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Degree of Openness and the Choice of Exchange Rate Regimes – A Re-Evaluation with Value-Added Based Openness Measures

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a_{ijk}	non-negative inter-industry coefficient, quantity of the *i*th commodity which is on average required in the *j*th industry for the production of one unit of the *j*th commodity in region *k*
A_k	direct requirements table of the production processes in region *k*, non-negative square matrix of inter-industry coefficients in region *k* of order four
B	identity matrix of order four
B	benefits curve of monetary integration
$(B-A_k)^{-1}$	total requirements table of the production processes in region *k*, non-negative square matrix of interdependence coefficients in region *k* of order four
b_{rs}	element of identity matrix with row index *r* and column index *s*
$\hat{c}_1$, $\hat{c}_2$	estimator in estimation equation
C	value of goods and services purchased by private households to fulfill current wants is called consumption
C	costs curve of monetary integration
c_{ijlk}	non-negative technical coefficient of the imported intermediate inputs in region *k*, quantity of the *i*th commodity imported from region *l* which is essential in the *j*th industry for the production of one unit of the *j*th commodity in region *k*.
C_{lk}	direct requirements table of imported intermediate products in region *k*, non-negative square matrix of technical coefficients of the imported intermediate inputs in region *k* of order four
D	value of goods and services demanded by domestic and foreign residents
d_0	break-even degree of openness
d_1	degree of openness based on the traditional openness concept
$d_{1'}$	degree of openness based on the actual openness concept
d_{gjk}	non-negative technical coefficient of the domestic production factors in region *k*, share of total expenditure of industry *j* which is spent to compensate production factor *g* in region *k*
D_k	direct requirements table of domestic production factors in region *k*, non-negative matrix of technical coefficients of the domestic production factors in region *k*
e	component of final demand in 1: home country

2: aggregated foreign country

or

1: home country

2: aggregated integration area

3: aggregated rest of the world

EDR value-added in home country created by exports of home country to aggregated foreign country as share of gross domestic product of home country within a year in percent

EDR_g income of production factor *g* in home country created by exports of home country to aggregated foreign country as share of gross domestic product of home country within a year in percent

EEDR value-added in home country created by exports of home country to aggregated rest of the world as share of gross domestic product of home country within a year in percent

$EEDR_g$ income of production factor *g* in home country created by exports of home country to aggregated rest of the world as share of gross domestic product of home country within a year in percent

EEER value-added in aggregated rest of the world created by exports of home country to aggregated rest of the world as share of gross domestic product of home country within a year in percent

$EEER_i$ value of commodity *i* in aggregated rest of the world created by exports of home country to aggregated rest of the world as share of gross domestic product of home country within a year in percent

EEIR value-added in aggregated integration area created by exports of home country to aggregated rest of the world as share of gross domestic product of home country within a year in percent

$EEIR_i$ value of commodity *i* in aggregated integration area created by exports of home country to aggregated rest of the world as share of gross domestic product of home country within a year in percent

EER value of goods and services of home country for aggregated rest of the world as share of gross domestic product of home country within a year in percent

EER_i value of commodity *i* of home country for aggregated rest of the world as share of gross domestic product of home country within a year in percent

EFR	value-added in aggregated foreign country created by exports of home country to aggregated foreign country as share of gross domestic product of home country within a year in percent
EFR_i	value of commodity *i* in aggregated foreign country created by exports of home country to aggregated foreign country as share of gross domestic product of home country within a year in percent
EIDR	value-added in home country created by imports of home country from aggregated rest of the world as share of gross domestic product of home country within a year in percent
$EIDR_i$	value of commodity *i* in home country created by imports of home country from aggregated rest of the world as share of gross domestic product of home country within a year in percent
EIER	value-added in aggregated rest of the world created by imports of home country from aggregated rest of the world as share of gross domestic product of home country within a year in percent
$EIER_g$	income of production factor *g* in aggregated rest of the world created by imports of home country from aggregated rest of the world as share of gross domestic product of home country within a year in percent
EIR	value of goods and services of home country from aggregated rest of the world as share of gross domestic product of home country within a year in percent
EIR_i	value of commodity *i* of home country from aggregated rest of the world as share of gross domestic product of home country within a year in percent
ER	value of goods and services of home country for aggregated foreign country as share of gross domestic product of home country within a year in percent
ER_i	value of commodity *i* of home country for aggregated foreign country as share of gross domestic product of home country within a year in percent
ERR3 (ERR5)	value of the 3- (5-) way classification of exchange rate regimes
Ex	value of goods and services sold to foreign residents is called export
Ex'	value of goods and services sold to domestic residents is called foreign export
f_{ijk}	non-negative interdependence coefficient, quantity of the *i*th commodity which is required in the economic system as a whole for the production of one unit of the *j*th commodity as a final commodity in region *k*
G	value of goods and services purchased by the government
g	production factor

1: unskilled labor

2: skilled labor

3: capital

4: land

5: natural resources

GOVEXP expenditures of the government

I value of goods and services used by private firms to produce future output is called investment

i commodity, intermediate commodity, product category

1: food

2: other primary products

3: manufactures

4: services

IDR value-added in home country created by imports of home country from aggregated foreign country as share of gross domestic product of home country within a year in percent

IDR_i value of commodity *i* in home country created by imports of home country from aggregated foreign country as share of gross domestic product of home country within a year in percent

IEDR value-added in home country created by exports of home country to aggregated integration area as share of gross domestic product of home country within a year in percent

$IEDR_g$ income of production factor *g* in home country created by exports of home country to aggregated integration area as share of gross domestic product of home country within a year in percent

IEER value-added in aggregated rest of the world created by exports of home country to aggregated integration area as share of gross domestic product of home country within a year in percent

$IEER_i$ value of commodity *i* in aggregated rest of the world created by exports of home country to aggregated integration area as share of gross domestic product of home country within a year in percent

IEIR value-added in aggregated integration area created by exports of home country to aggregated integration area as share of gross domestic product of home country within a year in percent

$IEIR_i$ value of commodity *i* in aggregated integration area created by exports of home country to aggregated integration area as share of gross domestic product of home country within a year in percent

IER value of goods and services of home country for aggregated integration area as share of gross domestic product of home country within a year in percent

IER_i value of commodity *i* of home country for aggregated integration area as share of gross domestic product of home country within a year in percent

IFR value-added in aggregated foreign country created by imports of home country from aggregated foreign country as share of gross domestic product of home country within a year in percent

IFR_g income of production factor *g* in aggregated foreign country created by imports of home country from aggregated foreign country as share of gross domestic product of home country within a year in percent

IIDR value-added in home country created by imports of home country from aggregated integration area as share of gross domestic product of home country within a year in percent

$IIDR_i$ value of commodity *i* in home country created by imports of home country from aggregated integration area as share of gross domestic product of home country within a year in percent

IIIR value-added in aggregated integration area created by imports of home country from aggregated integration area as share of gross domestic product of home country within a year in percent

