local off-farm	0.00			0.00		0.00
Agriculture	1.04	0.68	0.43	1.63	0.73	1.58
Shadow wage	1.48	1.80	1.79	1.30	1.76	0.81

range from -0.01 to -0.36. As desired, the two activities are substitutes to the households. The migration response to an increase in the formal off-farm wage is slightly negative in case of two of the three households who are engaged in formal off-farm work. As the own-wage response of formal off-farm work is very small, the changes reflect the income effect of the wage increase. The increase in income from formal off-farm work increases demand for leisure (not reported here) and the resulting rise in the shadow wage decreases labour supply to migration, among others. The cross-price elasticities of migration labour supply to the price of the agricultural activity are also consistently negative, ranging from -0.07 to -2.02. The negative effect is triggered by an increase in the shadow wage following the agricultural price shock and, again, shows the substitutional relationship between migration and agriculture.

Regarding migration, perhaps the most striking observation which can be made from Table 7.7 is the exceptionally strong cross-price responses of labour supply to migration of the high migration low income household. Regardless of whether the increase happens in informal or formal off-farm wages or in the price of the agricultural activity, the response of this household exceeds that of the other households by a factor of around ten. This comparatively strong cross-price response is rooted in the low share of remittances sent home by the migrants of this household, as reflected in the value of the parameter κ_h. The fact that only 1% of migrants' income is sent to the household implies a very low transmission of migration wage shocks to the household itself. As discussed above, this requires δ_{ah} in the migration function of this household to take a very low value in order to achieve a migration response which is as strong as that of other households. The corollary of this relatively elastic calibration of the utility term of the household's migration function is that a given change in the shadow wage triggers a much stronger migration response than in case of the other households. As increases in cross-wages or the agricultural activity price all cause increases in the shadow wage, the cross-price response of the household becomes strongly negative. This behaviour is logical insofar as the household which earns least in terms of monetary returns out of migration is the quickest one to pull out of this activity as soon as alternative income opportunities arise. It appears, however, counter-intuitive that this household is also the one with the lowest marginal disutility, which should have the highest interest in migration and tend to stick to this activity. A possible interpretation of this apparent contradiction might be that monetary aspects have a higher weight for the household than utility considerations.

Following the argumentation on the seeming outlier, a more general scheme which is at the bottom of the migration behaviour of the households in the model can be identified. As the value of δ_{ah} in the migration function determines the strength of the migration response to a change in the shadow wage, households with higher δ_{ah} should exhibit weaker cross-price responses. Indeed, the cross-price responses of migration labour supply in Table 7.7 point to such a pattern. Both the cross-wage response to an increase in the informal off-farm wage and the response to an increase in the price of the agricultural activity tend to follow the order of the values of δ_{ah} in the migration functions. Again, however, the correlation is not perfect and masked by the influence of other factors.

As in the case of the high migration low income household, which is discussed in the previous paragraph, due to the tendency of increasing disutility compensation with rising δ_{ah} it would again be the households with higher marginal disutilities which tend to stick to migration. As stated above, this would be against the intuition that those households which gain least utility of migration keep on working there instead of changes in incentives. Moreover, recalling that the dependency ratio is the variable, which underlies the grouping of the households, one might expect that migrants of the low migration group (with the high dependency ratio) will seize the opportunity to return home as soon as conditions there improve. Indeed, such behaviour would be in accordance with results of empirical studies on return migration in China. Studying the duration of migration spells, Hare (1999), for example, finds that the share of workers in a household significantly increases the migration spell. This suggests that migrants of households with higher dependency ratios tend to return earlier. Wang and Fan (2006) emphasize family demands as reasons for return. They underpin their argument by econometric results which show that return migrants are more likely to be married and tend to have more children in school age than continuing migrants. Likewise, Zhao (2002) finds that the number of laborers in a household significantly decreases the likelihood to take a decision in favour of return migration. The author's model, however, also points to a negative influence of the number of children and elderly in the household on return decisions, albeit not at a statistically significant level.

Apart from the argument brought forward above—that the low migration households would face a higher marginal income loss from drawing out of migration—it might, however, be argued that the underlying hypothesis of the studies mentioned is different from the one which is implicit to the present model. The studies discussed deal with the general patterns of return migration and seek to identify factors, which can explain the decision in favour of *eventual* return. The scenario analysed with the village equilibrium model, in contrast, is one in which migrants respond to rather short-term economic shocks. The responses to such shocks might be different from the long-term strategic behaviour which might drive the results of the studies mentioned. While it might be part of the strategy of migrants with more dependants to eventually return back home, it might also be their intention to work in migration for a certain time to supply their families with fund in form of remittances. In this context, they may not be willing to give up their job at the destination when relative prices and wages change slightly, in particular as their families depend more on remittances income and as the marginal income loss from reducing the level of migration might be higher for the household as a whole. Migrants with less dependants (and less responsibilities), in contrast, might be generally more flexible in their responses to changes in price incentives. Moreover, they might be more willing to give up their job at the destination of migration and to return home into a potentially uncertain labour market environment.

The type of behaviour just described fits with the theories of the New Economics of Labour Migration (NELM). According to this framework, households consider migration as a means to manage risk. As such, migration forms part of a family strategy to insure against income and production risks (Stark, 1982; Stark and Bloom, 1985; Taylor, 1999). Return as response to small changes in relative prices may not, or to a lesser extent, form part of this strategy. Similarly, in a theoretical model of return migration, Dustmann (1997) explains the return decision with the comparison of expected income at home and at the destination. In this model, relatively high perceived uncertainty in the home labour market might decrease expected income there and have a prolonging influence the duration of migration. Transferred to the model of this study, this would mean that migrants face uncertainty with respect to returning home and finding an alternative occupation there. Those with more dependants, and higher responsibilities for their families, might be more averse to take this kind of risk.

To summarise this discussion, the cross-price behaviour in migration exhibited by the households in the village equilibrium model does not correspond to what one a priori might expect. Likewise, empirical studies of return migration point into a different direction. There are, however, insights from theories like the NELM, which suggest that there are reasons to assume that migrants' behaviour in a situation in which relative prices change and which is simulated with the model is different from these expectations and empirical findings. On the grounds of these reasons, the current outcome of the first basic simulations carried out here can be defended.[12]

The effects of wage and price changes on households' supply of labour to the informal local off-farm activity appear to be more uniform than those to migration. Own-wage elasticities again correspond to the aspired target value which in case of this activity is 0.50. The cross-wage elasticities of labour supply to the informal off-farm activity to the migration wage range from -0.01 to -0.03. The order of magnitude of the elasticities follow the order of labour employed in migration. Households with higher amounts of labour allocated to migration have higher cross-wage elasticities, as the same relative change in labour supplied to migration corresponds to a higher absolute amount of labour which has to be drawn from other activities (compare Table 5.20). The (small) differences in the cross-price elasticities of labour supply to the informal off-farm activity to the price of the agricultural activity, in contrast, are mainly driven by the different changes in shadow wages due to this price shock. These, in turn, are the combined product of the cross-price responses in the other activities and the effect on labour allocation which are determined by the calibration of the respective labour allocation and consumption demand functions.

The own- and cross price elasticities of the formal off-farm activity are straightforward. The own-wage elasticity of labour supply in this activity is 0.01 for the

[12] In fact, the outcome of the model simulations presented here provides hypotheses for further research to investigate the behaviour of migrants in response to economic shocks, as opposed to the general analysis of return migration behaviour carried out by the authors cited.

three households. Although this is not perfectly inelastic, it fits into the set of assumptions regarding the workings of the labour market presented above to allow for very small changes in employment in this activity following a wage shock. Caused by the low own-wage elasticities, cross-price responses in the formal off-farm activity are zero for all households.

The final activity included into the model is agricultural production. As argued above, due to the absence of a utility term in agriculture it is not possible to calibrate the own-price response of labour supply to this activity to a particular value. Rather, the own-price elasticities in agriculture are determined by the interaction of the different labour supply responses in the off-farm activities and the demand for leisure, which jointly drive the change in the shadow wages. As this interaction is complex and as the calibrations differ among households, the own-price responses of agricultural labour supply also differ and it is not possible to identify a particular pattern. Compared to the other activities, own-price elasticities in agriculture are high, taking values between 0.43 and 1.63. Cross-wage elasticities in agriculture are also higher than those in other activities, ranging from -0.02 to -0.04 in case of an increase in the formal off-farm wage to -0.20 to -0.54 in case of a migration wage shock. In the tendency, the magnitude of the cross-wage elasticities again is determined by the amount of labour employed in the activity in which the wage shock occurs. Again, however, it is blurred by the complexity of the interactions taking place within the model.

The contemplation of the households' labour market behaviour under the current calibration teaches some lessons on the properties of the model itself. It becomes evident that the households' migration, or, more generally the labour market behaviour, differs, although the own-wage responses are calibrated to the same levels. The differences materialize in the cross-price responses of labour supply and can be traced back to the sizes of the disutility terms as well as to the different amounts of labour the households supply to the different activities. On the one hand, this means that the model is capable to capture differences in labour market behaviour which arise due to the utility considerations of the households represented in the model. On the other hand, the magnitudes of the cross-price responses is determined by factors which are exogenously given. Furthermore, the complexity of the interactions between the labour supply responses in the different activities also exerts an influence on the magnitudes of the cross-price responses. Thus, it is difficult if not impossible for the modeller to fully control the households' labour market behaviour. At least with the simple functional forms currently chosen there will always be at least one aspect of the labour market behaviour—own-price responses, cross-price responses or in the best conceivable case only the labour allocation to the agricultural activity—which is determined by the calibration of the remaining aspects. In the consequence, this implies a loss of flexibility for the modeller as she is forced to make a choice about which aspect to calibrate to match a desired behaviour. Regarding the perspective to calibrate the model to replicate the results of an econometric study of labour market behaviour it remains to be tested whether it is actually possible to obtain a fully identical behaviour. Most likely, it will be possible to calibrate a few aspects such as the own-price elasticities to resemble the econometric results and leave others to be determined by the calibration. A more flexible functional form, however, may also offer additional flexibility here. A more flexible specification may also be conducive to address the issues associated with the cross-price responses of migration which are discussed above.

Regarding the way the calibration is carried out—the calibration of the own-wage responses to meet assumptions on the size of these made previously—alternative approaches are conceivable. One might, for example, set all the δ_{ah} of each household to the same activity specific value. Labour supply responses would be different then and the differences could be interpreted as the manifestations of the households' utility considerations. Alternatively, the focus could be set on the cross-price responses instead of the own-price responses. In this case the latter would be determined by the former. In these cases, however, own-wage migration responses would differ from the onset. One of the purposes of the current study, however, is to analyse the impact of policy changes under different migration scenarios. Hence, it is necessary to have a benchmark of equal migration responses against which to assess a scenario with different migration responses. Under these considerations, the current approach, although there is certainly scope for improvement, is clearly warranted.

7.3. Scenarios

7.3.1. Policy Scenario

In order to carry out the policy simulations with the village equilibrium model, results on price and wage changes are taken from a national level CGE model and fed as a shock into the village model. In the present study, national level results from an existing study on China are used. This approach, of course, is only a second best option. Most ideally, one would carry out an own macro-level simulation, which is tailored to match the requirements of the village model in terms of commodity or spatial disaggregation and in which it would be possible to take full control of the scenario to be analysed and the assumptions made. Nonetheless, a CGE study on the impact of trade liberalisation on China could be found which at least offers a sufficient level of disaggregation at the commodity level and which is sufficiently transparent with respect to the core assumptions that are made.

The study chosen is part of a recent and broad based undertaking to analyse the impact of different types of trade liberalisation on inequality and poverty (Anderson et al., 2010a). In this effort, a number of modelling studies have been accomplished, focusing on global and national level impacts of trade reform. Drawing upon recent estimates of agricultural protection (Valenzuela and Anderson, 2009), three different global analyses are carried out, using the World Bank's Linkage model (Anderson et al., 2010c), the Global Income Distribution Dynamics tool (GIDD) (Bussolo et al., 2010) and the GTAP model (Hertel and Keeney, 2010). Ten further studies apply national CGE approaches to deal with specific developing countries.

The national CGE study this work draws upon is a simulation of impacts of different trade and domestic reform scenarios on China conducted by Zhai and Hertel (2010). It employs a comparative static CGE model for the Chinese economy which has been first presented by Hertel et al. (2004b) and further applied and developed by Hertel and Zhai (2004) and Zhai and Hertel (2006). The model distinguishes 100 representative households, classified by their primary source of income as well as by relative income levels. Rural households are stratified by agriculture specialised and diversified households, urban households grouped as transfer-specialised, labour-specialised and diversified. Consumption demand is modelled using an extended LES.

The model has several features, which allow taking into account some of the unique institutional factors, which shape the functioning of the factor markets in China. Households are assumed to be constrained in moving labour from the on-farm to the off-farm labour market; thus, a constant elasticity of transformation function is implemented to model imperfect transformation of labour between the two sectors. Similarly, the barriers to migration constituted by the *hukou* system, among others, as well as the resulting rural-urban income gap are depicted with a constant elasticity transaction cost function. The tenure insecurity which results from the current land regime is represented by making income from land dependent on the amount of labour worked on the farm.

Production in each sector is modelled using nested constant elasticity of substitution functions. Constant returns to scale are assumed. In each sector, imperfect substitutability of rural and urban labour is assumed in order to proxy the geographic distribution of industrial activity in the country. Similarly, rural labour markets are segmented in the model, with imperfect transformation of agricultural and non-agricultural labour. Capital, in turn, is fully mobile across sectors. The Armington approach is implemented for the modelling of import demand, but no such assumption is made on the export side.

A SAM for the year 2002 constitutes the benchmark data for the model. The SAM includes 48 sectors of production and the mentioned 100 representative household groups. In the agricultural sector, eight crop sectors and four livestock sectors are distinguished. The data on agricultural protection used in the model is taken from Huang et al. (2009) and the GTAP Database, version 7 (Narayanan and Walmsley, 2008).

The closure rules correspond to a common set of closures adopted in the overall research project (Anderson et al., 2010b). Fixed aggregate stocks of factors are assumed and land is specific to the agricultural sector, but mobile across crop and livestock activities. The current account is fixed in foreign currency. Real government spending is fixed and fiscal balance is assumed. A uniform income tax is applied to replace possible losses in revenue which may arise from policy

Table 7.8.: Sectoral structure of GDP, trade, import tariffs, and export subsidies, China, around 2004, in %.

Sector	Tariff rate	Export subsidy rate	GDP share	Export share	Import share
Agriculture	6.5	0.8	13.4	1.6	2.5
Mining	0.7	0.0	4.9	1.5	6.2
Food manufacturing	5.0	0.0	3.8	3.0	2.0
Non-food manufacturing	2.9	0.0	28.6	74.9	80.5
Utilities, construction, services	0.0	0.0	49.3	19.0	8.8

Source: Zhai and Hertel (2010).

reforms.

In their contribution to the volume by Anderson et al. (2010a), Zhai and Hertel (2010) analyse six different policy scenarios. In the context of trade reforms, unilateral liberalisation by China is contrasted with liberalisation in the rest of the world. Accordingly, four analyses are carried out. A first simulation deals with the liberalisation of the agricultural sector China. In a second simulation, the liberalisation of all merchandise trade is added, thus arriving at a full liberalisation scenario for China. A third one simulates agricultural liberalisation in the rest of the world. The fourth simulation is a full liberalisation scenario for the rest of the world, combining reforms in the agricultural as well as the merchandise sectors. In the more ambitious full liberalisation scenarios, production taxes and subsidies as well as export taxes and subsidies in the agricultural and lightly processed food sectors are eliminated. Furthermore, import tariffs are eliminated in all sectors.[13] The analyses of the trade reform scenarios are complemented by two further simulations, which deal with the relaxation of the *hukou* system and with a land reform to improve tenure security.

For the present study, the scenario for unilateral full trade liberalisation by China is chosen. This scenario involves the elimination of all export taxes and domestic subsidies in the agricultural and lightly processed food sectors and the elimination of import tariffs in all sectors. This scenario is selected because it offers, by the structure of its results, a suitable case for illustrating the consequences of differences in household migration for the potential outcomes of a trade reform at the level of a rural community.

[13] Liberalisation of trade in services, however, has not been included into the analysis (Anderson et al., 2010b).

Before carrying out a modelling study on the impacts of trade liberalisation, it is always useful to have a picture of the initial situation of the economy in question. At this, it is not only important to know about the structure of the economy, but also about the initial patterns of protection. As Table 7.8 shows, the agricultural sector contributed 13.4% to the national GDP. A further 4.9% came from mining, the second component of the primary sector. The manufacturing sector accounted for about a third of GDP. Food manufacturing had a share of 3.8%, non-food manufacturing 28.6%. The tertiary sector, consisting of utilities, construction and services with 49.3% made up the largest share of national GDP. With export and import shares of around 80%, the non-food manufacturing sector is the most trade intensive sector of the economy. Trade shares of primary as well as food manufacturing products are low, typically below 3%. As a direct consequence of China's accession to the WTO in 2001, the overall level of protection has been low by the middle of the first decade of the millennium. The agricultural and the food manufacturing sectors receive the relatively highest levels of protection in terms of tariffs and export subsidies.

According to the simulation by Zhai and Hertel (2010), the elimination of the support measures summarised in Table 7.8 leads to increases in GDP and trade, but to some welfare losses. Real GDP is 0.2% higher after unilateral trade reform and exports and imports expand by 5.8% and 5.5%, respectively (see Table 7.10). The increase in GDP is mainly a consequence of the movement of labour out of agriculture into urban non-agricultural activities. Overall welfare, as measured by the equivalent variation, decreases by -0.1%.[14] The deterioration in welfare is a result of the decline in the terms of trade, which in turn stems from the relatively limited import protection and the impact of China's exports on export prices. Thus, although the economy apparently becomes more efficient, the population is not better off as compared to the situation before reform.

Except for capital and skilled wages in the urban sector, factor returns decrease relative to the consumer price index (CPI). Most negatively affected are the returns to agricultural land, as well as the wages for unskilled agricultural labour. Returns to capital and skilled wages, in turn, increase relative to the CPI, or remain constant. Semi-skilled and skilled wages tend to be favoured over unskilled

[14]For an explanation of the concept of equivalent variation, see below.