$IIIR_g$ income of production factor *g* in aggregated integration area created by imports of home country from aggregated integration area as share of gross domestic product of home country within a year in percent

IIR value of goods and services of home country from aggregated integration area as share of gross domestic product of home country within a year in percent

IIR_i value of commodity *i* of home country from aggregated integration area as share of gross domestic product of home country within a year in percent

Im value of goods and services purchased from abroad is called import

Im_C value of imported goods and services purchased by domestic households

Im_{Ex} value of imported goods and services exported to foreign residents

Im_G value of imported goods and services purchased by the domestic government

Im_I value of imported goods and services invested by domestic firms

$Im'_{Ex'}$	value of imported domestic goods and services exported to domestic residents
IR	value of goods and services of home country from aggregated foreign country as share of gross domestic product of home country within a year in percent
IR_i	value of commodity *i* of home country from aggregated foreign country as share of gross domestic product of home country within a year in percent
j	industry 1: food industry 2: other primary production 3: manufacturing 4: services
k	region 1: home country 2: aggregated foreign country or 1: home country 2: integration area 3: rest of the world
l	region 1: home country 2: aggregated foreign country or 1: home country 2: integration area 3: rest of the world
MTAX	spending of trading partners' revenues on import taxes
NETINV	net investment
p_{lk}	column vector of value of imported intermediate commodities *i* in region *k* from region *l*
PRIVEXP	expenditures of private households
q_k	column vector of income of domestic production factors in region *k*
r	row index of element in identity matrix
s	column index of element in identity matrix
S	value of goods and services supplied for domestic and foreign residents
SAVE	global savings

t	number of country in the sample
$\hat{u}_t$	residual parameter in estimation equation
TAXES	net tax revenues
VDFA	value of domestic intermediate inputs demanded by firms
VDGA	value of domestic commodities demanded by the government
VDPA	value of domestic commodities demanded by private households
VIFA	value of imported intermediate inputs demanded by firms
VIGA	value of imported commodities demanded by the government
VIPA	value of imported commodities demanded by private households
VOA	value of production output, compensation of domestic production factors
VXMD	value of exports demanded by trading partners in the rest of the world
W_{gjk}	income of production factor *g* due to employment in industry *j* in region *k*
X_{ijkk}	value of commodity *i* which is delivered to industry *j* within region *k*
X_{ijkl}	value of commodity *i* which is exported from region *k* to industry *j* of region *l*, value of commodity *i* which is imported by industry *j* in region *l* from region *k*
X_{ik}	value of total output of commodity *i* in region *k*
X_{jk}	value of total output of industry *j* in region *k*
x_k	column vector of values of total output in region *k*
XTAX	spending of trading partners' revenues on export taxes
Y_{iekk}	value of commodity *i* which is delivered to final demand component *e* of region *k*
Y_{iekl}	value of commodity *i* which is exported from region *k* to final demand component *e* of region *l*, value of commodity *i* which is imported by final demand component *e* in region *l* from region *k*
Y_{ikkk}	value of commodity *i* which is delivered to consumers, government, and investment of region *k*
Y_{ilkk}	value of commodity *i* which is exported from region *k* to region *l*, value of commodity *i* which is imported by intermediate and final demand in region *l* from region *k*
y_k	column vector of final demand values in region *k*, vector of export values of region *k*
Y	value of all final goods and services produced by domestic factors of production is called gross domestic product
Y_C	value of domestic goods and services purchased by domestic households

Y_{Ex}	value of domestic goods and services exported to foreign residents
Y_G	value of domestic goods and services purchased by the domestic government
Y_I	value of domestic goods and services invested by domestic firms
Y_k	gross domestic product in region *k*
$Y'_{Ex'}$	value of foreign goods and services exported to domestic residents

Glossary

CDE	constant difference of elasticity
CES	constant elasticity of substitution
CGE	computable general equilibrium
CEEC	Central and Eastern European country
CEEC-8	Central and Eastern European countries which include Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia
e	estimated
EDR	export-induced domestic value-added ratio
EDR_g	export-induced domestic value-added ratio of production factor g
EEDR	extra-regional export-induced domestic value-added ratio
$EEDR_g$	extra-regional export-induced domestic value-added ratio of production factor g
EEER	extra-regional export-induced extra-regional value-added ratio
$EEER_i$	extra-regional export-induced extra-regional value-added ratio of intermediate commodity i
EEIR	extra-regional export-induced intra-regional value-added ratio
$EEIR_i$	extra-regional export-induced intra-regional value-added ratio of intermediate commodity i
EER	extra-regional export ratio
EER_i	extra-regional export ratio of commodity i
EFR	export-induced foreign value-added ratio
EFR_i	export-induced foreign value-added ratio of intermediate commodity i
EIDR	extra-regional import-induced domestic value-added ratio
$EIDR_i$	extra-regional import-induced domestic value-added ratio of intermediate commodity i
EIER	extra-regional import-induced extra-regional value-added ratio
$EIER_g$	extra-regional import-induced extra-regional value-added ratio of production factor g
EIR	extra-regional import ratio
EIR_i	extra-regional import ratio of commodity i
ERM	Exchange Rate Mechanism
EMU	Economic and Monetary Union

ER	export ratio
ER_i	export ratio of commodity i
Euro-12	euro zone which consists of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom
EU	European Union
EU-25	European Union which consists of Austria, Belgium, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, and United Kingdom
GATT	Agreement of Tariffs and Trade
GDP	gross domestic product
GTAP	Global Trade Analysis Project
IDR	import-induced domestic value-added ratio
IDR_i	import-induced domestic value-added ratio of intermediate commodity i
IEDR	intra-regional export-induced domestic value-added ratio
$IEDR_g$	intra-regional export-induced domestic value-added ratio of production factor g
IEER	intra-regional export-induced extra-regional value-added ratio
$IEER_i$	intra-regional export-induced extra-regional value-added ratio of intermediate commodity i
IEIR	intra-regional export-induced intra-regional value-added ratio
$IEIR_i$	intra-regional export-induced intra-regional value-added ratio of intermediate commodity i
IER	intra-regional export ratio
IER_i	intra-regional export ratio of commodity i
IFR	import-induced foreign value-added ratio
IFR_g	import-induced foreign value-added ratio of production factor g
IIDR	intra-regional import-induced domestic value-added ratio
$IIDR_i$	intra-regional import-induced domestic value-added ratio of intermediate commodity i
IIIR	intra-regional import-induced intra-regional value-added ratio
$IIIR_g$	intra-regional import-induced intra-regional value-added ratio of production factor g
IIR	intra-regional import ratio

IIR_i	intra-regional import ratio of commodity i
IMF	International Monetary Fund
IR	import ratio
IR_i	import ratio of commodity i
NAFTA	North American Free Trade Agreement
n.e.c.	not elsewhere classified
MERCOSUR	Mercado Común del Sur
WDI	World Development Indicators
WTO	World Trade Organization
..	data not available

1. Introduction

The aim of this study is the development of innovative measures of openness towards trade, the building of a new data base of degrees of openness to trade for numerous countries and for several years, and the empirical re-assessment of the potential association between the degree of openness and the choice of exchange rate regimes.

The degree of openness to trade aims to indicate the significance of international trade linkages for a country. Despite the concept of trade openness being conceptually simple, many approaches of empirically measuring openness have been developed. Many of these concepts were encouraged by the lack of the most widely applied ('traditional') indices of openness to accurately calculate the degree of openness to trade and the problems of its interpretation. For example, the export ratio, which relates the value of exports to the gross domestic product (GDP), can exceed 100 percent because trade is stated in gross terms, while the GDP is expressed in value-added terms. This implies a negative value of domestic non-tradeables. A very attractive feature of the traditional proxies is that they are readily available for most countries and for several years.

There is no broadly accepted measure of openness because no index provides a perfect or unambiguous indication of the importance of international trade. This is interesting because much of the economic research applies the degree of openness to trade as a potential determinant in empirical analysis. The interaction of domestic and foreign residents due to the exchange of commodities potentially affects national and international markets, and consequently economic variables, as well as economic policy, such as the potential influence of the degree of openness on the policy makers' selection of a specific exchange rate regime to achieve an internal and external economic balance.

This contribution proceeds as follows: Chapter 2 highlights the likely association between the degree of openness and the choice of exchange rate regimes as it is revealed in economic literature. The demonstration of the status quo begins with the *degree of openness* towards international trade (Section 2.1). This parameter tries to indicate how significant foreign trading partners are for a country's domestic economy with respect to trade relationships. The section outlines many factors which are likely to determine the intensity of trade between the country of interest and the foreign countries. Afterward, various alternative approaches of measuring openness towards international and bilateral trade are systemized and described. This is completed by a review of several applications of the openness towards trade in economic research to illustrate the general role of openness within economic literature.

In Section 2.2, the most widespread applied trade openness measures within the open-economy research, which are the 'trade shares', are emphasized. After a characterization of the 'traditional' indicators of openness (the *export ratio* and the *import ratio*), the section illustrates shares of trade which put emphasize on international trade and bilateral trade. In addition, indicators of structural openness (the *export ratio of commodity i* and the *import ratio of commodity i*) disaggregate the degree of openness by the contents of international and bilateral trade to disclose deeper insights in the structure of the trade patterns. Newly adjusted trade shares based on value-added were developed to compensate for the weaknesses of the traditional shares of trade in accurately measuring the status of international trade links for an economy. These traditional trade shares had measured the status of international trade links by the expression of trade in gross terms instead of in value-added terms (see chapters 3 and 5). The indication quality of both concepts is compared in an empirical analysis of the potential relationship between countries' degree of openness and their selection of exchange rate regimes in Chapter 4 and Chapter 6.

After a review of the degree of openness towards trade, the *choice of exchange rate regimes* is emphasized in Section 2.3. This begins with an outline of alternative exchange rate arrangements from which policy makers can choose, with the aim to achieve a balance in the national economy and between the country and foreign countries. The impact of policy makers on the market response of the national currency ranges from totally fixed exchange rate movements to entirely flexible exchange rate movements. Next, alternative potential determinants to the degree of trade openness for the selection of an appropriate exchange rate system are discussed. McKinnon (1963) and Mundell (1961) point out that the degree of openness towards bilateral trade might be an important parameter. In particular it can act as a decision-making aid for whether or not policy makers should adopt the currency of a single currency area - such as the euro of the euro zone - to support the development of the national economy.

Within the standard framework of the *cost-benefit analysis of monetary integration*, which has become popular under the heading of 'the theory of optimum currency areas', the deepening of regional integration towards trade has had an impact on the expected net gains of joining the single currency area (see, for example, De Grauwe, 2000). Costs represent the economic stability losses of an economy from pegging its currency to a fixed exchange rate area. They tend to decrease with a higher degree of openness. On the other hand, benefits do increase in response to the increase in the degree of openness and characterize monetary efficiency gains. If the candidate's degree of openness towards the member states of the integra-

tion area outperforms the break-even degree of openness, which indicates the degree of regional trade integration where benefits start to surpass costs, then the recommendation for a country is to participate in a single currency area. Finally, additional arguments for selecting a fixed exchange rate regime are discussed and the arguments for a system of flexible exchange rate complete the presentation.

In Chapter 3, the new *value-added based measures of openness towards international trade* are developed. Since traditional trade shares include a series of factors, such as comparative advantage, geographic variables, and economic policy and, thus, measure a country's actual exposure to trade interactions, trade shares may account quite well for the effective level of the importance of international trade. The main reason for the widespread application of conventional measures of openness in empirical literature might just be the fact that they are readily available for most countries. Several attempts have been made to increase the quality of how traditional indices of openness indicate the significance of trade relationships for a country. The majority of alternative openness measures lack of a correlation with the traditional concept which might indicate that these alternative measures capture different aspects of openness towards international trade.

In an analysis of the potential linkage between the degree of openness and the choice of exchange rate regimes, it may be found that outcome-based adjustments of the established trade shares improve the representation of 'openness' for cross-country comparisons. But their correction of traditional openness measures might not be far-reaching enough since these adjusted shares of trade disregard the fact that the general interpretation of the traditional trade shares is misleading. Traditional shares of trade are confusing because they do not take the international redistribution of income generated by trade into account. The export ratio attempts to indicate a country's surplus production (see, for example, Kotcherlakota and Sack-Rittenhouse, 2000). This measure overstates the potency of a country to build a surplus in output at home because imported intermediate commodities that are employed in the process of production of exported commodities are not part of the gross domestic product in the domestic economy. In addition, the import ratio is supposed to measure the dependency of a country's residents on imports. However, the openness index overstates the dependency on imports since residents have to spend a lower portion of their income to purchase goods and services from abroad. Imports are partly produced with intermediate products delivered by other countries. These countries include the country that creates income for its production factors.

The innovative measures of openness to international trade in this contribution attempt to adjust the conventional indices through expressing trade in value-added terms instead of gross terms. This value-added based concept is in clear contrast to the mainstream. Common approaches adjust the gross domestic product, which very likely increases the accuracy of cross-country comparisons, but the fundamental difficulty of traditional openness indices remains untouched. The numerator is still expressed in gross terms whereas the denominator is stated in value-added terms.

After the chapter presented the motivation for a value-added based adjustment of the well-established indices of trade openness in Section 3.1, it continues with an illustration of the principles of the *input-output economics*, which builds the theoretical foundation for an analysis of the income effects of international trade (Section 3.2). In Section 3.3, the *input-output framework* for the construction of value-added based measures of openness towards international trade is laid out. It consists of a multi-regional input-output table which systematically defines all transactions within a certain country and the foreign countries as well as between the regions. Its construction mainly follows the scheme proposed by Isard (1951) which incorporates less simplifying assumptions of interregional interconnections than most other approaches. The second part of the input-output framework is a multi-regional input-output analysis in an open static Leontief system. It describes the economic system of the world economy in terms of interdependent industries within a region and the interrelated regions through the theory of production. The input-output analysis of international trade evaluates the input-output table in respect to income effects due to international trade.