Table 7.9.: Effects of unilateral trade liberalisation in China on income inequality and poverty.

Indicator	Base	Scenario
Inequality		
Urban-rural income ratio	3.538	3.547
Gini coefficient	0.442	0.443
Urban	0.259	0.259
Rural	0.315	0.315
Poverty headcount ratio, US$ 2 a day		
Total	36.4	36.7
Urban	2.5	2.5
Rural	58.1	58.6

Source: Zhai and Hertel (2010).

Table 7.10.: Unilateral trade liberalisation in China - National level simulation results (% change against baseline).

Indicator	
Macro-economy	
Equivalent variation	-0.1
Real GDP	0.2
Exports	5.8
Imports	5.5
Terms of trade	-0.8
Consumer price index	-0.9
Factor prices	
Return to agricultural land	-3.5
Return to capital	-0.8
Unskilled wages	
Urban	-1.1
Rural non-agricultural	-1.3
Agricultural	-1.8
Semi-skilled wages	
Urban	-1.2
Rural non-agricultural	-1.1
Agricultural	-1.1
Skilled wages	
Urban	-0.9
Rural non-agricultural	-1.0
Labour force	
Farm labour	-0.4
Unskilled	-0.1
Semi-skilled	-0.7
Rural-urban temporary migration	1.5
Unskilled	0.4
Semi-skilled	2.6
Skilled	0.0

Source: Zhai and Hertel (2010).

wages and urban labour over rural labour (Zhai and Hertel, 2010). This pattern is a result of the relatively stronger decline in agricultural protection, which leads to a steeper decline in agricultural prices as compared to the prices of other sectors (see Table 7.11).

Unsurprisingly, an outcome of the relative changes in prices and factor returns is an increase in the urban-rural income ratio from 3.538 to 3.547 (see Table 7.9). In a similar manner, the overall Gini coefficient increases from 0.442 to 0.443. The Gini coefficients for urban and rural areas, however, remain constant. Poverty also increases slightly. The poverty headcount ratio rises by 0.3 percentage points to 36.7%. Following the relative decline in rural wages and returns to land, the increase in poverty entirely happens in rural areas, where the poverty rate increases from 58.1% to 58.6%. Due to the relatively low initial level of protection and the corresponding minor changes in relative prices, overall changes in poverty and inequality are small. This, however, in parts is also a consequence of the specification of the model, in particular its comparative static set-up and the assumptions of fixed factor endowments, perfect competition and constant returns to scale (Anderson et al., 2010b; Zhai and Hertel, 2010).

Along with the wage changes presented in Table 7.10, the simulations with the village equilibrium model draw upon disaggregated results on the commodity price effects of unilateral trade liberalisation in China. As Table 7.11 shows, commodity prices consistently fall with trade reform. While the overall magnitude of the reforms' price effects is modest—typically between -0.5% and -1.5%—, price decreases are most pronounced in the agricultural sector. In this sector, prices fall by between -0.8% in case of fishery and -7.4% in case of the sales price for oilseeds.[15] The food manufacturing sector experiences price decreases between -0.5% in case of the output price for tobacco products and -3.4% in case of the sales price for refined sugar. On average, the deterioration of prices in this sector is less than in agriculture, but more than in the non-food manufacturing sector, in mining or in services.

A price and wage shock which can be fed into the village equilibrium model

[15] Output prices refer to the prices of domestic output. Sales prices are composites of the prices of domestic output and imported goods and hence might differ from output prices (Zhai, 2011).

Table 7.11.: Price effects of unilateral trade liberalisation in China (national level, % change against baseline).

Commodity	**Output price**	**Sales price**
Agriculture		
Paddy rice	-1.0	-1.0
Other grains	-1.7	-1.7
Fruits and vegetables	-1.0	-1.1
Oilseeds	-3.6	-7.4
Other crops	-0.9	-2.1
Cattle, sheep, and so on	-1.2	-1.3
Other livestock	-1.3	-1.3
Raw milk	-1.2	-1.2
Fishery	-0.8	-0.8
Forestry	-0.7	-0.9
Food manufacturing		
Meat products	-1.1	-1.7
Grain, milled	-0.9	-0.9
Vegetable oils	-1.8	-3.0
Sugar, refined	-1.9	-3.4
Prepared fish products	-0.7	-0.7
Other processed food	-1.1	-1.4
Beverage	-0.8	-0.9
Tobacco products	-0.5	-0.8
Forage	-0.9	-0.9
Non-food manufacturing		
Textiles	-0.7	-0.6
Apparel and leather	-0.7	-0.6
Sawmills and furniture	-0.7	-0.8
Paper, printing, and so on	-0.8	-1.0
Chemicals	-0.9	-1.3
Metal products	-0.7	-0.8
Transport equipment	-1.6	-3.6
Electronics	-0.9	-1.1
Instruments	-0.9	-2.0
Other manufacturing goods	-0.5	-0.5
Mining		
Coal mining	-0.6	-0.6
Crude oil and natural gas	-0.5	-0.7
Services		
Utilities	-0.5	-0.5
Transport and postal services	-0.7	-0.7
Other services	-0.6	-0.5

Source: Zhai (2011).

is constructed by calculating average percentage changes for the different type of labour and commodity aggregates which are considered in the model. In order to do so, the percentage change results obtained by Zhai and Hertel (2010) are mapped to the individual items of the original sample. Price changes for the aggregates used in the model are calculated as weighted averages of the price changes of the individual items. As weighting factors, the value shares of each item in the corresponding aggregate of the model are used. Generally, results on sales prices from Zhai and Hertel (2010) are used for purchased consumption goods as well as intermediate inputs. In case of agricultural output and own-produced food, results for output price changes are applied. Apparently, the sectoral aggregation of the Zhai and Hertel (2010) model does not fully match the structure of the survey data. While in some instances an item of the survey data is exactly represented in the aggregate level results, in others assumptions have to be made to match the survey data with CGE results. In some cases, average changes are computed for a single item in the data. In case of rice, for example, the corresponding change in the output price can be taken directly from the national CGE results. For both fertilizers and pesticides, in contrast, the assumption is made that the price change in these items corresponds to the sales price change for the chemical sector of the CGE model. Another example is the change in the consumer price for textiles in the sample, which is approximated by an unweighted average of the change in the sales prices for textiles and apparel and leather from the CGE study. A detailed overview on the mapping of CGE results into the survey data and the following computation of aggregate price changes to be used in the policy simulations can be found in Annex E.

With respect to wage changes, one most ideally would seek to obtain national level CGE results which are disaggregated by skills level as well as by region. The former would allow to assess the different impacts of trade reform on different types of labour, whereas the latter would permit taking into account the spatial dimension, which is inherent to the village model because of the distinction of local off-farm and migration activities. Unfortunately, the Zhai and Hertel (2010) study does not offer this level of spatial detail. The differentiation of labour by skills levels and between rural and urban sectors, however, allows to match each of the activities of the village equilibrium model with one or more of the types of labour of the national CGE model.

The differentiation of labour by skills levels made by Zhai and Hertel (2010) is based on the educational attainment of the workers. Unskilled workers are illiterate or semi-literate, semi-skilled workers have visited middle or high school and skilled workers have education higher than high school level (Hertel et al., 2004b). From the survey data it is possible to calculate the average score for the educational attainment of the individuals working in the different activities. In agriculture, the average score of individuals working in this activity corresponds to incomplete primary school education. Hence, the changes of unskilled wages would apply here. Individuals from the village who take irregular local off-farm jobs have an average educational attainment between incomplete and complete primary school. Again, this matches unskilled labour of the Zhai and Hertel (2010) classification. The average educational attainment of self-employed villagers is slightly higher (complete primary education); hence they are classified as semi-skilled. People working in formal local off-farm jobs, however, on average have visited junior high school, which is semi-skilled in the national CGE model. Migrants on average also have completed primary school and are assumed to be semi-skilled.

The second layer of stratification of labour in the Zhai and Hertel (2010) model is the sector of employment. In case of agricultural labour as well as the wages in formal local off-farm employment in the village model, the correspondence is straightforward. Agricultural labour receives the agricultural wage whereas labour in the local off-farm activity is paid the rural non-agricultural wage. In the informal local off-farm activity as well as in migration, however, it is less easy to tell which sector of the aggregate model applies. People working in the informal local off-farm activity are either self-employed, take agricultural or non-agricultural jobs. In case of self-employment, rural non-agricultural wages are taken. In case of irregular jobs, which can be agricultural or non-agricultural, a weighted average of the changes in unskilled agricultural and rural non-agricultural wages is calculated. The weighting factor corresponds to the sample shares of irregular workers who work in agriculture (27%) and outside agriculture. A small share of migrants also works in agriculture. For these individuals, the change in unskilled agricultural wages can be assumed to apply. In case of other migrants, it

Table 7.12.: Price changes derived from aggregate simulation results.

	% change
Activity prices	
Agriculture	-1.79
Formal local off-farm work	-1.03
Informal local off-farm work	-1.32
Migration	-1.17
Intermediate input prices	
Capital	-1.28
Imported labour	-1.80
Services	-0.52
Consumer prices	
Own-produced food	-1.79
Food of plant origin	-1.26
Other food	-1.81
Non-food	-0.83
Services	-0.66

Source: Zhai and Hertel (2010); Zhai (2011); own calculations.

unfortunately is not known whether they take employment in urban or rural areas. Hence, a weighted average of urban semi-skilled and rural non-agricultural wages is calculated, assuming that two thirds of them work in urban and one third in rural areas. The aggregate change in migrant wages is calculated as the weighted average of the wage change for migrants working in agriculture and those who take non-agricultural jobs. The weighting factor again corresponds to the sample shares of migrant workers employed in agriculture.

Summarising the above discussion, Table 7.12 presents the price changes, which are derived from the national CGE simulation results and which constitute the policy scenario to be analysed with the village equilibrium model. Reflecting the negative impact on agricultural production in the national level CGE model, agricultural production is the most adversely affected of the three activities. The price of this activity, i.e. the aggregate price of agricultural output, deteriorates by -1.79%. Activity prices in the off-farm activities, i.e. wages, decline less. Wages in formal local off-farm work decline by -1.03%, in informal local off-farm work the decrease is at -1.35% and in migration workers have to accept -1.17% lower payment. As discussed above, the differences mirror the differences in skills levels of the individuals who work in the different activities.

Intermediate input prices are by between -0.50% and -1.80% lower after trade reform. The strongest decline is in the price of village imported labour, which is the wage for unskilled agricultural labour. The decrease in consumer prices is between -0.66% in case of services and -1.81% for other purchased food. The price for own-produced food is assumed to be the same as the agricultural output price, reflecting the opportunity cost of self-consumption. Hence, the same price change applies.

7.3.2. Simulated Scenarios

The previous section deals with the policy scenario to be analysed with the village equilibrium model. Along with the two different possible land market regimes in the model (recall Section 7.1) and the two calibrations for the different assumptions on households' migration behaviour (Section 7.2.3), this results in a total number of four policy simulations which are carried out:

- Simulation 1: Unilateral trade liberalisation without a land rental market and with equal own-wage responses in migration.
- Simulation 2: Unilateral trade liberalisation without a land rental market and with different own-wage responses in migration.
- Simulation 3: Unilateral trade liberalisation with a village land rental market and with equal own-wage responses in migration.
- Simulation 4: Unilateral trade liberalisation with a village land rental market and with different own-wage responses in migration.

In the following section, the results of the four simulations are presented and discussed. We start out with the results of the two first simulations, the impacts of trade liberalisation without a land market. In this part, a first insight in the impacts of trade reform on the village is provided. Further, the two calibrations of the migration behaviour of the households are compared and discussed. Finally, statements about the overall quality of the model are made.

In a second part, the results obtained under the assumption of a village land rental market with the calibration for equal migration responses are contrasted with the corresponding results from the simulations without a land market. These discussions are followed by the presentation of results from the two different calibrations of households' labour allocation behaviour. This allow assessing the effects of the differences in own-wage responses in migration in a situation with a land market. The section concludes with an assessment of the role of a village land rental market for the outcome of the policy reforms.

7.4. The Impact of Trade Liberalisation on Migration, Poverty and Inequality

7.4.1. Policy Impacts Without a Land Rental Market

7.4.1.1. Household Level Impacts

Households, which face price and wage changes induced by trade liberalisation adjust in order to cope with this shock. The adjustment reactions captured by the model comprise changes on the production side—labour allocation and input demand—as well as adaptations on the consumption side. At the household level, the consequences are new levels of activity outputs, sales and purchases, as well as income, expenditure and welfare impacts. Starting from income, expenditure and welfare, which represent the most general level of policy impacts, the present subsection discusses each of the single impacts in detail and provides a clear picture of the effects of trade liberalisation on Changtian village as well as of the pathways via which these impacts are generated. All percentage change results will be presented with two decimals. This choice is not made to pretend accuracy. Rather, due to the small relative changes actuated by the policy shock it is necessary in order to make visible the small differences between the different simulations.

7.4.1.1.1. Household Income, Expenditure and Welfare

Table 7.13 shows the effects of the policy reforms on household income levels, expenditure and welfare. The upper part of the table contains the results of the simulation with the calibration, which assumes equal own-wage responses in migration. The lower part presents the results for the one assuming different own-wage responses.[16]

[16] Given the differences in cross-price responses, the expressions "equal migration responses" and "different migration responses" of course are not fully correct (recall the discussions in Section 7.2.3). For the sake of simplicity in presentation, however, they are used in the tables

Table 7.13.: Household level impact of trade liberalisation on per capita income and expenditure (in value terms, % change against baseline).

Calibration:	**Equal migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Income						
Net income	-1.14	-1.42	-1.73	-1.32	-1.46	-1.69
Remittances	-1.39	-1.37	-1.22	-1.24	-1.16	1.09
Formal off-farm	-1.04			-1.04		-1.04
Informal off-farm	-1.86	-1.85	-1.87	-1.88	-1.88	-1.92
Agriculture	-2.55	-2.50	-2.36	-2.77	-2.52	-2.62
Expenditure						
Consumption expenditure	-1.32	-1.52	-1.84	-1.48	-1.65	-1.91
Household welfare						
EV (yuan per capita)	-2.55	-2.50	-2.36	-2.77	-2.52	-2.62
EV (% of initial expenditure)	-0.05	- 0.11	-0.18	-0.06	-0.09	-0.17
CPI[a]	-0.88					
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Income						
Net income	-1.12	-1.40	-1.73	-1.32	-1.46	-1.71
Remittances	-1.30	-1.29	-1.20	-1.27	-1.15	1.98
Formal off-farm	-1.04			-1.04		-1.04
Informal off-farm	-1.87	-1.85	-1.87	-1.85	-1.88	-1.94
Agriculture	-2.56	-2.51	-2.36	-2.76	-2.52	-2.74
Expenditure						
Consumption expenditure	-1.29	-1.50	-1.83	-1.48	-1.65	-1.93
Household welfare						
EV (yuan per capita)	-2.56	-2.51	-2.36	-2.76	-2.52	-2.74
EV (% of initial expenditure)	-0.05	-0.11	-0.18	-0.06	-0.09	-0.17
CPI[a]	-0.86					

a Average value for all households.

The figures on changes in net income in the upper part of the table reveal that the households in general suffer from decreases in net income. Differences between household groups are small, but visible. Low income households of both migration groups face the highest relative decreases, followed by the middle income households. The high income households are hurt least in terms of relative income losses. The overall magnitude of the deteriorations in income, however, is comparatively small, ranging between -1.14% for the low migration high income household and -1.73% for the low income households of the same migration group. The households of the high migration group tend to have slightly higher relative income losses from trade liberalisation. This mainly is a consequence of the stronger contraction of farm incomes, which weighs more heavily for this group, as its household on average also have higher shares of agricultural income in the initial situation (see Table 5.8 in Chapter 5).

Regarding the income from remittances, all households of the low migration group experience losses. The magnitudes of these losses range between -1.22% and -1.39%. The decrease is lower on average for the households of the high migration group. The high income household even earns around 1.09% more income from migration. The differences between low and high migration households stem from the different migration responses to the policy shock (see Table 7.14). As will be discussed more in detail below, migrants of the low migration group tend to return home, whereas the households of the high migration group return to a smaller extent or even expand their migration activity.

The comparatively large increase in remittances of the low income household of the high migration group is caused by its strongest and most positive migration response. As is further explained in the context of the labour supply responses of the households (Table 7.14), this reaction is related to a stronger migration response to a decline in the shadow wage. This strong reaction, in turn, stems from a more elastic calibration of the utility term in the migration function.

With respect to the relative income levels of the households within the migration groups, households with higher income appear to have higher losses of remittances. This observation can again be traced back to the stronger reduction of the time worked in migration. Furthermore, the higher share of their income the migrants

of the present chapter.

of these households send home and the higher marginal income losses a given reduction in migration consequently entails play a role.

By and large, however, relative changes in remittances are low, reflecting the only small changes in wages in the scenario and the correspondingly small migration responses. The exception, as mentioned, is the low income household of the high migration group, which responds to the relatively smaller decline in migration wages by putting comparatively high amounts of additional labour into migration.

Income from formal local off-farm employment contracts by -1.04% for all households, which are involved in this activity. As households are assumed to exhibit very inelastic labour supply reactions in this activity, this change in activity income mainly reflects the deterioration in formal local off-farm wages due to trade liberalisation. At around -1.9%, relative decreases in income from informal local off-farm work are virtually the same for all households.

In case of agricultural income, the combined effect of stronger price decreases and the reduction of agricultural production causes relative declines to be substantially larger than in the other activities. Furthermore, there is a tendency towards stronger income deterioration for the high income households of both migration groups. The explanation which applies to this observation again is related to the household shadow wage: A less pronounced decrease in the shadow wage (Table 7.15) lets farm labour be relatively more expensive to these households than to others. Therefore, the households reduce the time worked in farming more than others (Table 7.14) and the overall level of this activity declines relatively more. The magnitudes of the decreases in shadow wages, in turn, are related to a number of factors. First, the calibrations of the labour allocation functions of the different off-farm activities plays a role. Second, the behaviour of the utility terms in the migration functions influences how much the shadow wage moves as a response to a migration wage shock. Third, different endowments of household with family labour, differences in the earnings structure and differences in the parameters of the LES have an influence.

When comparing the two migration groups, the reductions in agricultural income appear to be higher in case of the households of the high migration group. This pattern arises because high migration households withdraw less labour from migration and on average reduce the time worked on the farm more than the low migration households. In the consequence, they also reduce their levels of the farming activity more than others. This leads to a lower demand for land and therefore to higher decreases in the returns from this factor.

The differences in losses of income from the different activities can contribute to explain the pattern which can be found in the net income changes. This becomes particularly visible when comparing the two migration groups. As said, overall higher relative decreases in agricultural income cause stronger declines in net incomes of the high migration group. The effect of the relative agricultural income changes appears to be sufficiently strong that the high migration households on average have higher relative income losses. This is true even in spite of the relatively stronger reduction of remittances of the low migration group.

The factors which contribute to the differences in relative income changes in the different activities also have already been mentioned. First, households have different labour supply decisions, which influences the allocation of time to the different activities and therefore the income earned. Second, the composition of the income of the households in the initial situation plays a role. Lower shares of remittances income increase the weight of decreases in income from the other sources and dampen the negative impact of losses in remittances. Higher initial shares of agricultural income boost the effect of relative decreases in returns from this activity. In both cases, it is in particular the low income households of both migration groups which are most negatively affected (compare also to Table 5.8 in Chapter 5).

Changes in consumption expenditure follow the pattern of net income changes. Compared to the changes in net income, the fact that consumption expenditure constitute a fraction of total expenditure (and, thereby, total income) causes percentage values to be slightly higher.

While trade liberalisation obviously decreases income and expenditure levels of all households, the actual welfare impact remains an open question. Given that the trade policy reforms analysed result in declines over the full range of prices and wages and that the households' adjustment reactions may entail changes in household shadow wages (which constitute the consumer price of leisure), declining incomes and expenditures might not be sufficient for losses in household welfare.

Even if incomes are lower, a decrease in consumer prices might still result in net welfare gains. On the other hand, the fact that net incomes and consumption expenditure decline relatively more than the CPI decreases leads to the expectation that overall welfare effects are indeed negative. Thus, in order to assess the combined net welfare impact of price and income changes, the equivalent variation (EV) is presented in addition to the results on income and expenditure changes in Table 7.13. The EV measures the amount by which the income of the household in the situation without a price change had to be changed for the household to be equally well off as in the situation after a price change (Varian, 1999). Positive values indicate welfare gains from the reform, negative values welfare losses.[17]

According to the results in Table 7.13, trade liberalisation leads to per capita welfare losses which range between -2.36 yuan and -2.77 yuan under the specification with equal own-wage responses in migration. Generally, the high migration households are more negatively affected in absolute terms than the households of the low migration group. Furthermore, the high income households of both migration groups experience the highest welfare losses in their respective group. Differences in the EV between households, however, are small. Bearing in mind that the period under consideration is one year and that total expenditures per adult equivalent in the base data range between 1,299 yuan to 5,600 yuan per capita (Table 5.8), the welfare losses appear to be almost insignificant.

If the welfare effects of the reform, however, are compared with the per capita expenditures of the representative household groups in Table 5.8, the size of the EV obtained from the simulation relative to per capita expenditure varies greatly among the households. In fact, the low income households benefit most. While the EV of the low migration high income household makes up only 0.05% of its per capita expenditure in the base situation, it accounts for 0.18% in case of the low migration low income household. Similarly, in the high migration group, the EV

[17]Due to the possibility to use the base period as the reference point, the EV has become the standard measure of welfare changes in general equilibrium analyses (Kuiper, 2005). The EV presented here is calculated in per capita terms. Using the notation as in the model and following the approach by Blonigen et al. (1997), the EV for the LES is computed as

$$EV_h = [\frac{(HEXPCP_h - \sum_c PD_{ch} * \sigma_{ch})}{\prod_c PD_{ch}^{\gamma_{ch}}}] \prod_c PD0_{ch}^{\gamma_{ch}} + \sum_c PD0_{ch} * \sigma_{ch}$$

.

of the high income household makes up 0.06% of the initial expenditure, whereas it is 0.16% for the low income household. Following this line of argumentation, the reforms could be considered to disproportionally hurt the poor, albeit at a very small scale. This, as in case of Zhai and Hertel (2010), stems from the disproportionate reliance of poorer households on agricultural income and low skilled employment.

Turning to the lower part of Table 7.13, the outcome of the reforms under the assumption that households have different own-wage responses in migration is similar to that obtained from the first simulation run. Changes in net income differ by at most 0.02 percentage points from the results of the previous simulation with the calibration for equal migration responses. A similar statement can be made for income from formal and informal off-farm work, as well as for the changes in consumption expenditure. Here, the maximum difference between the two simulations is 0.03 percentage points. In case of agricultural income, differences if existent are also a mere 0.01 percentage points. The exception is the low income household of the high migration group whose agricultural income decreases by 0.12 percentage points more in the second simulation with different migration responses.

The effects of the differences in the calibration, however, are somewhat more visible in case of remittances income. The decreases in remittances income of the high and middle income household of the low migration group are almost 0.1 percentage points lower than under the assumption of equal migration responses. The low income household has a by 0.02 percentage points lower decrease. This is related to a weaker migration response of the households under the new calibration: The households withdraw smaller amounts of labour from migration and hence have less pronounced declines in remittances.

In case of the households of the high migration group, the picture is less clear. The high income household has a reduction in remittances which is by 0.03 percentage points larger than before. This is caused by the stronger migration response of the household due to the more elastic calibration. The household now pulls more labour out of the migration activity and correspondingly experiences higher losses in remittances. In case of the low income household, the difference between the two calibrations is most pronounced. The remittances income now increases by 1.98%, as compared to 1.09% before. This is related to a more positive migration response. Thus, as was intended, the new calibration generally leads to more pronounced migration responses in the high migration group. These responses, however, are more negative for the high income household and more positive for the low income household than under the calibration with equal migration responses.

Regarding the EV measure, differences are also very small, As compared to the first simulation, welfare losses are the same or change by 0.01 yuan for most households. The exception again is the low income household of the high migration group. The welfare losses of this household are 0.12 yuan higher than before.

In summary, with respect to the most aggregate outcome variables at the household level, the different calibration of households' labour market behaviour appears to create little differences in model results. On should bear in mind, however, that the differences that can be observed may turn larger when simulating policy scenarios which entail price and wage changes of higher magnitudes.

7.4.1.1.2. Production, Factor Allocation and Input Demand

The discussion of the simulation results up to now show the relative changes in income, both of net income and of its components. As already noted in different occasions, the net income changes depend not only on the size of the changes in income components but also on the production structure of the households. Thereby, the changes in income components largely stem from the decisions of the households regarding factor allocation and input demand following the policy shock. Accordingly, Table 7.14 presents the impact on factor allocation and input use by the different household specific activities. Closely related to this are the changes in endogenous prices—the shadow prices for labour and land—which are provided in Table 7.15. The result of the adjustments in factor allocation, which also ultimately cause the changes in income from the respective activities, are alterations in output and sales. These are shown in Tables 7.16 and 7.17.

The changes in factor allocation and input use reported in Table 7.14 represent responses by the profit-maximising households to the new set of relative prices of inputs and outputs, including the endogenous changes in the shadow prices of land

Table 7.14.: Household level impact of trade liberalisation on factor allocation and input use (quantities, % change against baseline).

Calibration:	**Equal migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Factor allocation and input use						
Migration	-0.22	-0.20	-0.05	-0.07	0.02	2.29
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.61
Agriculture						
Labour	-0.36	-0.27	0.05	-0.66	-0.21	-1.39
Land	-	-	-	-	-	-
Capital intermediates	-0.06	-0.06	0.01	-0.12	-0.21	-0.29
Imported labour	-0.06	-0.06	0.01	-0.12	-0.21	-0.29
Services	-0.06	-0.06	0.01	-0.12	-0.21	-0.29
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Factor allocation and input use						
Migration	-0.13	-0.12	-0.03	-0.09	0.02	3.19
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.63
Agriculture						
Labour	-0.45	-0.31	0.04	-0.64	-0.21	-1.98
Land	-	-	-	-	-	-
Capital intermediates	-0.08	-0.07	0.01	-0.12	-0.04	-0.42
Imported labour	-0.08	-0.07	0.01	-0.12	-0.04	-0.42
Services	-0.08	-0.07	0.01	-0.12	-0.04	-0.42

and labour. The upper part of the table covers the results from the simulation with the calibration for equal migration responses. As can be seen from the first line of the table, the amounts of labour allocated by households of the low migration group to the migration activity decline slightly. In the high migration group, the middle and the low income households migrate more, whereas the high income household reduces its level of migration.

At this, it might be somewhat surprising that the households of the low migration group migrate less although local wages and returns from the factors employed in agriculture (see Table 7.15) decrease even more than migrant wages. The explanation lies in a strong price (read: substitution) effect of the lower household shadow wage on the consumption of leisure. As Table 7.18 shows, both households consume more leisure and thereby reduce their total supply of labour to productive activities. This is consistent with the theoretical notion that the low migration households require more work to be done in the household because of the higher shares of dependants. The fact that the households with lower income draw less labour out of migration and reduce their total supply of labour by a smaller amount also fits into this scheme, as poorer households can afford less to experience income losses.

Regarding the results that the high migration households on average maintain more labour in migration or even migrate more, the same explanation applies. In case of this group, the same two counteracting effects arise: On the one hand, the relative increase in the migration wage sets incentives to migrate more. These incentives are accentuated by the cross-wage and cross-price effects mediated via the decline in shadow wages which in the tendency would lead to higher levels of migration. On the other hand, the incentives for more migration are counteracted by a price effect of the deterioration of the shadow wage on leisure demand. As the decline in shadow wages, however, on average is not that pronounced in the high migration group, in case of the high and middle income households it is only sufficient to make them maintain broadly constant levels of migration instead of returning home at a significant scale. In case of the low income household the decline in the shadow wage in turn is so weak that the household expands its total labour supply and responds to the incentives to migrate by migrating more.

Driven by the assumption of inelastic labour supply, households cannot change the time worked in the corresponding activity very much. Thus, the time worked in formal local off-farm work remains almost constant in spite of the relative increase of the wage in this activity. All three households reduce the time allocated to formal local off-farm work by a mere -0.01%. In case of informal local off-farm work and agriculture, however, households allocate significantly less labour. The time worked in informal local off-farm jobs decreases by between -0.54% and -0.61% (Table 7.14).

In agriculture, all but one household reduce the time worked in this activity. The reduction is between -0.21% and -1.29%. Only the low income low migration household works slightly more on the farm, however only 0.05%. The pattern in the reduction of work in agriculture again is explained by the different changes in shadow wages (see Table 7.15). As compared to households with stronger increases in the shadow wage, households with relatively weaker decreases reduce the time worked in agriculture more, as family labour remains relatively more expensive. This implies that the change in the amount of household labour allocated to the agricultural activity is inversely related to the change in shadow wages .

The reduction in time worked in agriculture leads to a decline in the overall levels of this activity as well as the demand for other inputs. The households, which work less on the farm also decrease their demand for intermediate inputs by between -0.04% to -1.39%. Similarly, demand for land becomes lower. This, in turn, has the consequence of lower shadow prices of this factor. In fact, shadow prices for land are from -2.36% to -2.77% lower after reform. The explained effects on the demand for intermediate inputs and land are a direct consequence of the C-D specification of the agricultural production function. A lower use of household labour decreases output levels and thereby the demand for other inputs. Furthermore, households tend to substitute labour for land.

It is interesting to take a broader look at the relative changes in time allocated to the different activities reported in Table 7.14. Five out of the six households reduce the time worked in informal local off-farm work and agriculture more than the time worked in migration. Thus, they substitute migration for the different types of local activities. This is a logical consequence of the relative increase in migration wages.

All in all, however, there are two exceptional cases. The first case is the low

Table 7.15.: Household level impact of trade liberalisation on endogenous prices (% change against baseline).

Calibration:	**Equal migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Endogenous prices						
Family labour & leisure	-2.20	-2.24	-2.40	-2.12	-2.31	-1.25
Land	-2.55	-2.50	-2.36	-2.77	-2.52	-2.62
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Endogenous prices						
Family labour & leisure	-2.12	-2.20	-2.40	-2.14	-2.31	-0.78
Land	-2.56	-2.51	-2.36	-2.76	-2.52	-2.74

income household of the low migration group, which works more on the farm but migrates less, thus increasing the ratio of time worked in agriculture and migration. This seemingly perverse effect is caused by the interplay of several effects in the model:

- The low value of the share parameter κ in the remittances function causes a more elastic reaction of labour supply to the migration activity with respect to a fall of the shadow wage. This means that the time allocated to migration increases ceteris paribus (recall the discussion in Section 7.2.3). This effect acts contrary to the deterioration of the migration wage and causes the contraction of migration to be weaker for this household.
- At the same time, the comparatively small increase in demand for leisure—a consequence of the high income losses—lets the shadow wage fall by a relatively large amount. This, in spite of falling agricultural prices, causes an expansion of the time worked in farming.

The second exceptional case is the low income household of the high migration group. The household also substitutes migration for other activities, but exhibits a disproportionally strong positive migration response. This response is the strong effect of a shrinking shadow wage, i.e. a decline in the opportunity cost of migration. The strong effect, as is explained in Section 7.2.3, stems from the elastic calibration of the utility term in the migration function of this household. To summarise, the two examples of the exceptional cases once more illustrate the implications of the inclusion of the utility terms into the labour allocation functions of the migration activities.

The discussion up to now shows that the outcome of the policy reform in terms of the households' labour allocation crucially depends on the changes in the endogenous shadow wages. Repeating what is already said above, the differences in the changes in shadow wages are the result of the workings of a number of factors:

- The calibration of the factor allocation functions of the different off-farm activities which determines the relative strength of the price and quantity effects.
- The behaviour of the utility terms, as demonstrated by the cases of the low income households of both migration groups discussed above.
- Different endowments of households with family labour as well as differences in the earnings structures.
- Differences in the parameters of the LES.

Specifically the different labour endowments, differences in earnings structures and in the parameters of the LES cause that a given response in labour supply to the three off-farm activities results in different changes in the household shadow wage.

Tables 7.16 and 7.17 present the consequences the adjustments in factor allocations have on activity output and marketed surplus. Due to the direct translation of factor use in outputs and sales in case of the off-farm activities, the figures there are identical to the changes in the households' supply of labour to these activities. In case of agriculture, the comparatively strong decline in input demand results in more modest relative decreases in outputs. The low income low migration household keeps its agricultural output roughly constant. In case of all other households, output decreases by between -0.04% and -0.29%, with the low income household in the high migration group reducing its output most. But in spite of declining or at best constant levels of agricultural output, marketed surplus increases for all households at a scale by between 0.26% and 1.02%. This is a consequence of the decrease in consumption of own-produced food which follows from lower income levels (see Table 7.18).

Up to this point, the discussion of the effects of the trade policy scenario on

Table 7.16.: Household level impact of trade liberalisation on activity outputs (% change against baseline).

Calibration:	**Equal migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Activity output						
Migration	-0.22	-0.20	-0.05	-0.07	0.02	2.29
Formal local off-farm	-0.01		-0.01		-0.01	
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.61
Agriculture	-0.06	-0.06	0.01	-0.12	-0.04	-0.29
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Activity output						
Migration	-0.13	-0.12	-0.03	-0.09	0.02	3.19
Formal local off-farm	-0.01		-0.01		-0.01	
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.63
Agriculture	-0.08	-0.07	0.01	-0.12	-0.04	-0.42

production, factor allocation and input demand focuses entirely on the results obtained from the simulation with the calibration which assumes equal own-wage responses in migration. The lower parts of each table contain the simulated effects under the assumption of different own-wage responses.

Focusing first on the impacts on low migration households, it can be seen that these households draw less labour out of migration. At the same time, they tend to reduce their time worked on the farm more or increase farm time at a lower scale. This change with respect to the first simulation stems from the less elastic migration response, which causes overall adjustments in labour quantities allocated to migration to be weaker. Households now draw less labour out of migration as the migration wage falls. On the other hand, they also respond less positively to the lower opportunity costs of migration, as given by a lower shadow wage. This weaker effect of the shadow wage is caused by the less elastic calibration of the utility terms.

In this context, the weaker migration responses, i.e. the fact that less labour is drawn out of migration, leads to less pronounced declines of the shadow wages. This, in turn, further accentuates the per se weaker reactions to falling opportunity costs of labour. A further consequence of the lower reduction in shadow wages is that the decreases in time worked in the agricultural activity are steeper.

In the high migration group, the high income household ends up with a higher ratio of time worked in agriculture and migration as in the first simulation. In case of this household, the more elastic calibration of the migration function causes the decline in the migration wage to yield a stronger reduction in migration. This, in turn, triggers a larger decrease in the shadow wage than before, leading to a smaller contraction of the time worked in agriculture.

The low income household in the high migration group, in contrast, exhibits a much stronger response to the decline in the shadow wage and increases its supply of labour to migration significantly more. All in all, the decline in the shadow wage is now smaller as before, leading to a stronger reduction of the time worked on the farm and even a slightly more reduced allocation of labour to informal local off-farm work. The middle income household of the high migration group shows similar difference, however not at the level of two decimals presented in the table.

Regarding the shadow prices, the discussion of the simulation with the calibration with equal migration responses already points to a less strong decline in shadow wages in case of the low migration households. This results from the fact that these households draw less labour out of migration in the simulation with different migration responses (Table 7.24).

The lower demand for agricultural inputs other than family labour, in turn, depresses shadow prices of land even more than in the first simulation. In the high migration group, in contrast, the shadow wage decreases more only in case of the high migration household which retreats more from migration in the simulation with different migration responses. The enhanced cross-wage responses of the other two households which cause higher increases in migration lead to weaker declines in shadow wages. The shadow prices for land change accordingly.

The differences in agricultural output and marketed surplus of farm products between the two simulations follow the differences in the changes in the use of family labour which are observed. The high and middle income households of the low migration group as well as the low income household of the high migration group reduce their output more than before. In case of the other households, differences in labour use between the two simulations are not pronounced enough to materialize in output changes. Accordingly, marketed surplus decreases less

Table 7.17.: Household level impact of trade liberalisation on marketed surplus (% change against baseline).