Section 3.4 contains the *construction* of eight innovative value-added based measures of openness to trade, applying the instruments of the input-output framework introduced in Section 3.3. The *export-induced domestic value-added ratio* index corrects the export ratio by taking into account that exports engender income in the domestic economy and in foreign economies because domestic factors of production and imported intermediate inputs are employed for the production of the output. This adjusted trade share can be interpreted to signify the importance of foreign trading partners for a country as generators of income in the domestic economy. In addition, the *import-induced foreign value-added ratio* amends the import ratio measure. The proxy of openness represents the importance of foreign trading partners for the spending of domestic residents' income. These two measures of 'actual openness' which correct the indices of 'traditional openness' are supplemented by six openness indicators to reveal a more comprehensive insight into the structure of international trade, such as the

trade-induced production of intermediate commodities and the factors of production embodied in tradables.

Chapter 4 presents an empirical re-assessment of the potential *relationship between the degree of openness and the choice of exchange rate regimes*. The motivation behind the econometric analysis is to reveal whether actual openness leads to a better determination of the selection of exchange rate systems than traditional openness (Section 4.1). A brief *literature review* of empirical studies in Section 4.2 is followed by the presentation of the *data set* in Section 4.3. The process of data collection begins with the demonstration of the calculation of the degree of openness with traditional and value-added based indices of openness. The first sources of data are the data bases Global Trade Analysis Project (GTAP) Data Base Version 5.4 and 4 (GTAP, 2003, 1998).[1] These data bases represent the economic conditions for 66 countries and the economic linkages between these countries for the year 1997 and for 31 states within 1995 in US dollar terms.[2] Then, an outline of the structural transformation of the national input-output tables of the GTAP data bases is displayed, which fits the higher complexity of the multi-regional input-output table for the calculation of the value-added based indices of openness.

In a second step, the trade flows of the GTAP data bases are replaced by the structures of trade of the popular World Development Indicators (WDI) 2004 data base (World Bank, 2004). This substitution of the trade structure is necessary for the analysis in this chapter because of the limitation of the GTAP data bases to correctly represent international trade for some economies, such as China.[3] The WDI data base is employed to improve the quality of the calculated degrees of openness towards international trade and to forecast degrees of openness for those years within the period of 1989 and 2002 where data are not available from the GTAP data bases. Furthermore, the calculated degrees of openness based on the traditional and actual openness of 56 countries for 14 years are presented. Finally, the data base of Levy-Yeyati and Sturzenegger (2002) serves as the source of data for the exchange rate

[1] The data source GTAP Data Base Version 6 (the base year is 2001) could not be included in this study as planned because the release of the data base is postponed from April 2004 to the end of 2004.

[2] Beside these countries, the GTAP Data Base Version 5.4 (4) characterizes 13 (14) regions which consist of aggregated states. The degrees of openness of the countries within the regions are not calculated because the individual economies cannot be separated from each other.

[3] Missing values of trade flows are simulated in a world trade model where the value of total exports equals the value of total imports to construct the GTAP data bases (see Gehlhar et al., 1997).

arrangement of 172 countries between the years 1974 and 2000. The two alternative classifications of exchange rate regimes used in the data base are illustrated in this section.

The analysis of the degree of openness as a potential determinant for exchange rate commitments is structured in two parts. Section 4.4 presents the characterization of *actual openness towards international trade*. Following a visual analysis of the degrees of openness of 53 countries for the year 2001 (the latest year with the most cross-country data available), which are calculated with traditional and value-added based indices, the results of a frequency distribution, rank order correlation, and regression analysis of 682 observations of 56 countries' degrees of openness for the period between 1989 and 2002 are discussed. The change in the well-established openness indices towards the innovative openness measures, which accentuate the income generated by international trade and the regional redistribution of parts of the income, leads to systematic effects on the degree of openness towards international trade.

The most striking results are that, in general, both concepts indicate a relatively similarly high significance of international trade with a high degree of openness. The strong correlation of the rank orders of countries between traditional and actual openness is clearly an improvement over most alternative indices of trade openness that try to correct the conventional shares of trade. In all cases, the value added based openness measures indicate that countries are less open towards international trade and are at a more comparable level. For example, according to the traditional export ratio index, Singapore's degree of openness exceeds 100 percent. This would mean that the country produces domestic non-tradables with a negative value because the value of goods and services sold to foreign residents surpasses the value of all domestic goods and services. This is clearly not the case because exports include some imports which do not contribute to the national income in the domestic economy. The new value-added based export ratio measure takes this into account. In addition, the concept of actual openness reveals the tendency for an increased portion of imported intermediate inputs in the manufacturing process of a country's exports at the expense of domestic factors of production the more open an economy is.

Section 4.5 presents the analysis of the influence of the swap from measures of the established method to the value-added based method of calculating the degree of openness on the quality of trade openness, to explain the choice of *exchange rate regimes*. The test results of the regression analysis of 525 observations of 54 countries between the years 1989 and 2000 suggest, as expected, that the more open an economy is, the more likely it is that policy makers select a fixed exchange rate system as an instrument in exchange rate policy to achieve an

internal and external balance. All four value-added based indicators outperform the corresponding four traditional proxies as parameters in the regression analysis.

After Chapter 3 introduced the development of the value-added based measures of openness towards international trade and Chapter 4 presented the application of these indices in the empirical re-evaluation of the selection of exchange rate arrangements on a global scale, Chapter 5 expounds the design of the innovative *value-added based measures of openness towards bilateral trade*. In the next chapter, these openness proxies are used for the empirical re-assessment of the potential association between the degree of openness and the choice of exchange rate regimes within an integration area, such as the European Union (EU). Established and value-added based measures of openness to bilateral trade allow differences between trading partners that are member states of an integration area and all other economies which are located outside the region to be distinguished. This regional splitting of international trade is an aim to make the increased adequacy of the openness indication of the basic value-added based concept, compared to the traditional method, useful to the cost-benefit analysis of monetary integration (Section 5.1).

Section 2.3.3 points out that the intensity of trade between a country and a single currency area, as for example the euro zone, might influence the decision of policy makers to abandon the national currency. The standard cost-benefit analysis of monetary integration suggests concentrating on the degree of openness towards intra-regional trade. In the absence of the knowledge of the exact break-even degree of openness of a potential client country, this might lead to wrong conclusions. Say, for example, a country's degree of openness towards intra-regional trade is in the range of those realizations of the existing members. On the other hand, its trade with the rest of the world dominates its domestic economy (which is reflected by a higher degree of openness to extra-regional trade than its degree of openness to intra-regional trade). Should, this potential member country adopt the euro? Since the forecast of the break-even degree is out of the range of this study (due to severe difficulties in the exact identification of the cost and benefit functions of monetary integration), measures of openness towards extra-regional trade complement the construction of openness indices to intra-regional trade.

Section 5.2 highlights the *extended input-output framework*. After the multi-regional input-output table with three regions is illustrated, the multi-regional input-output analysis of income effects due to bilateral trade is described. The regions include the candidate country, the integration area, and the rest of the world. Similar to the basic version of the input-output framework, the extended input-output framework serves as an instrument for designing the

new value-added based indices of openness to bilateral trade by explaining the economic conditions in a nation, in the member countries of an integration area, and in the economies of the rest of the world as well as the trade flows between these regions. Subsequently, in Section 5.3, the *construction* of 20 new adjusted trade shares based on value-added is pointed out and the association between openness measures to bilateral trade and indices to international trade is illustrated. Section 5.4 describes the *relationship between traditional openness and actual openness* for bilateral and international trade.

Chapter 6 takes up the indices of openness to bilateral trade of the traditional and actual concept for the re-evaluation of the potential relationship between the degree of openness and the choice of exchange rate regimes. Whether or not the Central and Eastern European countries (CEECs) in the prospective final step of their process of monetary integration within the European Union should adopt the euro is analyzed. The CEECs under investigation are the eight new member states of the European Union since May 1, 2004 (besides Cyprus and Malta) which are the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia.[4] Section 2.3.3 illustrates that the degree of openness towards intra-regional is a vital parameter for a state that is deciding whether it should peg its currency to a single currency area or not. In the comparative investigation of this chapter, it is of interest which impacts a change in the calculation of the degree of openness from the broadly applied traditional concept towards the value-added based approach of measuring openness has on the outcomes of the cost-benefit analysis of monetary integration and whether this would lead to a revision of the recommendation for policy makers in one of the CEECs to participate in the euro zone (Section 6.1).

In Section 6.2, the innovative concept of actual openness is characterized by means of a *comparative analysis of the integration of trade* between the Central and Eastern European economies and the 15 pre-accession member countries of the European Union.[5] The comparison of the value-added based indices of openness towards intra-regional trade to the traditional proxies of openness is complemented by measures of openness towards extra-regional trade of the actual and the traditional concept. The data set consists of four traditional and six value-added based degrees of openness towards intra-regional and extra-regional trade of the

[4] Bulgaria and Romania are in negotiations of accession with the European Union.

[5] The 15 member countries of the EU that had been members before May 1, 2004 are labeled as 'pre-accession member countries'. These are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

25 member states of the European Union for the year 1997, which represents the year with the latest data available. The GTAP (2003) data base is the source of data for the calculation of the trade shares of the traditional and actual concept. The WDI data base of the World Bank (2004), however, does not serve as source of data, as in Chapter 4, to adjust the trade structure of the GTAP (2003) data base or for the computation of the CEECs' degrees of openness for a period of several years. The unadjusted patterns of trade of the GTAP (2003) are used to calculate degrees of openness, despite their weakness in accurately describing the economic relationships between countries, because of a comparison of the base year 1997 with the year 2008 which might be a realistic date for the CEECs to adopt the euro after they will have enduringly met the Maastricht criteria for several years and they will not have devaluated their currency for two years as member countries of the Exchange Rate Mechanism (ERM) II (Section 6.5). Similar to Section 4.4, the value-added based proxies of openness are characterized by a visual, frequency distribution, correlation, and regression analysis. The change of the traditional openess indices towards the value-added based openness indices leads to the same systematic effects on the degree of openness towards bilateral trade as was discussed for international trade.

In Section 6.3, the *computable general equilibrium (CGE) analysis* is introduced. It is applied to forecast the potential degrees of openness to trade of the Central and Eastern European countries for the year 2008. Computable general equilibrium models assume an economic equilibrium which is distorted by an external shock. Then, the models forecast the economic effects that are necessary to come back into a situation of system-wide balance. The Global Trade Analysis Project (GTAP) model is chosen for this study since it is a well established simulation system in the economic research. The GTAP model is a multi-regional multi-sector CGE model. It is deemed an applied model and not a theoretical one because its focus is on economic policy relevance and not insights about economic key mechanisms. Furthermore, it is a general equilibrium model and not a partial equilibrium model because resources shift among alternative uses, feedback effects among income and expenditure exist, and the GTAP model offers a sound theoretical structure. The model is also a multi-regional and not single-regional one because patterns of specialization and trade among regions exist and international trading partners are not exogenous. In addition, this model consists of accounting equations and relies on value flows. Value flows correspond to real flows crossing markets in the opposite direction. In doing so, the GTAP model describes the economies of the world. It divides the world into several countries and regions, respectively. Consequently, every econ-

omy is modeled in the same way. The model links all economies by trade flows and thus it is a global model.

The GTAP model describes economic relationships within an economy and between economies by means of the interactions on markets. Inside a country, the income of regional households is linked with the spending of private households, government expenditure, and savings. Producers are connected with income and expenditure. Taxes and subsidies are related to the agents. Furthermore, a region is linked with the rest of the world through its exports and imports. A global banking sector ties global savings to investments. The agents and the world are linked through markets where supply equals demand. The underlying system of equations of the GTAP model includes two different kinds of equation. Equilibrium relationships ensure that receipts and expenditures of agents are balanced and behavioral relationships specify the agents' behavior of optimization. An empirical analysis with the GTAP model enhances a theoretical one because it allows the significance of the induced economic consequences to be forecasted.

The GTAP data base and the GTAP behavioral parameters along with the theory of the GTAP model determine the simulation results. Version 5.4 of the GTAP data base consists of 78 regional economic data bases which are linked among each other by bilateral trade, transport, and protection matrices (GTAP, 2003). The data are value flows which are measured in US dollar terms and effective rates of protection. Regional input-output tables describe the inter-industry linkages of 57 industries within each region which are derived from individual national input-output tables. Endowment commodities of each industry include unskilled labor, skilled labor, capital, land, and natural resources. Behavioral parameters consist of the agents' elasticity specifications for each region. These are substitution elasticities in consumption and production, demand elasticities of consumers, transformation elasticities (which determine the degree of mobility of domestic production factors across sectors), and allocation flexibilities of regional investment. Therefore, an empirical analysis with the GTAP model enhances a theoretical one because it allows the significance of the induced economic consequences to be forecasted.