Calibration:	**Equal migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Sales						
Migration	-0.22	-0.20	-0.05	-0.07	0.02	2.29
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.61
Agriculture	0.28	0.55	1.02	0.39	0.45	0.26
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Sales						
Migration	-0.13	-0.12	-0.03	-0.09	0.02	3.19
Formal local off-farm	-0.01		-0.01		-0.01	
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.63
Agriculture	0.24	0.52	1.01	0.40	0.45	0.09

for the low migration group and the low income household of the high migration group. The high migration high income household has a slightly higher increase in marketed surplus and that of the middle income household is as before.

7.4.1.1.3. Household Consumption

The combined effect of changes in relative prices and income causes households to adjust their consumption bundles. Given that all prices as well as income levels decrease, it is a question specific to each commodity whether the price (substitution) effect or the income effect dominates. Under both calibrations, the picture which arises from the simulations is similar. Demand for own produced food decreases by -0.79% to -1.45%. Changes in demand for food of plant origin and other food are slightly positive or negative, depending on the level of decrease in income of the respective household. At this, the markedly stronger decrease in consumption of own-produced food stems from the differences in income elasticities of demand. They are higher in case of own-produced food and the resulting income effect is sufficient to overcompensate the relatively stronger decline in the price of the commodity due to trade liberalisation.

Similarly, households consistently consume less of the non-food and the ser-

Table 7.18.: Household level impact of trade liberalisation on consumption (% change against baseline).

Calibration:	Equal migration responses					
Migration group:	Low migration			High migration		
Income level:	High	Middle	Low	High	Middle	Low
Household consumption						
Own produced food	-0.81	-1.04	-1.32	-0.96	-1.17	-1.42
Food of plant origin	-0.07	-0.23	-0.41	-0.17	-0.31	-0.48
Other food	0.16	-0.02	-0.24	0.05	-0.13	-0.33
Non-food	-0.58	-0.97	-1.43	-0.82	-1.19	-1.60
Services	-0.79	-1.21	-1.70	-1.05	-1.44	-1.88
Leisure	0.61	0.31	0.04	0.34	0.18	-1.03
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Household consumption						
Own produced food	-0.79	-1.03	-1.32	-0.96	-1.17	-1.45
Food of plant origin	-0.06	-0.22	-0.41	-0.17	-0.31	-0.50
Other food	0.18	-0.01	-0.24	0.04	-0.13	-0.35
Non-food	-0.55	-0.95	-1.43	-0.83	-1.19	-1.65
Services	-0.76	-1.18	-1.70	-1.06	-1.44	-1.94
Leisure	0.58	0.30	0.04	0.35	0.18	-1.45

vices commodity, reflecting the comparatively high income elasticities of these items. As already noted above, consumption of leisure is positively affected by the comparatively strong decreases of the households' shadow wages. Although income elasticities for leisure demand are also relatively high, the income effect is dominated by the substitution effect and demand for leisure increases at rates between 0.04% and 0.61% in case of five out of the six households. The exception, again, is the low income household of the high migration group which decreases its consumption of leisure by -1.03% and -1.45%, respectively.

As already noted in the context of labour supply, the corollary of the increase in leisure demand of most households is that total labour supply declines. Thus, the lower wages and prices not only lead to reallocations of labour between the activities, but also cause the household to work less.

7.4.1.2. Village Level Impacts

Taken together, the household level impacts of trade liberalisation lead to a particular outcome for the community as a whole. From the perspective of the village

Table 7.19.: Impact of trade liberalisation on village trade (% change against baseline).

Calibration:	**Equal migration**	**Different migration**
Exports		
Migrant labour	0.20	0.32
Formal local off-farm labour	-0.01	-0.01
Informal local off-farm labour	-0.55	-0.55
Agricultural outputs	0.46	0.44
Imports		
Capital intermediates	-0.08	-0.09
Imported labour	-0.06	-0.07
Food of plant origin	-0.24	-0.24
Other food	0.00	0.00
Non-food	-0.91	-0.90
Services	-1.08	-1.07

economy and its contribution to the national economy, exports and imports are relevant variables. As Table 7.19 shows, the village as a whole exports more migrant labour to the rest of the country. The increase is 0.20% for the simulation with equal migration resonses and 0.32% in case of the simulation with different migration responses. Formal local off-farm labour remains practically constant, but villagers seek less informal employment outside the village. At -0.55% for both simulations the decrease corresponds to the average of the household level values. The trend to raise the marketed surplus of the agricultural commodity results in an overall increase in exports of farm outputs from the village by about half a percent.

Shrinking imports of the capital intermediate input and hired labour by -0.06% to -0.09% mirrors the lower agricultural production activity in the village. Imports of food of plant origin decline by about quarter a percent and those of other food remain constant. The latter reflects the higher consumption by some households and reductions by others. Imports of non-food products and services, however, decrease more, by roughly 1% for both commodities. In case of services, this decrease stems not only from lower consumption levels, but also from the lower use of services in agricultural production.

The issue this research ultimately is concerned with is the impact of trade liberalisation on poverty and inequality in the village. As the first line of Table 7.20 indicates, total village income, which can be regarded as a rough indicator for the living standard in the village as a whole, decreases by about -1.4% in both

Table 7.20.: Impact of trade liberalisation on village income, poverty and inequality.

Scenario:	**Base**	**Trade liberalisation**	
Calibration:		**Equal migration**	**Different migration**
Total village income[a]	0.0	-1.39	-1.38
Poverty indices			
P0 (low)	0.220	0.220	0.220
P0 (high)	0.447	0.449	0.449
P1 (low)	0.049	0.050	0.050
P1 (high)	0.105	0.107	0.107
P2 (low)	0.018	0.018	0.018
P2 (high)	0.043	0.044	0.044
Gini coefficient (%)	29.410	29.493	29.495

a %-change against baseline.

simulations. This overall decline in income, however, only translates into minor increases in the poverty measures used.

The poverty headcount ratio (P0) remains constant when using the low poverty line. Under the high poverty line, the share of poor in the population rises by 0.2 percentage points to a post-reform level of 0.449. The latter corresponds to an increase in poverty by about -0.2% trough trade reform. Seen in the context of estimated annual rate of poverty reduction for Guizhou during the years 1988-2000 of -6.5% (Ravallion and Chen, 2007), this figure appears to be small.

The poverty gap index (P1) increases by about 0.1 percentage points for both model calibrations when calculated with the low poverty line. For the high poverty line, the change again is larger with a rise of P1 from 0.105 to 0.107. Expressing the average shortfall of income of the poor from the poverty line, these results suggest that the poor on average have moved a little further away from the poverty line. Expressed in percentage terms, the poverty gap from the high poverty line is increased by around 2.0%. As in case of the poverty headcount, this appears to be small when compared to the longer term rate of reduction of -7.7% provided by Ravallion and Chen (2007).

The poverty severity index, which puts a higher weight on higher poverty gaps, remains constant for the low poverty line and increases from 0.043 to 0.044 for the high poverty line. This is equivalent to a rise by 2.3%, again with the high poverty line. As in case of the poverty headcount and the poverty gap, this rate seems small when compared to the annual rate of poverty reduction of -8.35% in

Guizhou during the 1990s as estimated by Ravallion and Chen (2007).

The relatively higher decrease in net incomes of the low income households in both migration groups results in a distributional impact at the village level. Following trade reform, the Gini coefficient increases from 29.410 to 29.493 and 29.495, respectively. Thus, in this model trade reform appears to accentuate the general trend of increasing inequality in China (Ravallion and Chen, 2007).

7.4.1.3. Summary

At this point, it is possible to provide a first assessment of the village equilibrium model. Overall, the relative changes in model variables compared to the base situation are small. Due to only minor price and wage changes in the policy scenario, this is within expectations. In general, magnitudes of the results and directions of change are comparable to those found in the national level simulations. Returns to land decrease by around -2.6% in the village model as compared to -3.5% in the national model and returns to agricultural labour decline by -2.0% on average in the village model and by -1.8% in the national level CGE (Zhai and Hertel, 2010). Regarding the allocation of labour, both models find an increase in migration at the expense of the agricultural sector. The change in migration, however, is of a lower magnitude in the village model. In the Zhai and Hertel (2010) model, semi-skilled rural-urban temporary migration increases by 1.3%, whereas the village model predicts around 0.25% more migration. One of the reasons for this difference certainly is the impact of reform on households total labour supply in the village model. The advantage of the village model, however, is that it offers much more detailed insights with respect to the question of who migrates and why.

The two models also coincide with respect to the direction of the impact of the trade reform on poverty and inequality. Regarding poverty, both models predict an increase in the poverty headcount ratio, but again the change in the village model (0.02 percentage points) is smaller than in the national model (an increase by 0.5 in the rural poverty headcount ratio). In inequality, the slight increase in the Gini coefficient by around 0.08 compares to a Gini coefficient which remains constant for rural areas and which increases by 0.001 in general in the Zhai and Hertel (2010) model. In spite of the higher increase in poverty, Zhai and Hertel

(2010) also expect relative welfare losses higher than those resulting from the village model. While welfare losses make up around -0.5% for the income of rural diversified households in the former case, they account only for -0.05% to -0.18% of expenditures in the latter. As several reasons for these differences can be found, such as the inclusion of leisure consumption into the village model and the use of potentially different income or expenditure measures, the important result is that the direction of change is identical.

Regarding the results at the household level, several patterns arise from the village model. With respect to the welfare impact of the reform, high migration households tend to be slightly worse off than low migration households in terms of absolute EV. Likewise, high income households tend to lose more than low income households. This result is consistent insofar as home time generally is attached a positive utility and those who can spend more time at home result to have the lowest welfare losses. Attention, however, should be paid to the explanation that the price of leisure plays a role for rise of the observed patterns. As this price, i.e. the shadow wage, depends on the migration responses of the households, this clearly shows how the labour market behaviour of the households indeed matters for the outcomes of the model simulations.

At this, the migration patterns predicted by the model appear to make sense. The low migration households with relatively more dependants migrate less, i.e. they shift relatively less labour from local activities to migration. At the same time, the result that migration levels decrease due to an overall reduced supply of labour does not stand contrary to this statement.

Some interesting aspects related to the results on households' labour allocation, however, should be mentioned. Apparently, different migration responses arise although factor allocation functions in migration are calibrated to the same own-wage responses. This is a consequence of the differences in the effect of changes in shadow wages which in turn are ultimately determined by the values of κ (also recall the discussion in Section 7.2.3). The implication is that the share of income, migrants send home has a substantial influence on model results.

This influence becomes especially visible in the cases of the low income low migration household, which contrary to the general trend increases the time worked in agriculture relative to migration, and the low income household of the high migration group, which has comparatively strong migration responses. The interpretation of these behavioural patterns is found in the calibration of the utility terms in the labour allocation functions for migration: Falling values of κ correspond to lower marginal returns from migration. This increases the weight of the opportunity cost of labour in the households' labour allocation decisions and causes strong reactions to changes in the shadow wage.

From the perspective of the households, this appears to be fully rational. If the financial returns from migration to the household are low, the household loses little in monetary terms when it reduces migration and puts the labour to alternative local uses. Therefore, it appears preferable to pull comparatively large amounts of labour out of migration as soon as the opportunity cost of labour declines. On the other hand, such a behaviour in the model also implies the assumption that the perspective of the migrant is neglected and that the household back home exerts full control about the fate of the migrant.

Thus, in general the differences between the two calibrations that are observed are very small. In fact, many of them are invisible when presented with only one decimal. As regarding the practical outcome of the examined trade liberalisation scenario, the differences might be largely irrelevant. They might matter, however, when applying a scenario which involves stronger price changes. Furthermore, from a technical point of view the discussion on the differences throughout this section illustrated the properties of the model. In particular, with respect to household labour allocation it is possible to highlight the symmetry of less elastic migration responses. While in the calibration the less elastic response was only calibrated to an increase in the migration wage, households also exhibit a less elastic response when the situation requires return migration. Although logical, it is however somewhat disturbing that high migration households which should be more interested in working in migration also might return home quicker under the assumption of more elastic own-wage responses in migration.

7.4.2. Introducing a Land Rental Market

Well functioning markets are generally expected to increase the allocative efficiency in an economy and to enhance the potential welfare gains of policy reforms aimed at reducing economic distortions. In the two simulations studied previously, the assumption of absent land markets was made, thus restricting land use by households to their initial levels. All adjustments are made by a shadow price for land which was endogenous to each household. In the second set of simulations, the results of which are discussed in the present section, the existence of a village land market, which is perfect in a neoclassical sense, is assumed. Land can be traded among households and a uniform village land rental rate which clears the land market arises.

The section is subdivided into three parts. In the first part, the household level and village level impacts of trade liberalisation are dealt with. Unlike in the section on the simulations without a land market, in this first part only the results of the simulations under the calibration with equal migration responses are discussed. In order to facilitate the assessment of the role of the land market, however, they are directly contrasted with the corresponding results obtained from the simulations without a land market.

The second part seeks to assess the effects of the different assumptions regarding the households' migration responses in the simulations with a land market. Selected results from the two simulations with the different calibrations are compared. The third part summarises the section and provides an assessment of the role of a land market in the village.

7.4.2.1. Comparing Reform Impacts With and Without a Land Market

7.4.2.1.1. Household Level Impacts

Table 7.21 presents the impact of the trade liberalisation scenario on income, expenditure and welfare for the two closures regarding the land market regime. The upper part of the table contains the results from the simulations with a land market, the lower part repeats those obtained from the simulations without a land market, both with the calibration assuming equal migration responses.

Focusing on the upper part of the table first, households experience losses in net income by between -1.14% and -1.77%. High migration households have higher losses on average and those with low income tend to be affected more negatively by the reform in terms of relative income losses. Compared to the effects of trade

Table 7.21.: Household level impact of trade liberalisation on per capita income and expenditure, equal migration responses (in value terms, % change against baseline).

Land market closure:	**Land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Income						
Net income	-1.14	-1.39	-1.54	-1.41	-1.44	-1.77
Remittances	-1.40	-1.39	-1.34	-1.11	-1.21	1.63
Formal off-farm	-1.04			-1.04		-1.04
Informal off-farm	-1.87	-1.87	-1.92	-1.79	-1.90	-1.91
Agriculture	-2.51	-2.43	-1.99	-3.27	-2.43	-2.82
Expenditure						
Consumption expenditure	-1.31	-1.49	-1.63	-1.58	-1.62	-2.00
Household welfare						
EV (yuan per capita)	-2.22	-1.89	0.64	-6.06	-1.90	-3.73
EV (% of initial expenditure)	-0.04	-0.08	0.05	-0.12	-0.07	-0.27
CPI[a]	-0.86					
Land market closure:	**No land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Income						
Net income	-1.14	-1.42	-1.73	-1.32	-1.46	-1.69
Remittances	-1.39	-1.37	-1.22	-1.24	-1.16	1.09
Formal off-farm	-1.04			-1.04		-1.04
Informal off-farm	-1.86	-1.85	-1.87	-1.88	-1.88	-1.92
Agriculture	-2.55	-2.50	-2.36	-2.77	-2.52	-2.62
Expenditure						
Consumption expenditure	-1.32	-1.52	-1.84	-1.48	-1.65	-1.91
Household welfare						
EV (yuan per capita)	-2.55	-2.50	-2.36	-2.77	-2.52	-2.62
EV (% of initial expenditure)	-0.05	-0.11	-0.18	-0.06	-0.09	-0.17
CPI[a]	-0.88					

a Average value for all households.

reform on net income in a situation without a land market, four out of the six households lose less, whereas two have more pronounced income reductions.

This latter observation can be directly traced to the existence of the land market. The two households which have higher income losses than in the situation without a land market, i.e. the high and the low income household of the high migration group, reduce the area they use for agricultural production (see Tables 7.22 and 7.23). This leads to comparatively high decreases in income from farming and ultimately also to the observed higher losses in net incomes. Even the fact that the two households also have lower reductions in remittances and informal off-farm income than in the situation without a land market cannot compensate for these losses.

In case of remittances income, the households of the low migration group as well as the middle income household of the high migration group have to accept losses which are higher than without a land market. Overall, these losses range between -1.21% and -1.40%. The high and the low income household of the low migration group, in contrast, end up with larger amounts of remittances than without a land market. Remittances of the high income household are reduced by -1.11%, as compared to -1.24%. The low income household after reform receives 1.63% more in remittances, up from 1.09%.

A look at the changes in agricultural income confirms that this pattern is related to the possibility to trade land on the village market. The households which have higher reductions in remittances have lower losses in farm incomes (and vice versa) than in the situation without a land market. This stems from stronger reductions in the involvement in off-farm activities and lower reductions of the time worked in agriculture by these households. These effects, in turn, are rooted in an expansion of land use (Tables 7.22 and 7.23).

In summary, the existence of a land market has a perceivable impact on the relative income changes experienced by the different households due to trade reform. Thereby, at the level of the single activities, the land market allows some households to focus more on agriculture by using more land. In comparison with the situation without a land market, the consequence is a lower reduction in farm incomes, but higher losses in off-farm incomes for these households. Other households draw out of agriculture and apparently put more emphasis on migration and local off-farm work. This results in lower reductions in income from these activities for these households, but stronger declines in farm income. As the former, however, are not sufficient to compensate for the latter, the net income effects of trade reform for them is more negative in the situation with a land market.

The decreases in consumption expenditure again follow the pattern of the changes in net income. After reform, households spend by between -1.31% and -2.00% less on consumption and the decline is higher for the high migration households. According to the high reductions in net incomes (relative to the CPI), the welfare outcome of the reform is negative for five out of the six households. The EV in absolute terms ranges between a positive 0.60 yuan per capita for the low income household in the low migration group and -6.06 yuan per capita for the high income household in the high migration group. Relative to initial levels of per capita expenditure, welfare losses are between -0.04% and -0.27%. The welfare gain of the low income household of the low migration group is 0.05% of initial expenditure.

Compared to the situation without a land market, the reforms' welfare impacts, as expressed by the absolute as well as the relative EV, differ much more between the households. The pattern observed previously that poorer households tend to loose out more in relative terms now vanishes. Rather, the four households which manage to at least partly mitigate the losses in farm income by using more land also have smaller welfare losses than in the situation without a land market, or even gains. The two households which reduce their land use incur higher losses in farm income and therefore also higher reductions in net income, in contrast, are worse off.