Subsequently, Section 6.4 presents a *scenario of the economic situation* of the CEECs, the other member countries of the European Union, and the countries outside the integration area for the year 2008. Within this scenario the prospective degrees of openness towards intra- and extra-regional trade are simulated for the Central and Eastern European economies. The simulation design is based on growth rates of gross domestic production during the period of 1997

and 2008, which are estimated for the years after 2002. Section 2.1.2 discusses the likely linkage between the economic development and the degree of openness. In general, the trade integration of the CEECs in 2008 might not much deviate from 1997. Imports might become more important and the significance of exports may shrink. In addition, the CEECs might increase their openness towards the other members of the European Union to the expense of the trading partners outside the integration area. These results are as expected due to the strong economic integration of the CEECs with the European Union which the new member states already attained before their accession in 2004.

Finally, the analysis of the *CEECs' potential accession of the euro zone* for the year 2008 is given in Section 6.5.[6] It is performed within a standard cost-benefit framework of the theory of optimum currency areas since the judgment of whether a candidate country should join a fixed exchange rate area uses the degree of openness as an important determinant. If the degree of openness towards intra-regional trade is higher than the break-even degree of openness then the country should abolish its currency. If traditional measures of openness overstate the influence of trade integration on the domestic economy, as revealed in section 4.4 and 6.2, the outcome of the cost-benefit analysis of monetary integration will be affected. Furthermore, traditional openness suggests that CEECs are significantly more integrated in the European Union than the member countries of the euro zone, whereas, according to actual openness, the regional integration of the CEECs and the members of the euro zone is relatively similar. If the degree of openness becomes even lower than the minimum break-even degree of openness (which is possible in the wake of the shift from the traditional openness concept towards the actual openness method), the recommendation for the candidate country to peg its currency to the fixed exchange rate area might have to be revised. All Central and Eastern European economies are more open towards the member states of the European Union than to the member countries of the euro zone, independent from the concept of calculating the degree of openness. This means that if participating countries in the euro zone gain net benefits due to the abolishment of their national currency, then the CEECs might also benefit from adopting the euro in the year 2008.

Chapter 7 *concludes* and discusses the implications of the outcomes for the development of proxies of openness and the evaluation of the potential association between the degree of openness and the choice of exchange rate regimes.

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[6] The 'euro zone' consists of twelve member countries of the Economic and Monetary Union, which are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.

2. Significance of the degree of openness for the choice of exchange rate regimes

Chapter 2 highlights the potential association between a country's degree of openness and its choice of exchange rate regimes as it is discussed in the economic literature. The depiction of the status quo starts with an introduction of the degree of openness (Section 2.1). After a definition of the term 'trade openness', the section outlines factors which determine the intensity of trade relations between a country and its foreign trading partners. Then, alternative approaches for measuring the significance of international trade are reflected and applications of trade openness in economic research are described to illustrate the common role of openness within economic literature. This general view on indices of openness towards trade leads to an accentuation of the most widespread applied openness measures within the open-economy research in Section 2.2 – the shares of trade. The presentation divides the indices of openness that place emphasis upon international trade and those that draw attention to bilateral trade.

Following the review of the degree of openness, the choice of exchange rate regimes is presented in Section 2.3. The section begins with an outline of different exchange rate arrangements. Then, several potential determinants of the selection of a sound exchange rate system are accentuated. In addition, the section illustrates openness of trade as a decisive parameter for a country that plans to peg its currency to a fixed exchange rate area which at the same time floats against economies in the rest of the world. Finally, arguments for selecting a fixed and flexible exchange rate regime are discussed.

2.1 Synopsis of the term 'degree of openness'

2.1.1 Definition of openness to trade

The *degree of openness to trade* indicates the importance of international trade linkages for a country. This broad definition is necessary to account for the large amount of alternative measures of openness which accentuate different aspects of international trade (see Section 2.1.3). Importance refers to the power that trading partners abroad have to influence the operation of a market economy (see Section 2.1.4). Tighter connections between domestic and foreign markets can reduce the effectiveness of demand stimulation by fiscal and monetary policies. For example, increased spending by domestic consumers might be directed at foreign firms. In addition, external factors can exert greater influence on domestic outcomes. For example, increased product-market competition might affect production output, income, employment, or price level of the domestic economy.

A value of zero for the degree of openness indicates that the country is a closed economy in total autarky. The higher the level of openness, the more likely it is that the foreign countries have a stronger affect on the economic variables of the home country. Common synonyms for the term 'degree of trade openness' are 'degree of openness to international trade' and simply 'degree of openness'. The degree of openness might rise over time, either because of reduced official obstacles in trade flows or due to decreased transportation and information costs between markets (see Section 2.1.2).

If the economic role of the member states of an integration area, such as the European Union, is accentuated for a country then bilateral trade flows are emphasized and the terms 'degree of trade integration' and 'degree of integration' are alternatively applied to the presented terms. The focus of a country on a group of trading partners is of interest, for example, if the country decides whether it should join a fixed exchange rate area or not (McKinnon, 1963 and Mundell, 1961). Net benefits of pegging a country's currency to the region is largely determined by the country's level of exchange of trade with the members of the integration area (see Section 2.3.3). In this study, the term *degree of openness to intra-regional trade* is used to demarcate the significance of trading partners within an integration area from all foreign countries. Furthermore, the *degree of openness to extra-regional trade* focuses on trade linkages between a country and the economies outside the integration area to gain additional insights into the assessment of the significance of the country's regional integration (see Chapter 6).

Brahmbhatt (1998) points out three proxies of an economy's openness besides *international trade*. "[T]he establishment and operation of a business in one country that is substantially controlled by residents of another, through *foreign direct investments*; the purchase and sale of financial assets either through portfolio investments or lending and borrowing, which can be referred to as *financial integration*; the offer of labor services in one country by residents of another through *labor migration*."[7]

2.1.2 Determinants of an economy's openness

How does the *behavior of market participants* affect the openness of trade? *Lowering production costs* of tradables might rise the degree of economic openness. If domestic (foreign) exporting producers are more competitive than their foreign (domestic) counterparts, then the

[7] The additional aspects of openness are not part of this study because of the focus on international and bilateral trade connections.

companies might be able to sell more goods on the world (home) market as given by the price elasticity of demand of the traded goods.[8] The Ricardo model points out the role of *technological differences* between nations for international trade. In addition, the Heckscher-Ohlin model emphasizes the *divergence of resources*. Lower costs of production occur due to a better utilization of given resources, either by an *increase in the productivity of resources* or by a *more intensive use of abundant factors*. Moreover, *achieving economies of scale* might increase openness because of an increased efficiency in production. In the first two cases, the trade pattern is characterized by inter-industry trade and the latter by intra-industry trade.

Bernard and Jensen (1999) find that exporters have substantially higher productivity levels than non-exporters and that exporting companies grow faster. Furthermore, exporting is associated with the reallocation of resources towards the more efficient exporting firms. Roberts and Tybout (1997) develop a model of exporting with sunk costs of entry. Only the relatively productive firms will choose to pay the entry costs and enter the foreign market. Rose (2004) gives additional determinants on the degree of trade openness such as falling *transaction costs*, converging *tastes*, and the shift of the *structures of production* from primary products towards manufacturing and services.