At this, although little intuitive at the first sight, this behaviour is entirely rational. In fact, if the households' initial utility functions are recovered from the calibrated parameters and if values for utility are calculated from these functions, the two households which reduce their land use and migrate more have higher utility levels if a land market exists. This also suggests that the EV as used in the current analysis does not capture all welfare impacts of trade reforms and perhaps should be modified to include the utility connotations which are attached to labour market participation.

Table 7.22 presents the simulation results for the household level impacts of trade liberalisation on factor allocation and input use. According to the upper part of the table, the changes in relative prices caused by trade liberalisation bring about a return of migrants from the low migration group to the village. These households reduce the time worked in migration by between -0.16% and -0.22%. Households of the high migration group migrate more. The high and middle income households show a slightly positive migration responses, with increases in the time worked in migration by 0.06% and 0.03%, respectively. The low income household of the high migration group responds strongly positive to the relative increase in the migration wage and allocates 2.83% more time to the activity.

When contemplated against the changes in supply of household labour to the agricultural activity and land use by the households, the patterns already identified in the context of the discussion of the income changes, become more pronounced. Four out of the six households, namely those from the low migration group and the middle income household of the high migration group, use more land following trade reform. The two remaining households reduce the area farmed. Those which increase their land use, also work more on the farm, or at least reduce the time worked less than in the situation without the land market. This reaction, however, happens at the expense of local off-farm activities and/or migration, as the time worked in these activities declines more than before.

This observation inevitably leads to the question for the reasons why a particular household uses more land after trade reform, or less. The explanation involves the changes in shadow prices for land in the situation without a land market. The bottom part of Table 7.23 reveals the two important points:

- The two households which make land available to other households have relatively large decreases in their shadow prices. This reflects an implicit and relatively strong reduction in demand for land.
- The decline in the shadow prices of the remaining four households, in contrast, is lower.

The consequence is that, as soon as land can be traded on the market, a uniform land rental rate arises within the village. This land rental rate is, as the upper part of Table 7.24 shows, higher than the shadow prices for land of the high and low income households of the high migration group in the situation without a land market and lower than those of the remaining households. Hence, the former

Table 7.22.: Household level impact of trade liberalisation on factor allocation and input use, equal migration responses (quantities, % change against baseline).

Land market closure:	**Land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Factor allocation and input use						
Migration	-0.22	-0.22	-0.16	0.06	0.03	2.83
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.55	-0.61	-0.48	-0.58	-0.60
Agriculture						
Labour	-0.18	0.08	2.12	-3.19	0.15	-2.35
Land	0.36	0.70	3.30	-3.58	0.70	-1.19
Capital intermediates	0.27	0.56	3.07	-3.51	0.59	-1.43
Imported labour	0.27	0.56	3.07	-3.51	0.59	-1.43
Services	0.27	0.56	3.07	-3.51	0.59	-1.43
Land market closure:	**No land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Factor allocation and input use						
Migration	-0.22	-0.20	-0.05	-0.07	0.02	2.29
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.61
Agriculture						
Labour	-0.36	-0.27	0.05	-0.66	-0.21	-1.39
Land	-	-	-	-	-	-
Capital intermediates	-0.06	-0.06	0.01	-0.12	-0.21	-0.29
Imported labour	-0.06	-0.06	0.01	-0.12	-0.21	-0.29
Services	-0.06	-0.06	0.01	-0.12	-0.21	-0.29

make land available to the latter.

Table 7.23.: Household level impact of trade liberalisation on land rentals, equal migration responses (quantities, % change against baseline).

Migration group:	Low migration			High migration		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Net land rentals						
Net area rent in	4.54	-	-	-46.60	5.09	-36.78
Net area rent out	-	-95.10	-70.01	-	-	-

This leads to an adjustment in agricultural land use by the households. These adjustments result in changes in land rentals, as already indicated during the above discussions and depicted in Table 7.23. The high income low migration household, which rented in land in the initial situation, increases its rentals by 4.54%. Similarly, the middle and low income households of the same migration group rent out less land after trade liberalisation, reducing the area rent out substantially by -95.10% and -70.01%, respectively. The middle income household of the high migration group, which also increases its land use, rents in around 5.09% more land. The land demand by the four households mentioned is matched by increases in supply by the high and low income households of the high migration group, which reduce the area they rent in to around a half and two thirds of the initial levels.

Regarding changes in output, presented in Table 7.25, the figures for the off-farm activities again correspond to those on input use. Changes in agricultural production reflect the adjustments in land use and therefore differ substantially from the results obtained from the simulations without a land market. The high and the low income household of the high migration group both reduce their levels of output by magnitudes between -3.51% and -1.43%, as compared to -0.12% and -1.43%, respectively. The households which use more land after reform produce between 0.27% and 3.07% more of the agricultural commodity, which means a reversal in sign for three and a substantial increase for all households when put against the results without a land market.

Changes in marketed surplus of agricultural products as reported in Table 7.26, once again reflect the effect of the land market and in most cases are more pronounced than output changes. Households with increased outputs raise their

Table 7.24.: Household level impact of trade liberalisation on endogenous prices, equal migration responses (% change against baseline).

Land market closure:	**Land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Endogenous prices						
Family labour & leisure	-2.05	-1.97	-1.45	-2.96	-2.04	-1.42
Land	-2.58	-2.58	-2.58	-2.58	-2.58	-2.58
Land market closure:	**No land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Endogenous prices						
Family labour & leisure	-2.20	-2.24	-2.40	-2.12	-2.31	-1.25
Land	-2.55	-2.50	-2.36	-2.77	-2.52	-2.62

marketed surplus by higher margins than without a land market. The high and low income households of the low migration groups no longer increase their marketed surplus as in the situation without without a land market, but reduce their sales.

Table 7.27 illustrates how consumption levels and patterns of the households in the village are affected by trade liberalisation under the different assumptions regarding the presence of a village market for land. As the upper part of the table shows, the effect of lower consumption expenditure, i.e. income, prevails over the effect of lower consumer prices for all households in case of own produced food, purchased food of plant origin, non-food products and services. That means, for these products the decline in income leads to a reduction in consumption levels. Consumption of own produced food contracts by between -0.81% and -1.49%. Demand for food of plant origin declines by between -0.07% and -0.53%. Between -0.58% and -1.72% less non-food items are consumed. Regarding services, households reduce their purchases from -0.79% to -1.15%.

In case of other purchased food, the picture is more mixed. The high income household of the low migration group increase its consumption by 0.17%. The other households maintain their consumption levels constant or reduce them. The reduction, however, is less pronounced than in case of the commodities discussed before. Similarly, in response to a relative decline of the prices for labour, three out

Table 7.25.: Household level impact of trade liberalisation on activity outputs, equal migration responses (quantities, % change against baseline).

Land market closure:	**Land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Activity output						
Migration	-0.22	-0.22	-0.16	0.06	-0.03	2.83
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.55	-0.61	-0.48	-0.58	-0.60
Agriculture	0.27	0.56	3.07	-3.51	0.59	-1.43
Land market closure:	**No land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Activity output						
Migration	-0.22	-0.20	-0.05	-0.07	0.02	2.29
Formal local off-farm	-0.01		-0.01		-0.01	
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.61
Agriculture	-0.06	-0.06	0.01	-0.12	-0.04	-0.29

Table 7.26.: Household level impact of trade liberalisation on marketed surplus, equal migration responses (quantities, % change against baseline).

Land market closure:	**Land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Sales						
Migration	-0.22	-0.22	-0.16	0.06	-0.03	2.83
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.55	-0.61	-0.48	-0.58	-0.60
Agriculture	0.76	1.54	6.31	-5.03	1.35	-1.40
Land market closure:	**No land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Sales						
Migration	-0.22	-0.20	-0.05	-0.07	0.02	2.29
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.54	-0.55	-0.54	-0.57	-0.61
Agriculture	0.28	0.55	1.02	0.39	0.45	0.26

Table 7.27.: Household level impact of trade liberalisation on consumption, equal migration responses (quantities, % change against baseline).

Land market closure:	**Land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Household consumption						
Own produced food	-0.81	-1.03	-1.18	-1.01	-1.15	-1.49
Food of plant origin	-0.07	-0.22	-0.32	-0.21	-0.30	-0.53
Other food	0.17	-0.01	-0.13	0.00	-0.11	-0.38
Non-food	-0.58	-0.94	-1.20	-0.92	-1.16	-1.72
Services	-0.79	-1.18	-1.45	-1.15	-1.41	-2.01
Leisure	0.50	0.11	-0.53	0.95	-0.01	-1.00
Land market closure:	**No land market**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Household consumption						
Own produced food	-0.81	-1.04	-1.32	-0.96	-1.17	-1.42
Food of plant origin	-0.07	-0.23	-0.41	-0.17	-0.31	-0.48
Other food	0.16	-0.02	-0.24	0.05	-0.13	-0.33
Non-food	-0.58	-0.97	-1.43	-0.82	-1.19	-1.60
Services	-0.79	-1.21	-1.70	-1.05	-1.44	-1.88
Leisure	0.61	0.31	0.04	0.34	0.18	-1.03

of the six households substitute towards the consumption of leisure and increase the time spent at home by 0.11% to 0.95%, thus decreasing their total supply of labour. For the two low income households and the middle income household of the low migration group, in comparison, shrinking household incomes makes them spend more time working.

Not surprisingly, the differences between the two simulations with the different land market regimes follow the pattern of the differences in income changes. This pattern, however, is not maintained in case of leisure. Here, not only the income changes matter, but also the shadow wages. As the possibility to create land allows the households to reduce the time worked in agriculture less or even spend more time on the farm as compared to the situation without the land market, the decline in the shadow wage is weaker for the households which expand their land use (see Table 7.24). Hence, the increase in the consumption of leisure is weaker than before or even reversed (in case of the low income household of the low migration group and the middle income household of the high migration group). The two households which make land available, in comparison, have stronger decreases in the shadow wage in the situation with a land market and therefore increase their leisure consumption more or reduce it by a lower extent.

7.4.2.1.2. Village Level Impacts

Regarding village exports, the existence of a land market leads to considerable differences in migration and the export of agricultural output as compared to the situation without such a market (see Table 7.28). Mostly due to the strong increase in migration by the low income high migration household, exports of migrant labour are by 0.28% higher after trade reform. This compares to 0.20% without a land market.

In case of agricultural output, village exports increase by 0.26%, which is substantially lower than the 0.46% obtained before. Once more, however, the strong decrease of marketed surplus by the low income household of the high migration group dominates the picture, as it dwarfs the increases by other households. While the changes in exports of local off-farm labour are practically the same in both simulations, the differences in migration and agricultural exports reflect the effect of the stronger specialisation of the households made possible by the land market.

It is also notable that with a land market, although the picture at the level of individual households is different, the village as a whole unlike in the situation without a village market increases migration by a larger extent than the supply of agricultural products. This would correspond to prior expectations regarding the impact of a relatively strong decrease in agricultural prices as compared to migrant wages. It can also be seen, however, that the magnitude of this outcome very much depends on the calibration of the factor allocation functions for migration. If, for example, the calibration for the low income household of the high migration group would be less elastic, it would show a weaker migration response. This might reverse the picture.

On the import side, substantial differences between the two land market regimes can be found with respect to the commodities which are used as intermediate inputs. While imports of capital intermediates decrease by -0.08% in the situation without a land market, they are by -0.29% lower with a land market. This is caused by the reduction in demand for this input from the high and low income

Table 7.28.: Impact of trade liberalisation on village trade, equal migration responses (quantities, % change against baseline).

Land market closure:	**Land market**	**No land market**
Exports		
Migrant labour	0.28	0.20
Formal local off-farm labour	-0.01	-0.01
Informal local off-farm labour	-0.54	-0.55
Agricultural outputs	0.26	0.46
Imports		
Capital intermediates	-0.29	-0.08
Imported labour	0.20	-0.06
Food of plant origin	-0.23	-0.24
Other food	0.00	0.00
Non-food	-0.90	-0.91
Services	-1.12	-1.08

households of the high migration group, which overcompensates the increase in demand by the remaining households (Table 7.22). The same effect is visible in case of the services commodity.

Interestingly, village imports of farm labour increase with a land market, although relative changes in demand for this input at the household level are the same as for capital and services. As Table 7.1 shows, however, the high and low income households of the high migration group happen to have the lowest shares of labour in the quantity of the aggregated input. Therefore, the reduction in demand by these households has a lower weight for the village and imports rise. This also reverses the reduction observed in the situation without a land market.

The development of the imports of consumption commodities reflects the changes in consumption demand. Imports of food of plant origin, the non-food commodity and services decline by between -0.23% and -1.12% under both calibrations. Imports of other food remain constant. As the differences in changes in consumption demand are small between the simulations for the two land market regimes, changes in imports are also virtually the same.

Given that income levels of the households are differently affected under the two land market regimes, it is interesting to contemplate the changes in poverty and inequality in the village. As Table 7.29 shows, however, the poverty impacts of trade reform are identical in both situations. Thus, the differences in income changes have not been sufficient to affect the values of the poverty measures.

Table 7.29.: Impact of trade liberalisation on village income, poverty and inequality; equal migration responses.

Scenario:	Base	Trade liberalisation	
Land market closure:		Land market	No land market
Total village income[a]	0.0	-1.38	-1.39
Poverty indices			
P0 (low)	0.220	0.220	0.220
P0 (high)	0.447	0.449	0.449
P1 (low)	0.049	0.050	0.050
P1 (high)	0.105	0.107	0.107
P2 (low)	0.018	0.018	0.018
P2 (high)	0.043	0.044	0.044
Gini coefficient %	29.410	29.466	29.493

a %-change against baseline.

In case of inequality, as measured by the Gini coefficient, the differences between the land market regimes have a perceivable impact. In the situation with a land market, the inequality enhancing effect of trade reform is somewhat dampened. The Gini coefficient rises to 29.466%, which is lower than the increase to 29.493% obtained without a land market.

7.4.2.2. Effects of Different Migration Responses

The discussion up to this point has elaborated the differences between the two land market regimes, which arise in the simulations with the calibrations for equal migration responses. In order to present the effects of different migration responses, this part contrasts the results from the simulation runs carried out with the closure for a village land market and the two calibrations for equal and different migration responses. To avoid repetitions and to present a more compact analysis, not all variables are considered.

7.4.2.2.1. Household Level Impacts

Table 7.30 presents selected results on household income and welfare obtained from the simulations carried out with the presence of a land market. The upper part contains the results from the simulation with the calibration for equal migration responses, the bottom part those with different migration responses. When comparing the results of the two simulations, small but visible differences can be

Table 7.30.: Household level impact of trade liberalisation on per capita income and expenditure, with land market (values, % change against baseline).

Calibration:	**Equal migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Income						
Net income	-1.14	-1.39	-1.54	-1.41	-1.44	-1.77
Remittances	-1.40	-1.39	-1.34	-1.11	-1.21	1.63
Formal off-farm	-1.04			-1.04		-1.04
Informal off-farm	-1.87	-1.87	-1.92	-1.79	-1.90	-1.91
Agriculture	-2.51	-2.43	-1.99	-3.27	-2.43	-2.82
Household welfare						
EV (yuan per capita)	-2.22	-1.89	0.64	-6.06	-1.90	-3.73
EV (% of initial expenditure)	-0.04	-0.08	0.05	-0.12	-0.07	-0.27
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Income						
Net income	-1.11	-1.36	-1.49	-1.38	-1.42	-2.26
Remittances	-1.31	-1.31	-1.29	-1.14	-1.29	7.02
Formal off-farm	-1.04			-1.04		-1.04
Informal off-farm	-1.89	-1.88	-1.94	-1.81	-1.91	-1.92
Agriculture	-2.48	-2.39	-1.90	-3.12	-2.34	-4.29
Household welfare						
EV (yuan per capita)	-1.78	-1.52	1.38	-5.09	-1.25	-10.38
EV (% of initial expenditure)	-0.03	-0.07	0.11	-0.10	-0.05	-0.63

found. The introduction of different migration responses in the second simulation has the consequence that five out of the six households experience slightly weaker net income losses. The exception is the low income household of the low migration group, which has stronger income reductions in the simulation with different migration responses.

It can be seen that this outcome for the first five households is mainly a consequence of weaker reductions in agricultural income. For all these households, the decline in income from this source is lower with different migration responses. Income of the low income household of the high migration group from these sources, in contrast, shrinks by larger magnitudes.

As is shown below (Table 7.31), the more elastic calibration of the migration functions of the high migration households causes a very strong positive migration response of the low income household of that group. In the consequence, this household makes land available to all other households. These households therefore can expand their levels of the agricultural activity more or reduce it to a lesser extent than in the simulation with equal migration responses. Hence, they incur lower losses of farm income.

Regarding income from remittances, the change in the calibration also leads to differences in the simulation results. Due to their less elastic migration responses, the low migration households are slower to draw out of migration under the calibration with different migration responses (Table 7.31). Therefore, they have less pronounced reductions in income from that activity. In case of these households, this contributes to the differences in net income changes between the two simulations.

Similarly, the low income household of the high migration group shows a much more positive migration response to the policy shock, which leads to a stronger increase in remittances. In case of the high and middle income households of the high migration group, however, the picture is more complex. A weaker decline in shadow wages lets these households respond less positively to the migration shock and their remittances income is reduced more than in the simulation with equal migration responses.

The explained changes in net income levels are materialised in welfare losses which are smaller than in the simulation with equal migration responses. Furthermore, the household which has welfare gains, is even better off. Once again, the low income household of the high migration group represents the exception: the household is more negatively affected with respect to both measures.

Table 7.31 shows selected impacts of trade reform on the production side of the households. Regarding the time worked in migration, differences in return migration between the two household groups are less pronounced with different migration responses (again with the exception of the low income high migration household). The households of the low migration group return home less than before. The migration responses of the high and middle income households of the low migration group are weaker. As said above, this is caused by a lower decline in the shadow wage which unfolds a stronger effect due to the more elastic calibration of the migration function of these households. The middle income household even migrates less.

Table 7.31.: Production impacts of trade liberalisation, with land market (% change against baseline).