Furthermore, the *expansion of multinational enterprises* might increase the degree of openness to international trade due to *foreign direct investments*. Multinational enterprises do not only transfer capital to create or expand foreign subsidiaries, they also transfer management capabilities to extend their local control to build a multinational organization (see, for example, Itoh and Wang, 2004 and Wang, 2004c). From a theoretical point of view, as Goldberg and Klein (1998) highlight, foreign direct investments may encourage export promotion, import substitution, or greater trade in intermediate inputs, which depends on the focus of production of multinational companies. In emerging economies, most foreign direct investments of multinational enterprises are export-oriented, which increase the speed of a host economy to become integrated into a global production network in sectors in which it may formerly have lacked experience (OECD, 1998). Cuadros, Orts and Alguacil (2001) obtain a positive relationship between foreign direct investments and the degree of openness but point out that the empirical evidence in recent works is ambiguous.

[8] The concept of comparative advantage states that a country is more competitive in a good than its trading partners if the opportunity cost of producing that good in terms of other goods is lower in that country than it is in other nations. (see, for example, Krugman and Obstfeld, 2003, pp. 10 ff.)

The gravity model of international trade might reveal additional determinants of trade openness. The source of the model extends back to Tinbergen (1962) and Pöyhönen (1963). It is an empirical model that explains the volume of bilateral trade between countries by taking *geographic variables* into account. By analogy to Newton's theory of gravitational attraction between two masses, the flow of trade between a pair of countries is modeled by *size* and *distance*. Leamer and Levinsohn (1995) find consistent results in their survey of empirical contributions that applied the gravity model of international trade. The volume of trade between countries is positively related to their sizes and negatively linked to the distance between them. In addition to the gravity model's success in the empirics, it is based on solid theoretical foundations (see, for example, Deardorff, 1998).

The gravity model of international trade clearly relates distance to openness of trade but not to geographic variable size. A country that is an island which is far away from large countries is less integrated into the world economy through trade than a country with equal size that is adjacent to large neighbors. With respect to size, the affect on trade openness is less obvious. Big countries are associated with larger volume of trade than small countries, but they also have larger domestic markets. If the markets at home dominate those abroad, which is likely for big countries just because of the size of markets, then big countries are less open than small countries. Alesina, Spolaore and Wacziarg (2000) empirically prove the expected inverse correlation between average country size and trade openness. Their line of argument starts with the fact that after the end of World War II, the number of countries almost tripled and the volume of international trade and financial flows expanded considerably. Small countries are economically viable when their market is the world, because of the small market size at home. These nations have an interest in maintaining open borders in a relatively free-trade environment.

As Rose (2004) and Frankel and Romer (1996) indicate, geographic variables account for a major part of the variation in international trade. On the one hand, national *incomes*, *populations*, land *areas*, *per capita GDPs*, and *factor accumulations* are good explanatory variables for size. On the other hand, *landlockedness*, shared *colonial history*, common *border*, common *languages*, and common *membership* in regional trading arrangements are good dummy variables for distance. In the case of sharing a common language, Wei (1996) finds that countries with this link have a trade volume 80 percent higher than without. A common language greatly reduces the transaction costs associated with gathering information, making contacts, and conducting negotiations. For example, the small country Luxembourg has a high degree

of trade openness. It is in a densely populated part of the world and adjacent to the larger countries Germany, France, and Belgium as well as several other major countries.

In addition to geographic factors, *political decisions* might determine a country's openness of international trade. Governments try to influence the economy with a wide range of instruments in their policy mix to achieve specific aims, for example, to defend a recession at home by stimulating demand. Their actions might spill over to trading partners abroad and thus influence the trade relationships. Two areas which are likely to affect trade openness are being looked at closer: international coordination of policies and trade-oriented economic development of developing countries. This includes several economic policies, such as the trade, exchange rate, monetary, and development policies.

An *entry into a multilateral trading system* might be positively correlated with the degree of openness. A widespread argument for a multilateral organization, such as the World Trade Organization (WTO), is that such a system is likely to promote trade among its member countries because it helps to reduce tariff and non-tariff trade barriers between the joined nations (see, for example, Subramanian and Wei, 2003). Rose (2004) estimates the effect on the international trade of the WTO, its predecessor the General Agreement of Tariffs and Trade (GATT), and the Generalized System of Preferences.[9] According to him, membership in the GATT/WTO is not associated with a higher degree of trade openness than the levels of openness of non-members. From a theoretical point of view this is surprising since trade liberalization increases international trade due to lower prices, for example due to the reduction of transportation costs and increase of competition. By taking gravity effects on international trade into account, the formerly supposed large effect of the GATT/WTO on bilateral trade completely erodes. On the one hand, the GATT/WTO has not forced most members to lower trade barriers, especially developing countries, as would be expected. On the other hand, many member countries extend most-favored-nation treatment unilaterally to outsiders. Rose (2004) concludes that the GATT/WTO increased trade but not as the driving force.

In contrast to multilateral trade systems, *participation in a unilateral trade agreement* such as the Generalized System of Preferences or the Preferential Trading Agreement, might promote

[9] The Generalized System of Preferences allows industrialized countries to grant non-reciprocal tariff reductions to developing countries to help developing economies industrialize (http://www.eurunion.org/legislat/gsp/gsp.htm, last time accessed 2004-07-29).

the degree of openness.[10] The formation of unilateral trade agreements to reduce trade barriers between the agreeing nations might promote the trade integration among the participating countries when intra-regional trade leads to the effect of trade creation. High-cost domestic producers are replaced by low-cost imports from other member countries. In the case of trade diversion which is the replacement of low-cost imports from non-members with higher-cost imports from member nations, the level of trade integration rises but not the general degree of openness. Rose (2004) finds significant and large effects not only on trade of unilateral trade agreements but also for currency unions as, for example, the euro zone.

Why might the *adoption of a common currency* increase the degree of trade openness between a potential entrant and the member states of a monetary integration area?[11] International borders strongly reduce trade between countries due to border costs. Reasons for this intra-national bias in trade might be a common currency, common cultural norms, common legal system, common history, and so forth (Rose, 2000). According to Anderson and van Wincoop (2001), the presence of an international border is estimated to reduce trade among industrialized countries by 30 percent. Alesina, Barro and Tenreyro (2002) argue that the elimination of the usage of different currencies on the two sides of a border – one source of border costs – might have a large effect on trade. Rose (2000) points out that a common currency represents a serious commitment of a government to long-term integration. This commitment might encourage the private sector to engage in greater international trade. The empirical results of Alesina, Barro and Tenreyro (2002) and their review of existing empirical work support the argument that a monetary integration area has an important positive effect on bilateral trade flows between participating countries.

Additional effects of currency unions on trade, such as the reduced *exchange rate volatility* and the abolished *fees on currency conversion* which are typically a small percentage of total transportation costs, are estimated to be small (see, for example, Rose, 2000 and De Grauwe and Skudelny, 2000). In respect to exchange rate volatility, Mussa et al. (2000) estimate a stronger inverse relation to trade openness than Rose (2000) does. An increased exchange rate volatility might negatively affect trade openness because of rising costs for hedging uncertainties in the development of the exchange rate.