Calibration:	**Equal migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Factor allocation and input use						
Migration	-0.22	-0.22	-0.16	0.06	0.03	2.83
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.55	-0.55	-0.61	-0.48	-0.58	-0.60
Agriculture						
Labour	-0.18	0.08	2.12	-3.19	0.15	-2.35
Land	0.36	0.70	3.30	-3.58	0.70	-1.19
Capital intermediates	0.27	0.56	3.07	-3.51	0.59	-1.43
Imported labour	0.27	0.56	3.07	-3.51	0.59	-1.43
Services	0.27	0.56	3.07	-3.51	0.59	-1.43
Net land rentals						
Net area rent in	4.54	-	-	-46.60	5.09	-36.78
Net area rent out	-	-95.10	-70.01	-	-	-
Endogenous prices						
Family labour & leisure	-2.05	-1.97	-1.45	-2.96	-2.04	-1.42
Land	-2.58	-2.58	-2.58	-2.58	-2.58	-2.58
Agricultural outputs and sales						
Outputs	0.27	0.56	3.07	-3.51	0.59	-1.43
Sales	0.76	1.54	6.31	-5.03	1.35	-1.40
Calibration:	**Different migration responses**					
Migration group:	**Low migration**			**High migration**		
Income level:	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
Factor allocation and input use						
Migration	-0.14	-0.14	-0.12	0.03	-0.12	8.29
Formal local off-farm	-0.01			-0.01		-0.01
Informal local off-farm	-0.57	-0.57	-0.62	-0.49	-0.59	-0.61
Agriculture						
Labour	-0.02	0.24	2.61	-2.45	0.55	-9.30
Land	0.88	1.14	4.12	-2.52	1.43	-7.95
Capital intermediates	0.72	0.94	3.84	-2.50	1.26	-8.23
Imported labour	0.72	0.94	3.84	-2.50	1.26	-8.23
Services	0.72	0.94	3.84	-2.50	1.26	-8.23
Net land rentals						
Net area rent in	11.00	-	-	-32.80	10.46	-246.44
Net area rent out	-	-154.66	-87.55	-	-	-
Endogenous prices						
Family labour & leisure	-1.76	-1.76	-1.20	-2.71	-1.79	-1.19
Land	-2.64	-2.64	-2.64	-2.64	-2.64	-2.64
Agricultural outputs and sales						
Outputs	0.72	0.94	3.84	-2.50	1.26	-8.23
Sales	1.40	2.13	7.62	-3.43	2.31	-11.31

The low income high migration household shows the largest differences as compared to the simulations with equal migration responses. The time worked in migration increases by 8.29%, almost three times the value of the first simulation. Again, this is a strong effect of the decline in the shadow wage, rooted in the elastic calibration of the utility term of the migration function of this household. In order to cover the labour requirements for such an expansion in migration, the household reduces the time worked in agriculture by -9.30% and uses similarly less land.

As this land becomes available on the village market, all other households use more land than in the simulation with equal migration responses, or reduce their land use less. These changes in land use are also reflected in the village price of land and the changes in land rentals. The low income high migration household shifts from renting in land to renting out. This causes that the land rental rate decreases more in the second simulation which in turn allows the other households to rent in even more land or rent out less. The middle income household of the low migration group even ceases to rent out land and turns to renting in.

The fact that more land is available in the simulation with different migration responses also affects the changes in the time allocated to farming. The five households which use more land in the simulation with different migration responses than in the one with equal responses reduce the time worked on the farm to a lower extent or can expand it more. This prepares the ground for the weaker declines in agricultural incomes of these households described above.

The differences in input demand by the agricultural activities between the two simulations are manifested in the changes in farm outputs as reported in Table 7.25. The low income high migration household reduces its output much more than before. The remaining households, in turn, increase outputs by a higher margin or at least reduce it less. Marketed surplus changes accordingly (see Table 7.26).

7.4.2.2.2. Village Level Impacts

The comparison of the simulated impacts of trade liberalisation on household production under under the two different calibrations of the households' migration

Table 7.32.: Impact of trade liberalisation on village trade, with land market (quantities, % change against baseline).

Calibration:	**Equal migration**	**Different migration**
Exports		
Migrant labour	0.28	0.92
Formal local off-farm labour	-0.01	-0.01
Informal local off-farm labour	-0.54	-0.55
Agricultural outputs	0.26	0.30
Imports		
Capital intermediates	-0.29	-0.21
Imported labour	0.20	0.64

behaviour shows that the adjustment of the calibration leads to differences in factor allocation and production between the two simulations. As can be seen in Table 7.32, these differences are also reflected in the results for village imports and exports.

Mostly due to the stronger reaction of the low income household in the high migration group, the increase in migration from the village becomes more pronounced. While migration in the simulation with equal migration responses is by 0.28% higher after trade reform, this increase rises to 0.92% in the simulation with different migration responses. Similarly, the increase in agricultural exports is 0.64%, up from 0.20%.

The differences in the changes in imports of intermediate inputs reflect the higher levels of agricultural production in the simulation with different migration responses. The decline in capital inputs is reduced from -0.29% to 0.21%. Imports of labour increase by 0.64%, as compared to 0.20%.

Regarding poverty, however, the change in the calibration has no effect on the simulation results (see Table 7.33). This, along with the only minor differences between the changes in total village income, implies that the differences in income changes are not sufficient to change the overall picture of poverty in the village as a whole.

Turning to inequality, the increase in the Gini coefficient is slightly more pronounced in the simulation with different migration responses. This is a result of the smaller net income losses of the high and middle income households and the higher reduction in income of the low migration household in the high migration

Table 7.33.: Impact of trade liberalisation on village income, poverty and inequality, with land market.

Scenario:	Base	Trade liberalisation	
Calibration:		Equal migration	Different migration
Total village income[a]	0.0	-1.38	-1.39
Poverty indices			
P0 (low)	0.220	0.220	0.220
P0 (high)	0.447	0.449	0.449
P1 (low)	0.049	0.050	0.050
P1 (high)	0.105	0.107	0.107
P2 (low)	0.018	0.018	0.018
P2 (high)	0.043	0.044	0.044
Gini coefficient	29.410	29.466	29.492

a %-change against baseline.

group.

7.4.2.2.3. Assessment

As can be seen, the attempt to incorporate different assumptions on households' migration behaviour again brings about only small, albeit perceivable, differences with respect to most of the more aggregate variables such as net household income, consumption expenditure, welfare, village trade or inequality and poverty.

Regarding the factor allocation of the households, however, the differences become more significant. This is in particular the case for migration and agricultural production, including land rentals. In the consequence, the associated village level variables are also affected. This suggests that the differences in the labour migration behaviour may well play a role for the outcome of a particular reform. This is all the more true for reforms which entail larger changes in relative prices. Also, if the primary focus of the modelling effort is different, say, for example, on the impacts of a reform on agricultural output, the current set-up of the model can help to shed light on important aspects of the interplay between migration, land markets and agricultural production. It might be of great interest, however, to find a better calibration of the households' factor allocation functions for off-farm labour which might yield better results and which could help to control the strong effects of the shadow wage which occur in particular in cases of more elastic specifications of the utility terms.

7.4.2.3. Assessment of the Role of a Land Market

At this point, it becomes possible to summarize the above discussions of the simulation results obtained under the assumption of an existent village land rental market. The section starts with a short general evaluation of the results from the model with this second land market closure and proceeds to provide an assessment of the role of the land market.

By and large, the results correspond to prior expectations. Net incomes as well as overall welfare are negatively affected by the trade reforms and impacts are more severe for low income households. The patterns of the households' migration responses appear to make sense. Low migration households return from migration whereas high migration households tend to work more outside the province. In this context, the result that people work less in local off-farm activities as compared to migration is in line with the fact that local wages decline relatively more than migrant wages. It is, however, somewhat surprising that some households again get more involved into farming, whereas agricultural prices are affected most negatively by the policy changes. The discussion of the corresponding results shows that simulation outcomes here are strongly driven by the adjustments in the prices for household labour and land which take place in the context of the households' adjustment to the price shock. In parts, these results are unexpected but cannot be discarded as unrealistic.

In general, simulation results again are in line with those obtained from the national CGE analysis by Zhai and Hertel (2010). Poverty as well as inequality increases, although poverty effects are weaker in the village equilibrium model. At a more detailed level, returns to agricultural labour as well as land decline in both simulations. The effect for agricultural labour (if comparable) is about the same in both models, but the village model leads to smaller decreases in case of land (-2.6% against -3.5%). Differences, however, are small. In accordance with the study by Zhai and Hertel (2010), the village model predicts an increase in migration from the village. The rises in migration by 0.28% and 0.92%, respectively, from the village model compare to 0.1% for unskilled labour and 1.3% for semi-skilled labour in the CGE model. The village model, however, shows that this migration response may not be uniform among households, but some might return home while others migrate more.

In the course of the comparison of the two sets of simulations—those with a village land market and those without—the implications and relevance of the different land market regimes are discussed. Unsurprisingly, the impact of a land market is most visible in the context of the factor allocation to agricultural production. The two households which decreased their demand for land most in the situation without a land market, i.e. those with the strongest decline in the shadow price for land, now start to make land available on the village market. This benefits also other households which can draw more land into farming and thereby expand their levels of agricultural production. On the other hand, households which tend to migrate more in the situation without a land market do so more easily if such a market is present.

At the level of household income and welfare changes this translates into small differences between the simulations with and without a land market. With respect to net income, those which can increase the use of land are better off with a land market, those which reduce it are worse off in terms of net income. As a consequence, similar differences appear in the welfare impacts of the reform: low migration households as well as middle income household of the high migration group are better off with a land market, the other two, which reduce their land use, suffer higher welfare losses in terms of EV. This happens because their preferences with respect to labour allocation let the two households put more emphasis on migration which offers lower monetary returns than agricultural production. Thereby, net incomes are reduced further than under the assumption of a missing land market. It has been argued that this behaviour may be fully rational, even if it looks counter-intuitive at the first sight. In this context, doubts about the adequacy of the EV for the current analysis have been raised.

A further question of interest in terms of income and welfare is whether the land market in the second set of simulations supports the poorer strata of the village population in coping with trade reform. Regarding the effect on impacts on net incomes and welfare, the picture is mixed. The low income household of the low migration group is hurt less by trade reform and can even increase its welfare, albeit by a very small amount. The low income household of the high migration group, in contrast, looses more with a land market, both in terms of net income and welfare. The comment made above on the use of the EV as a welfare measure, however, applies here, as well.

As regards to the consequences of a land rental market for the simulation outcomes at the village level, several statements can be made. First, as the amounts of migrant labour exported from the village are higher with a land market, its presence apparently facilitates migration at the village level. It should be noted, however, that a large part of this result comes from the strong migration response of the low income high migration household. Agricultural exports, in comparison, are lower with a land market. This result, however, again is related to the steep decline in farm outputs by the household mentioned.

Second, in the present model, the existence of a land market has no perceivable impact on the poverty outcomes of trade reform. Results for the poverty measures are the same for both sets of simulations. Regarding inequality, however, the land market sightly dampens the inequality enhancing impact of the reform. This latter effect, although small, certainly warrants more investigation into the issue. It may be particularly interesting to assess the impact of a land market if the strong changes in the low income household of the high migration group are controlled for. The latter might be achieved, for example, by choosing a calibration which assumes less elastic migration responses for this household.

8. Conclusions and Outlook

In the course of three decades after the onset of economic reforms, China has undergone an enormous economic and social transformation. Arguably one of the greatest successes is a substantial reduction in poverty in the country. The current situation, however, is characterised by increasing tensions caused among others by rising rural-urban and inland-coastal disparities as well as by a divergent development of the different sectors of the economy. Furthermore, pockets of poverty remain, in particular in rural areas. At the same time, increasing inequality makes the fight against poverty ever more difficult. In this context, further trade liberalisation can play a highly important role, not least due to the comparatively strong impacts it may unfold on the agricultural sector and on China's rural areas as a whole.

Against this background, the present work presents a village level analysis carried out in order to study the impacts of trade liberalisation on poverty and inequality in a rural community in Guizhou Province in South-western China. A village equilibrium model is developed and embedded into a macro-microsimulation framework. The salient feature of the village model is an innovative approach towards the modelling of labour allocation, putting special emphasis on migration. It is based on a composite utility function, which allows taking into account households' preferences towards the work in different occupations. Through this approach, differences in migration responses, which stem from differences in household demographics as well as relative income levels, are explicitly taken into consideration in the model.

The model is applied to a scenario of unilateral trade liberalisation in China. Overall, four simulations are carried out. Two different calibrations of the migration behaviour are implemented. Under the first calibration, all households have identical own-wage responses in migration. Under a second calibration, households with higher shares of dependants exhibit weaker own-wage responses. This incorporates the assumption of lower propensities to migrate of these households. For each of the two calibrations, the impact of trade reforms is simulated once with the assumption of an absent land market and once allowing for land rentals within the village.

Overall, as a result of the relatively small price changes brought about by the policy scenario, the simulations find only comparatively weak impacts of trade liberalisation on the village. According to the initial patterns of trade protection—a relatively high support to the agricultural sector—returns to land as well as to agricultural labour decrease. Along with generally lower off-farm wages, this causes losses in income for all households and leads to slight increases in poverty in the village. Higher relative income losses for low income households result in rising inequality due to trade reform.

As intended, the specification of the labour allocation behaviour of the households in the model leads to differences in labour supply responses, in particular in case of migration. Overall, households with higher shares of dependants tend to return home whereas those with less dependants respond more positively to the enhanced incentives to migrate. Thereby, differences arise also within migration groups as low income households appear to have a stronger affinity to migration and migrate more or return home less than other households.

Not surprisingly, the introduction of a village land rental market into the model leads to more pronounced adjustments in agricultural production. At this, a relationship between migration and land rentals can be observed: households which have stronger and more positive migration responses make land available on the village market, whereas others increase their land use. In the consequence, the possibility to trade land within the village obviously facilitates migration and leads to a higher level of migration from the village. This affects the impacts of trade reform on households' income levels by accentuating the differences between migration groups already observed in the set of simulations without a land market. As monetary returns from migration are comparatively low, low migration households are less negatively affected than without such a market. High migration households on average have to accept higher income losses. In spite of these differences at the household level, the land market has no perceivable impact on the poverty outcome of reform. The increase in inequality, in turn, gets slightly weaker with a land market, pointing towards an inequality reducing effect of such a change in institutions.

With respect to the different calibrations of the households' migration behaviour, differences mostly appear at the level of the households' labour allocation. Higher level outcomes, such as changes in income, expenditure or welfare, let alone village level variables, are affected only marginally. The exception is one household whose already comparatively strong migration responses under the calibration with equal migration responses are accentuated substantially.

8.1. Strengths and Weaknesses of the Village Model

The discussions in the respective sections show that the overall quality of the outcome of the model simulations is acceptable. Both with respect to the directions of change and the magnitude of the impacts of trade reform results correspond to prior expectations and are in line with results reported by macro-level studies. This statement refers not only to the study by Zhai and Hertel (2010), which serves as the source of the policy scenario, but can also be extended to other CGE studies of trade liberalisation in China as are discussed in earlier sections of this work.

Nonetheless, it is sensible to make an assessment of the strengths and weaknesses of the village model. In this context, the depiction of the labour allocation behaviour based on a composite utility function, which represents the innovative element of the model, is of particular importance.

In general, the model proves to be capable of depicting differences in migration behaviour. Thereby, migration can be identified as a factor which explains different reform outcomes at the household level. Thus, a principal objective of this work is achieved. It can also be demonstrated that the approach offers substantial (albeit not full) flexibility in the calibration of households' occupational choices. This aspect definitely represents one of the strengths of the model.

As regarding the households' labour migration behaviour in the model, it is worthwhile to take another closer look. In general terms, the simulated policy scenario consists of changes in price incentives, which favour migration over local

Table 8.1.: Migration responses, parameter values of migration functions and dependency ratios.

	Low migration			High migration		
	High	*Middle*	*Low*	*High*	*Middle*	*Low*
Migration response[a]	-0.22	-0.20	-0.05	-0.07	0.02	2.29
Disutility	4.39	3.97	1.27	1.13	0.84	-0.62
κ_h	0.15	0.14	0.06	0.06	0.05	0.01
Dependency ratio	0.58	0.63	0.69	0.17	0.21	0.22

[a] %change with calibration for equal migration responses and no land market.

activities and agricultural production. As desired, low migration households show a tendency to migrate less than high migration households, which appear to respond more positively to the migration shock. These differences in the migration responses mostly arise from the mathematics of the labour allocation functions in the households' migration activities. Further, a substitution effect in leisure consumption which causes the low migration households to reduce their overall labour supply plays a role.

In this context, a connection between the shares of dependants in the households, the sizes of the disutility terms, the value of the share parameters in the remittances functions and the migration responses can be identified. Table 8.1 puts the households' migration responses obtained from the simulation with equal migration responses and without a land market against selected parameter values of the migration labour allocation functions and the dependency ratios. It can be seen that the low migration households on average have higher dependency ratios, higher disutility terms and higher values of κ_h. These households also appear to be less inclined to migrate and indeed withdraw labour from migration. High migration households, in contrast, have lower disutility terms and lower share parameters in the remittances functions. These households tend to migrate more. Hence, the households' migration behaviour so far appears to be theoretically consistent, as lower marginal disutilities lead to more positive migration responses. At this, the higher shares of income migrants of the low migration group send home would only underline the stronger ties between migrants and their families, which may exist.

The pattern, which arises between the two migration groups is resembled within the groups. In both groups, the low income households respond more positively to the policy shock and reduce migration by a lower amount or expand it more than the middle and high income households. Considering the differences in the sizes of the disutility terms, this behaviour again is consistent: the lower the marginal disutility from migration, the more positive the revealed attitude of the households toward migration.

It is, however, more difficult to defend the result that there also appears a positive correlation between the migration response and the dependency ratio as well as a negative one with the share parameter of the remittances function within the migration groups. Why should households, which have relatively more dependants, stick more to migration? And why do households, which receive lower shares of the migrants' incomes, i.e. which have lower marginal returns from this activity, respond more positively to incentives to migrate?

An answer to these questions would be given when recognising that there is a strong link between the magnitudes of the migration responses and the changes in overall labour supply of the households. As is discussed in Section 7.4.1, poorer households tend to have higher dependency ratios and therefore might be less able to afford income losses. Hence, they tend to reduce the time spent in productive activities less than their richer peers.

On the other hand, even with higher income losses for the poorer households, the observed behaviour could be defended by invoking a hypothesis of the NELM according to which migration would constitute an element of a strategy to diversify income sources and a means for the households to cope with risk (Stark, 1982; Stark and Bloom, 1985; Taylor, 1999). Thereby, it is not even necessary to explicitly model risk, as the utility considerations incorporated into the model in principle include all concerns of the households related to migration. Thus, all in all the results of the simulations can be considered to be meaningful from a theoretical point of view.

In this context, two other related aspects of the labour market behaviour of the households as simulated by the model are worth emphasising again. First, the more stylised simulations presented in Section 7.2.3 reveal strong cross-wage responses in migration. These cross-wage responses are caused by strong effects of changes in shadow wages in the migration functions. In cases in which local wages or prices for agricultural output increase ceteris paribus, households respond by drawing labour out of migration. Thereby, households of the low migration group tend to retain more family labour in migration whereas high migration households return home more quickly (recall Table 7.7). Furthermore, within the migration groups, low income households, i.e. those with lower marginal disutilities, lower values of κ_h and higher dependency ratios, are also faster to draw labour out of the migration activity as a response to improved economic conditions at home.

Once more, two lines of argumentation can be used to explain the observed phenomena. The first argument again involves the NELM hypothesis already mentioned in the context of the explanation of the differences between the two migration groups. According to this argument, the slower return of household with higher dependency ratios would form part of the mentioned strategy of the households to diversify economic risk: Following their objective to ensure a more constant flow of remittances back to the households, the low migration households may be less willing to give up jobs at the destinations.

The second argument is concerned with the differences in cross-wage responses within the migration groups. Here, low income households, apart from lower marginal disutilities due to the lower share parameters in the remittances functions, also experience lower marginal income losses when reducing the time worked in migration. Thus, they would be more inclined to reduce the time worked in migration as soon as alternative opportunities to earn income arise or present ones improve. From a theoretical point of view, this interpretation implies that monetary aspects would dominate the households' utility considerations. Furthermore, it would entail the questionable assumption that the household exerts full control over the labour supply decisions of the migrant. While of course rooted in the specification of the theoretical model with a utility function for the household alone and not one for both the household and the migrant, this latter notion can be considered as overly simplifying.

The second aspect to be discussed in the context of the households' labour market behaviour concerns the labour market responses of the low income household in the high migration group. In principle, the reactions of this household to wage and price shocks in general fit into the patterns described and discussed above. When compared to the remaining households, however, they appear to be overly pronounced. Apart from appearing little realistic, this is in particular worrying as, given the small number of representative households in the model, extreme behaviour by a single household can well drive (some of) the village level results obtained from policy simulations.

A last concrete issue regarding the depiction of the households' labour allocation in the model refers to the problem of limited flexibility. In the current version of the model, certain aspects are still determined by others. This concerns, for example, the mutual exclusiveness of simultaneously setting particular values for own-wage and cross-wage elasticities in the labour allocation functions. Similarly, as no utility considerations are attached to agricultural production, allocation of household labour to the farm is driven by the households' labour supply reactions in the remaining activities in the current model.

These considerations lead to a more general assessment of the utility function based approach towards the modelling of migration taken in this study. Most generally and as already mentioned, the model shows that migration matters for the outcome of policy reforms and that it is worthwhile to take this aspect into account in a simulation analysis. At this, the approach developed has proven capable of capturing differences in the migration behaviour of different household groups.

The simulations under the calibration schemes chosen yield results, which at least from a theoretical point of view, can be defended. The quality of the model results from an empirical point of view, however, still remains an open question. Due to the still rather experimental character of the present work, a possible empirical weakness of the model, can be fully defended. That said, and as is explained below, there are several conceivable routes to improve the empirical quality of the model.

Apart from the treatment of the households' labour allocation behaviour, other aspects of the model also deserve some discussion. A stated goal of the modelling effort was to allow for specific local market conditions and to introduce a substantial level of disaggregation at the household level in order to take into account differences in factor endowments, production structures and consumption patterns in the model. As regarding the former, the modelling of a village land rental market highlights the importance of such an institution for the nature of the outcome of policy reforms. The assumption of a perfectly neoclassical market, however, still constitutes a substantial deviation from the institutional reality in the village and would certainly require further improvement.

In the depiction of product markets, a number of simplifying assumptions are made, as well. Most notably, perfect price transmission from the rest of the country is assumed. Furthermore, the SAM structure as well as the model treat sales within the village and outside the village as being the same. The assumptions made can be defended against the background of the analyses of marketing and commercialisation of the villagers' outputs and a number of studies on market integration and price transmission in China. On the other hand, a more thorough look at the transmission of prices may still reveal that the village is not perfectly integrated. In this case, the changes in relative prices could be different. For example, it might be possible that agricultural prices as assumed are transmitted well. The development of wages following a policy shock, however, due to the characteristics of the local and regional labour market could be different than assumed. Apparently, this would affect the character of the policy shock.

Regarding the level of disaggregation and the consideration of specific household characteristics in the simulation, the model definitely succeeds in that the representative household groups of the model consist of a comparatively small number of households (around 50), thus offering a disaggregate view on the village community. It is shown that households with different demographic characteristics and different levels of income are affected differently by the simulated policy reforms. Thereby, results appear to be driven by the households' labour allocation behaviour, which in turn can be linked to the mentioned characteristics of the households. The role of other aspects, such as factor endowments, production structures and consumption patterns, however, at the first sight is eclipsed by the consequences of the relatively pronounced patterns in labour market behaviour which emerge. They do, however, contribute to a certain extent to ultimate changes in net incomes and consumption expenditure as well as to the household specific welfare outcomes of the reform.

8.2. Policy Implications

In spite of the several qualifications made regarding the village model, some careful policy implications can be identified from the results obtained. The first important insight gained from the modelling exercise is that trade liberalisation has adverse impacts both on poverty and on the distribution of income in the village. Against this prospect, the authorities in charge should seek to improve the social safety net available to the population before embarking on further reforms which go in the direction as those simulated in this study. Although this recommendation amounts to little more than the standard recommendation of Post-Washington Consensus thinking (Marangos, 2009), it cannot be overemphasised in the Chinese context where the social security system still is considered to be of low quality and to provide too low levels of support (Lu and Feng, 2008) and where there is a permanent menace of social tensions. The result from the model that poorer households are affected more negatively in terms of net income losses only underlines this statement.

In addition, a careful approach to further trade reforms should be taken. In any case it would be preferable to undertake further reform steps only in the context of multilateral trade reform, which, as has been shown by other studies, would entail more positive impacts on the agricultural sector. Given the ambitious unilateral liberalisation China has carried out in the context of its accession to the WTO, further reform steps are anyway more likely to take place only in a multilateral context of multilateral liberalisation. On the other hand, given the current state of the WTO Doha Round, it is questionable how likely at all a multilateral agreement in the near future would be.

The comparative analysis of the simulation results obtained under the two assumptions regarding the presence of a land market gives hints that a reform of the land rental regime would partly offset the inequality enhancing effects of trade liberalisation. Furthermore, the possibility to rent out land without restrictions would facilitate migration by households that wish to leave the village. In the consequence, this would lead to higher levels of rural-urban migration. Thus, if the patterns observed in the model would prove to be true for the village as well as for rural China as a whole, land markets could contribute to reduce rural-urban disparities and should be assessed positively. On the other hand, this positive assessment should be considered against the observation that households which migrate more would be more negatively affected in terms of income losses in a situation with a land market. The question remains, however, how strongly this effect should be weighted as the observed outcome is a result of the households' stronger preferences towards migration.

A highly important result of the simulations is that clear differences in the impacts of trade liberalisation arise between the two migration groups as well as within them. The fact that the former as well as the latter can be traced back to different migration responses clearly shows that the migration behaviour of rural households matters for the outcome of trade (and other policy) reforms. This underlines the importance of the rural-urban linkages provided by migration and suggests bearing in mind these linkages when assessing future policy reforms. Lacking a sound counter-factual with fully identical migration responses, however, it is difficult to arrive at clearer policy recommendations here.

8.3. Outlook

The preceding discussion of the strengths and weaknesses of the approach to village modelling taken in the present study points out some promising directions for future research. Apparently, one important direction concerns the treatment of labour allocation and, in particular, migration in the model. As the present work overall constitutes a first step towards the consideration of utility aspects of labour market participation in the context of a village equilibrium model, there is still substantial room for improvement.

A first area of the critique raised concerns the empirical quality as well as the theoretical consistency of the results obtained for the households' labour allocation. A part of this critique is rooted in the in parts strong reactions of a particular household in the model. From a technical point of view, these strong reactions are explained by strong cross-wage effects on migration, which stem from what is called an elastic calibration of the utility term in the household's migration function.

A possible way to tackle this problem would be to choose a different calibration scheme for the migration functions in the model. Such a scheme would involve a less elastic own-wage reaction in migration of the household concerned. While an ad hoc calibration aimed at dampening the strong reactions of this household could be readily accomplished, it would be more desirable to do it in a theoretically convincing manner.

One possibility of doing so would be to introduce differences in the own-wage responses to migration within the migration groups, for example by giving higher own-wage elasticities to the high income households and lower ones to the low income households. More precisely, the size of the own-wage elasticities could be set to values which move in proportion to the share parameters κ_h of the remittances functions. The underlying assumption would be that households which have lower marginal monetary returns from migration are less inclined to invest more labour time in this activity, even if the corresponding wages rise.

Due to the negative correlation between κ_h and the dependency ratios, this intuitively would also fit with expectations regarding the influence of household demographics on the migration behaviour: households with relatively more dependants would migrate less. Another implication of this type of calibration, however, would also be that households with lower marginal disutilities from migration have lower propensities to migrate (and vice versa). This points to a conflict between two alternative strategies of the calibration of the households' migration behaviour: one following considerations in which monetary aspects receive a higher weight or a second in which utility aspects play a greater role.

In any case, a better empirical foundation for the calibration of the labour market behaviour would add a great deal to the quality of the model. To this end, a modelling study as undertaken here can be supplemented with empirical studies of the labour market behaviour of rural households. In this context, different types of studies suggest themselves. One direction of work could seek to obtain econometric estimates of labour supply parameters following the approach by Sicular and Zhao (2004). Most ideally, such work would be tailored to the village model, for example in terms of the aggregation of the productive activities.

Another suggestion would involve exploring the actual behaviour of migrant households in situations as those simulated in the model. Questions about the (hypothetical) reactions of migrants and households to relative wage and price changes as delivered by trade liberalisation would be of central importance here.

A third line of work could start at a much more fundamental point and seek to shed light on the utility perceptions of households in the village regarding farm- and off-farm employment, including migration. Such research would probably start with qualitative surveys and would not least serve to assess the fundamental assumption of increasingly negative marginal utility, which has been made in the model.

An additional critique raised concerns the weight of the household and the migrant in the decision making problem depicted by the model where the perspective of the migrant is neglected. While this stems from the specification of the theoretical model with a utility function for the household alone and not one for both the household and the migrant, this aspect can be considered as overly simplifying. Consequently, it is certainly a good recommendation for further research on village modelling to integrate a joint utility function for the household and the migrant into the household modules. An example for an econometric application of such a joint utility function can be found, for instance, in Hoddinott (1994).

Concerning the limitations in the flexibility of labour allocation, which are still present in the model, the logical direction for future research would seek to obtain a fully flexible depiction of households labour market behaviour. A conceivable way of doing so, for example, would be to apply more flexible functional forms in the labour utility component of the composite utility function. In the particular case of agricultural production, the incorporation of a utility term into the labour allocation functions for agriculture would add substantially to the flexibility of the approach.

Going beyond the modelling of labour allocation, a further issue is related to the depiction of the land market. As mentioned, the village land market closures in the current model can only be considered to be a highly stylised representation of reality. Hence, and not least in light of the ongoing political debate on China's land tenure regime, further work on this issue is certainly indicated. At this, it would be particularly interesting to take into account interactions between migration and the land market. A possible effect of migration on the land market would be, for example, a higher demand for land due to increased income from remittances.

Next, the problem of market integration and price transmission represents a field for further research efforts. In addition to what is already done in this work, further studies of price transmission to the village would provide a valuable background for the depiction of the state of local output markets in the model. Similarly, based on more detailed inquiries into the decisions of the village households regarding sales and purchases of farm commodities, involving, for example, the presence of transaction costs, it would become possible to more accurately model the market positions of the households (net-buyers, net-sellers, autarky). Such efforts essentially would amount to an incorporation of the price band model by Sadoulet and de Janvry (1995) into the model and would represent a fusion of the approach presented in this study with the village model proposed by Kuiper (2005), but could well go beyond that. The problem of wage changes mentioned above also indicates further investigation on the functioning of national, regional and local labour markets.

Further applications of the present model might also seek to improve the treatment of agricultural production in the village model. Currently, for reasons related to the labour market reactions, all agricultural production is aggregated into a single agricultural activity. As the focus of the present study is on the allocation of family labour between farming and different off-farm activities, this approach is sufficient for that purpose. It may, however, become relevant to take into account the substitutional relationships which exist between land intensive and labour intensive crops. Accordingly, further efforts should be put into addressing this problem.

Two additional aspects which, in spite of their relevance, have only received a rudimentary treatment in the present study, merit additional consideration in future research. These aspects are gifts and blood donations. As other studies of the Guizhou villages highlight, both gifts and blood sales play a highly important role for the village economy and for the livelihoods of the population. Blood donation is identified by Xing et al. (2009) as a major source of cash income, which is a particularly important element of the livelihood strategies of the poorer population segments, but which also may result in adverse health impacts in the longer run. Brown et al. (2010) find that spending on gifts is motivated by status concerns, leading to potentially severe welfare implications, especially for poorer households. Consequently, blood sales and gifts as well as their depiction in the village equilibrium model would be a promising and highly relevant direction for further research.

The final recommendation for future research amounts to a call to apply the model to different policy scenarios. As mentioned at several occasions throughout the text, the price changes brought about by trade liberalisation are comparatively small. When fed into a comparative-static modelling framework—as represented by the village model—the overall impacts of these changes are also small. In order to illustrate the mechanisms at work in the model, this might be sufficient. From both a scientific and a policy point of view, however, more relevant scenarios are in the waiting. As a first example, one may only mention the increasingly volatile behaviour of food prices on the world market during the past years, which involves changes by 100% or more within a few months. Such shocks may not only yield much stronger results in the model, but also matter much more to the villagers in Guizhou.

As a summary of the above discussion, it can be stated that the treatment of labour allocation based on a composite utility function in an agricultural household model represents a novel way of the modelling of labour market behaviour in village equilibrium models. Thereby, in spite of the qualifications made, the approach offers substantial flexibility in the modelling of migration and other aspects of off-farm employment of rural households based on a sound theoretical framework.

The simulations carried out show that the village model is capable of offering important insights into the relevance of migration and differences in labour market behaviour as a whole. At this, the efforts undertaken here still are of a rather experimental nature. Nonetheless, the model already in its current set-up represents a highly useful tool for the thorough analysis of migration behaviour along the lines of household demographics and income levels. It constitutes an excellent source of hypotheses on the migration behaviour of rural households under changing economic environments.

Due to its innovative character, the current work offers an important contribution to the methodological development of village equilibrium modelling. By providing a basic modelling framework, it paves the way for similar applications in different settings. And finally, the approach to include household group specific non-monetary disutilities resulting from certain occupations in labour allocation functions in a CGE model opens an interesting field for applications, which may also extend to levels of higher regional aggregation.

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Appendices

A. Contents of the Electronic Annex

The electronic annex is enclosed as a CD and provides complementary information to the present text.

Table A.1.: Contents of the electronic annex

Folder	Description
Guimod 1.01	This folder contains the village equilibrium model. It includes the GAMS code, data files as well as program files used for the analysis of poverty and inequality in R.
SAM	This folder contains the SAM for Changtian village, including the coefficient matrix. Furthermore, it includes the R code used for the compilation and balancing of the SAM.

B. Measuring Poverty and Inequality

The descriptive statistics on Changtian village presented in Chapter 3 as well as the simulation analyses of Chapter 7 employ a number of measures of poverty and inequality. The objective of this annex is to provide some background information on the measures used.

For the measurement of poverty, three different indices, known as representatives of the Foster-Greer-Thorbecke (FGT) class of poverty measures (Foster et al., 1984), are used. The first of these indices is the poverty headcount index

$$P_0 = \frac{1}{N} \sum_{i=1}^{N} I(y_i < z) \tag{B.1}$$

where N is the total population, y_i the income or expenditure of individual i, z a poverty line and $I(\cdot)$ an indicator function which takes a value of 1 if the expression $y_i < z$ is true and a value of 0 otherwise. The poverty headcount index measures the proportion of the population which lives below the poverty line, i.e. the share of the poor in the population (Haughton and Khandker, 2009).

While being convenient in terms of data requirements and simplicity, the poverty headcount index is not able to capture the extent to which the income or expenditure level of an individual falls short of the poverty line. That is, the index does not take into account the intensity of poverty nor is it sensitive to changes in income of expenditure levels of the poor, unless they pass the poverty threshold. This might imply the risk that poverty reducing policies only focus on the most wealthy among the poor, which would be easiest to be brought out of poverty (Haughton and Khandker, 2009; Ray, 1998).

The second index used, the poverty gap index, addresses these issues by measuring the average income shortfall of the poor from the poverty line, expressing it as a percentage of this poverty line (Haughton and Khandker, 2009). The poverty gap index reads

$$P_1 = \frac{1}{N}\sum_{i=1}^{N}\frac{G_i}{z} \tag{B.2}$$

with the index function

$$G_i = (z - y_i) \times I(y_i < z). \tag{B.3}$$

According to Haughton and Khandker (2009), a common interpretation of the poverty gap index is to take its value as the minimum cost of eliminating poverty.

The poverty headcount index and the poverty gap index share the drawback that they both ignore the issue of inequality among the poor (Ray, 1998). It is possible to take this relative deprivation among the poor into account by squaring the poverty gap index, thus taking a weighted sum of the poverty gaps (Haughton and Khandker, 2009). The resulting index, the third one used in this study, is the poverty severity index

$$P_2 = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_i}{z}\right)^2. \tag{B.4}$$

By elevating the poverty gap to the power of 2, a higher weight is put on cases which fall farther below the poverty line (Haughton and Khandker, 2009).

For the measurement of inequality, the widely used Gini coefficient is applied. The Gini coefficient takes the difference between all pairs of incomes or expenditures and sums up the absolute differences which then is normalised by the square of the population:

$$Gini = \frac{1}{2N^2\bar{y}}\sum_{j=1}^{m}\sum_{k=1}^{m} n_j n_k |y_j - y_k| \tag{B.5}$$

where $\bar{y}$ is the mean income in the sample, m are distinct incomes or expenditures, j and k are income classes and n_j and n_k are the number of individuals earning the respective incomes (Ray, 1998). In the above form and when all incomes or expenditures are positive, the Gini coefficient takes a value between 0 and 1. Thereby, 0 indicates perfect equality and 1 perfect inequality. However, following common practise (see, for example, Ravallion and Chen, 2007) we multiply the above formula by 100 to obtain values between 0 and 100:

$$Gini = \frac{1}{2N^2\bar{y}} \sum_{j=1}^{m} \sum_{k=1}^{m} n_j n_k |y_j - y_k| \times 100 \tag{B.6}$$

The Gini coefficient fulfils the four criteria commonly formulated for measures of income inequality, namely mean independence, population size independence, symmetry, and the Pigou-Dalton transfer principle (Haughton and Khandker, 2009).

The indices chosen represent only a small selection of a broad range of measures which are available. Although certainly more comprehensive and accurate indicators can be found, those applied here have the great advantage of being in widespread use and comparatively easy to generate. Taken together, they provide a set of indicators which allow for a quick and convenient assessment of poverty and inequality impacts of policy reforms and therefore are sufficient for the present purpose.

From a technical point of view, the calculation of the poverty and inequality measures requires the definition of a poverty line and the computation of a measure of income or expenditure from the survey data. Regarding the poverty line, a low poverty line of 668 Yuan and a high poverty line of 892 Yuan per capita and year in 2004 prices have been chosen. These are the poverty lines used by Brown et al. (2010) and Xing et al. (2009) in their analyses of poverty and inequality in the Guizhou villages. The low poverty line reflects China's official poverty line[1]. The high poverty line, which has been introduced by Ravallion and Chen (2007), corresponds to a daily consumption allowance of US$ 1.08. As the survey period of the present study is 2006, the poverty lines by Xing et al. (2009) are further adjusted by the development of the consumer price index for China (World Bank, 2010). Accordingly, the low poverty line used is 653 Yuan per capita and year. The high poverty line becomes 871 Yuan.

[1]The official poverty line was defined as 300 Yuan per capita annual income in 1995 and adjusted for inflation by the authors (Xing et al., 2009).

With respect to the choice of the welfare measure, the present study also follows the work by Brown et al. (2010) and Xing et al. (2009) and uses total annual per capita consumption expenditure. This measure comprises all living expenditures of the households except for expenditures on housing, durable goods, and weddings/funerals of family members (Brown et al., 2010). Therefore, as the streams of utility which originate from these latter items are neglected in particular the results for the poverty indices have to be considered to represent likely upper bounds of the actual levels of poverty.

C. Model Sets

Table C.1.: Model sets (as in GAMS code).

	Set	Description
Activities	A	All activities
	AC(A)	Cobb-Douglas activities
	AO(A)	Off-farm work activities
	AOM(A)	Migration activities
	AOL(A)	Local off-farm activities
	AOF(A)	Formal local off-farm activities
	AOI(A)	Informal local off-farm activities
Commodities	C	All commodities
	CI(C)	Intermediate input commodities
	CQ(C)	Commodities produced by households
	CD(C)	Commodities consumed by households
	CM(C)	Commodities traded by households on the market
	CN(C)	Nontraded commodities consumed by households
	CVNT(C)	Village nontraded commodities
	CVX(C)	Village exported commodities
	CVM(C)	Village imported commodities
Factors	F	Factors
	FU(F)	Utility factors
	FN(F)	Non-utility factors
Households	H	All households
Cross-sets to map activities to households		
	HA(H,A)	All household specific activities
	HAC(H,A)	Household Cobb-Douglas activities
	HAO(H,A)	Household off-farm activities
	HAOL(H,A)	Household local off-farm activities
	HAOF(H,A)	Household formal local off-farm activities to households
	HAOI(H,A)	Household informal local off-farm activities to households
	HAOM(H,A)	Household migration activities
Sets with household specific activities		
	HALMHI(A)	Activities of low migration high income household
	HALMMD(A)	Activities of low migration middle household
	HALMLO(A)	Activities of low migration low household
	HAHMHI(A)	Activities of high migration high income household
	HAHMMD(A)	Activities of high migration middle income household
	HAHMLO(A)	Activities of high migration low income household

Table C.1 describes the sets of the village equilibrium model as used in the GAMS code. The notation follows the convention of GAMS, i.e. XY(X) indicates that the set XY is a subset of X.

D. Model Parameters and Variables

Table D.1.: Parameters.

Parameter	Description
$\mathrm{actfacsh_{fah}}$	Share of activity a in use of factor f in household h
$\mathrm{alpha_{ah}}$	Efficiency parameter in CD production function
$\mathrm{beta_{fah}}$	Share parameter of CD production function
$\mathrm{delta_{fah}}$	Exponent for labour in activity a in labour utility function
$\mathrm{epsilon_{ah}}$	Shift parameter in labour utility function
$\mathrm{gamma_{ch}}$	Share parameter of Stone-Geary utility function
$\mathrm{hactive_{h}}$	Number of economically active members in household
$\mathrm{hdeps_{h}}$	Number of dependants in household
hdepscal	Scaling factor for dependants in household
$\mathrm{hexpgift_{h}}$	Expenditure of household h on gifts
$\mathrm{hexpshock_{h}}$	Expenditure of household h on shocks
$\mathrm{hexpsi_{h}}$	Expenditure of household h on savings
$\mathrm{hobloodconst_{h}}$	Income of household h from blood sales
$\mathrm{hoexpconssh_{h}}$	Share of household h of expenditure on construction
$\mathrm{hogiftconst_{h}}$	Income of household h from gifts
$\mathrm{hogovconst_{h}}$	Government transfers received by household h
$\mathrm{hosiconst_{h}}$	Income of household h from savings
$\mathrm{hoshoconst_{h}}$	Income of household h from shocks
$\mathrm{ica_{cah}}$	Share of intermediate input commodity c in quantity of aggregate input in activity a of household h
$\mathrm{ielast_{ch}}$	Income elasticity of household h for commodity c
$\mathrm{inta_{ah}}$	Leontief Parameter for demand for aggregate intermediate input by CD activity a of household h
$\mathrm{ioqqqa_{ach}}$	Share of commodity c in output by activity a of household h
$\mathrm{ivash_{ah}}$	Value-added coefficient of C-D activity a of household h
$\mathrm{kappa_{h}}$	Share parameter of remittances function of household h
$\mathrm{lambda_{h}}$	Marginal utility of income of household h
$\mathrm{pcscal_{h}}$	Scaling parameter for household per capita consumption in the labour allocation function for migration
$\mathrm{sigma_{ch}}$	Per capita subsistence consumption quantity of commodity c of household h
tp	Time period covered by the model

Table D.2.: Variables.

Variable	Description
FDC_{fah}	Use of factor f by CD activity a in household h
FDD_{fah}	Use of factor f by off-farm work activity a in household h
FSH_{fh}	Household endowment with factor f
$HEXPC_{h}$	Consumption expenditure of household h
$HEXPCONS_{h}$	Expenditure of household h on construction
$HEXPCP_{h}$	Per-capita consumption expenditure of household h
HS_{h}	Number of persons (consumer equivalents) living in the household
PA_{ah}	Price of activity a to household h
PD_{ch}	Consumer price of commodity c to household h
PI_{ch}	Price of intermediate input c to household h
PIA_{ah}	Aggregate price of intermediate input in activity a of household h
PVA_{ah}	Value-added price of activity a to household h
QA_{ah}	Output of activity a in household h
QD_{ch}	Per capita demand of household h for commodity c
QDT_{ch}	Total demand of household h for commodity c
$QINT_{ach}$	Demand of activity a in household h for intermediate commodity c
$QINTA_{ah}$	Aggregate demand of activity a in household h for intermediate commodity c
QP_{ch}	Quantity of commodity purchased by household h
QQ_{ch}	Quantity of commodity c produced by household h
QR_{ch}	Net quantity of village traded commodity c rented by household h
QRM_{c}	Net quantity of village traded commodity c rented by migrated household
QS_{ch}	Quantity of commodity c sold by household h
QVA_{ah}	Quantity of value-added of C-D activity a of household h
QVM_{c}	Quantity of commodity c imported into the village
QVX_{c}	Quantity of commodity c exported out of the village
$WALRAS_{h}$	Slack variables
WF_{fah}	Price for factor f in activity a of household h
WFV	Village price for land
YH_{h}	Total income of household h
YR_{h}	Remittance income of household h
YT	Total income of all households

E. Derivation of a Price Shock for Policy Simulations from National Level CGE Results

The following Table E.1 provides additional information on the calculation on the derivation of the trade liberalisation scenario used in the policy simulations. The table gives detailed insights into the mapping of the national level CGE results obtained from the study carried out by Zhai and Hertel (2010) to the survey data and the subsequent aggregation of to the level of aggregation used in the village model.

The first column of Table E.1 names the individual items as they appear in the survey data. The second column gives evidence about the result(s) of the national level CGE model which is assumed to correspond to the respective item. For cases in which no direct correspondence between the items of the survey data and the sector of the national CGE existed, assumptions have been made. These assumptions are also explained in Column 2. The third column contains the price shock expressed in percentage change terms as obtained by Zhai and Hertel (2010) from the simulation of unilateral trade liberalisation in China. Column 4 gives the value share of each item in the respective item of the aggregation of the village model, which is named in the fifth column. The value shares of the fourth column are the weighting factors for the aggregation of the price shocks from the national level CGE into an aggregate price shock. This aggregate price shock, which is used for simulations with the village model, is presented in the sixth column of Table E.1.

Table E.1.: Mapping of national level CGE results into price shock for policy simulations.

Item in data	**Corresponding result Z-H***	**Price shock (%-change)**	**Share in model aggregation**	**Model aggregation**	**Aggregate price shock (%-change)**
Purchased goods					
Farm inputs					
Urea	Sales price for chemicals	-1.30	0.39	Intermediate	-1.28
Pesticides	Sales price for chemicals	-1.30	0.00	capital inputs	
Manure	Sales price for chemicals	-1.30	0.01		
Fertiliser	Sales price for chemicals	-1.30	0.08		
Other fertiliser	Sales price for chemicals	-1.30	0.01		
Maize seed	Sales price for other grains	-1.71	0.05		
Rape seed	Sales price for oil seeds	-7.35	0.01		
Rice seed	Sales price for paddy rice	-0.99	0.00		
Vegetable seed	Sales price for vegetables and fruits	-1.06	0.00		
Other seed	Sales price for other crops	-2.11	0.01		
Feed	Sales price for forage	-0.91	0.22		
Livestock breed	Sales price for cattle, sheep and so on	-1.26	0.16		
Poultry breed	Sales price for cattle, sheep and so on	-1.26	0.02		
Veterinary services	Sales price for other services	-0.54	0.00		
Machine rentals	Sales price for other services	-0.54	0.00		
Machine maintenance	Sales price for other services	-0.54	0.00		
Other inputs	Average of all other farm inputs	-1.45	0.04		
Irrigation	Sales price for utilities	-0.52	0.10	Services	-0.52
Gas	Sales price for utilities	-0.52	0.90		
Hired labour	Unskilled agricultural wages	-1.80	1.00	Imported labour	-1.80
Consumption goods					
Grains	Unweighted average of sales prices for paddy rice, wheat and other grains	-1.34	0.73	Plant products	-1.26

Table E.1.: Mapping of national level CGE results into price shock for policy simulations.

Item in data	Corresponding result Z-H*	Price shock (%-change)	Share in model aggregation	Model aggregation	Aggregate price shock (%-change)
Fruits & vegetables	Sales price for vegetables and fruits	-1.06	0.27		
Eating out	Unweighted average of sales price for different manufactured food items (Grain, milled, meat products, vegetable oils, refined sugar, prepared fish products, other food)	-1.86	0.10	Other food	-1.81
Condiments	As 'eating out'	-1.86	0.63		
Meat and eggs	Sales price for meat products	-1.74	0.25		
Seafood and dairy	Sales price for prepared fish products	-0.75	0.02		
Durables	Unweighted average of sales price for different non-food manufacturing goods (paper, printing, chemicals, metal products, transport equipment, electronics, instruments, other manufacturing goods)	-1.33	0.13	Non-food	-0.83
Clothing	Unweighted average of sales price for textiles and apparel	-0.60	0.35		
Drinks and tobacco	Unweighted average of sales prices for beverages and tobacco	-0.86	0.52		
Water	Sales price for utilities	-0.52	0.00	Services	-0.66
Electricity	Sales price for utilities	-0.52	0.12		
Coal	Sales price for coal mining	-0.64	0.09		
Fuel	Sales price for oil and gas	-0.65	0.02		
Telephone	Sales price for other services	-0.54	0.03		
Transport	Sales price for transport services	-0.69	0.22		
Other household services	Sales price for other services	-0.69	0.05		
Health and medicine	Sales price for other services	-0.69	0.27		
Education	Sales price for other services	-0.69	0.17		
Misc. consumption goods	Sales price for other services	-0.69	0.02		
Others	Sales price for other manufacturing goods	-0.53	0.01		
Self consumption					
Corn	Output price for other grains	-1.69	0.06	Own-produced	-1.51

Table E.1.: Mapping of national level CGE results into price shock for policy simulations.

Item in data	Corresponding result Z-H*	Price shock (%-change)	Share in model aggregation	Model aggregation	Aggregate price shock (%-change)
Maize	Output price for other grains	-1.69	0.60	food	
Rapeseed	Output price for oilseeds	-3.60	0.01		
Rapeseed oil	Output price for vegetable oil	-1.80	0.01		
Paddy	Output price for paddy rice	-0.99	0.03		
Rice	Output price for paddy rice	-0.99	0.02		
Other grains	Output price for other grains	-1.69	0.04		
Other crops	Output price for other crops	-0.90	0.02		
Vegetables	Output price for fruits and vegetables	-1.00	0.15		
Fruits	Output price for fruits and vegetables	-1.00	0.01		
Pigs	Output price for cattle, sheep, etc.	-1.24	0.03		
Cows	Output price for cattle, sheep, etc.	-1.24	0.00		
Poultry	Output price for cattle, sheep, etc.	-1.24	0.00		
Eggs	Output price for cattle, sheep, etc.	-1.24	0.01		
Other animal products	Output price for cattle, sheep, etc.	-1.24	0.00		
Activities and wages					
Agricultural production					
Corn	Output price for other grains	-1.69	0.05	Agriculture	-1.79
Maize	Output price for other grains	-1.69	0.34		
Rapeseed	Output price for oilseeds	-3.60	0.15		
Rapeseed oil	Output price for vegetable oil	-1.80	0.14		
Paddy	Output price for paddy rice	-0.99	0.02		
Rice	Output price for paddy rice	-0.99	0.01		
Other grains	Output price for other grains	-1.69	0.02		
Other crops	Output price for other crops	-0.90	0.01		
Vegetables	Output price for fruits and vegetables	-1.00	0.06		

Table E.1.: Mapping of national level CGE results into price shock for policy simulations.

Item in data	Corresponding result Z-H*	Price shock (%-change)	Share in model aggregation	Model aggregation	Aggregate price shock (%-change)
Fruits	Output price for fruits and vegetables	-1.00	0.01		
Pigs	Output price for cattle, sheep, etc.	-1.24	0.10		
Cows	Output price for cattle, sheep, etc.	-1.24	0.03		
Poultry	Output price for cattle, sheep, etc.	-1.24	0.01		
Eggs	Output price for cattle, sheep, etc.	-1.24	0.00		
Other animal products	Output price for cattle, sheep, etc.	-1.24	0.00		
Forestry	Output price for forestry	-0.67	0.00		
Fishery	Output price for fishery	-0.76	0.04		
Rentals	No assumptions made due to low income share	-	0.00		
Food processing	As above	-	0.00		
Others	As above	-	0.01		
Off-farm employment					
Village cadre	Skilled rural non-agricultural wages	-1.00	0.50	Formal local off-farm	-1.03
Teacher	Skilled rural non-agricultural wages	-1.00	0.17		
State owned or private enterprise	Semi-skilled rural non-agricultural wages	-1.10	0.17		
Other local wage work	Semi-skilled rural non-agricultural wages	-1.10	0.17		
Local irregular work	Weighted average of unskilled agricultural and rural non-agricultural wages. Weighting factor corresponds to sample shares of informal workers who work in agriculture and off-farm employment	-1.36	0.85	Informal local off-farm	-1.32
Self employment	Semi-skilled rural non-agricultural wages	-1.10	0.15		
Migration	Weighted average of unskilled agricultural, urban semi-skilled and rural non-agricultural wages. Weighting factor corresponds to sample shares of migrant workers who work in agriculture; semi-skilled urban and rural non-agricultural wages are weighted by 0.66 and 0.33,	-1.17	1.00	Migration	-1.17

Table E.1.: Mapping of national level CGE results into price shock for policy simulations.

Item in data	Corresponding result Z-H*	Price shock (%-change)	Share in model aggregation	Model aggregation	Aggregate price shock (%-change)
respectively.					

* Simulation results by Zhai and Hertel (2010); Zhai (2011).

Author's declaration

I hereby declare that I have completed the dissertation independently, and this research is original. I have not been supported by a commercial agent in writing this dissertation. Additionally, no aids other than the indicated sources and resources have been used. Furthermore, I assure that all quotations and statements that have been inferred literally or in a general manner from published or unpublished writings are marked as such. This work has not been previously used neither completely nor in parts to achieve any other academic degree.

Stuttgart-Hohenheim, March 2011

Ulrich Kleinwechter