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[10] The Preferential Trading Agreement allows the formation of unilateral trade agreements at different levels of policy coordination between member nations, such as regional free trade areas, customs unions, or common markets.

[11] It is also argued that trade openness might increase the possibility for a country to join a fixed exchange rate area (see Section 2.3.3).

The second policy decision under investigation is the attempt of developing countries to reduce the income gap between themselves and the advanced nations. Policy makers that *take foreign economies into account* to initialize a catching-up process of the home economy, might increase the degree of trade openness. Many policy makers in developing countries assumed that economic development could only be achieved through moving resources from the agricultural sector towards the manufacturing sector. Margins of agricultural goods are typically very low because customers see them as homogeneous goods and they are not willing to pay adequately. For example, the market price of coffee beans is below production costs. Furthermore, oversupply of many agricultural goods exists on the world market due to, for example, export subsidies on agricultural goods (e.g. in the European Union) or the strong import protection of domestic farmers (e.g. in Japan). Manufactured goods are attractive for developing countries, for example, because the World Trade Organization achieved reductions of trade barriers for manufactured goods which substantially outperform those outcomes for agricultural goods.

Two main alternative instruments of development policy were applied to spur economic growth (see, for example, Baldwin, 2003). Temporary *limiting of imports of manufactured goods* should protect the manufacturing sector which in turn supports the domestic market rather than supporting manufacturers abroad. The most important economic argument for the import-substituting industrialization is the infant industry argument. Developing countries have a potential comparative advantage in manufacturing and they can realize that potential through an initial period of protection. Since this strategy broadly failed to raise the standard of living in developing countries, many policy makers sought for an alternative.

Instead of almost certainly serving the world market with manufactured goods in the future, why not *promote exports of manufactured goods* now to create higher economic growth? A policy mix of trade policy and industrial policy in conjunction with high saving rates and a rapid improvement in public education was extremely successful for developing countries in terms of catching up with the advanced nations. Even when the importance of such policies might be questionable, since there was a wide variety of policies among the developing countries and failures of industrial policy, the political decision to take foreign countries into account in promoting economic development had a strong impact on the openness of trade. Developing countries which followed the strategy of export-led growth, such as China and Sin-

gapore, are significantly more open towards international trade than, for example, Brazil and India which aimed for an import-substituting industrialization (Mussa et al., 2000).[12]

2.1.3 Alternative measures of openness

Even though the concept of trade openness is simple in theory, *many approaches* of measuring it have been developed.[13] This reflects the numerous determinants of trade openness revealed in the previous section. As Pritchett (1996) proposes, this review distinguishes three broad categories of existing indices of trade openness: outcome measures, deviation measures, and administrative measures.[14]

Outcome-based measures describe either the quantities or the prices of the integration in product markets. These type of indicators of trade openness can be classified by whether their *orientation* is towards all international or towards particular bilateral trading partners and whether their *coverage* includes a summary of all tradables ('average') or specific goods and services or industries ('component') of the trade flows. The measures which indicate the significance of international trade on an average basis give a general overview of a country's trade openness whereas the other classifications concentrate on specific aspects of trade relationships. Variations can be designed for many outcome indicators of openness to fit other combinations of these attributes as, for example, the compilation of a summary index. In the following, such variations are not mentioned explicitly for simplicity reasons.

The first group of outcome measures reflects the international integration of product markets on average. The *volume of trade* describes the value of existing exports or imports for a period of one year. In addition, total trade and mean trade are common. Total trade denotes the sum of exports and imports whereas the latter index proxies openness by the sum of exports and imports divided by two. These indicators simply state that the more an economy trades, the more open it is. By far the most common measures of trade openness are based on the *share of trade*. They relate the value of a country's exports, imports, total trade, or mean trade

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[12] In this study, trade is seen as a channel for policy makers in developing countries to catch up with advanced nations. See Section 2.1.4 for the likely role of trade for economic growth.

[13] In this section, only measures of openness towards trade are presented. Further dimensions of a country's openness, such as capital flows and labor migrations, are not reviewed because of the exclusive focus of this study (i.e. to adjust traditional shares of trade in the context of the choice of exchange rate regimes). Andersen and Herbertsson (2003) make an innovative attempt to indicate openness with a multi-dimensional approach. They combine several indicators which emphasize trade as well as capital to form a single measure of openness.

[14] In addition to Pritchett (1996), e.g., Brülhart (2002), Brahmbhatt (1998), Harrison (1996), and Leamer (1988) survey the literature on the measurement of trade openness.

to its gross domestic product (GDP).[15] The GDP refers to the total value of all final goods and services produced in a nation. A value of zero of the trade share expresses a country's situation of total autarky without any trade links. The higher the degree of openness, the more important trading partners abroad are for the domestic economy. Section 2.2 presents these traditional measures of openness in detail due to their role as a benchmark for the newly developed indicators in this study.

Beside this, concepts of *adjusted trade share* are applied to calculate the degree of openness. A partial adjustment for the Balassa-Samuelson effect is to use *gross domestic product at purchasing power parity* as the denominator of the trade ratios (see, for instance, Fidrmuc, 2001 and Brahmbhatt, 1998). The Balassa-Samuelson theory states that countries' price levels tend to rise as their real incomes per capita rise. Non-tradables tend to be more expensive relative to tradables in richer countries than in poorer nations, which results in an understatement (overstatement) of trade shares for rich (poor) countries. The theory of purchasing power parity is applied to express nations' price levels in terms of a single currency.

Another approach which adjusts the share of trade is the ratio of traded goods to the *gross domestic product of goods*. This measure emphasizes a component of international trade instead of the average value as those before. Brahmbhatt (1998) argues that rich countries tend to devote a higher share of their output to services. This can result in an understatement of the extent of trade openness of rich nations in relation to poor countries as well as to their own historical past because services tend to be less internationally tradable.

McKinnon (1963) considers the *ratio of tradables to non-tradables* to express the openness of an economy. He argues that an economy with a high degree of openness should rely more on fiscal and monetary policy than on floating exchange rates to cure a balance of payments disequilibria. Knetter and Slaughter (2001) propose measures which reflect product market integration by the geographical dispersion of international production and by the fragmentation of international production. The *measure of geographical dispersion of production* indicates the degree of concentration of the worldwide production. The index equals one if a single country produces all of the world's output of an industry and it is zero when world production is spread evenly across all countries. Harrigan (2001) points out that the *measure of production fragmentation* tries to address the phenomenon of offshore outsourcing. This concept indi-

[15] Besides the gross domestic product, the gross national product is applied in some studies as denominator to proxy national income.

cates openness of trade with the value added share of gross output by industry. A value of zero (one) could be interpreted as maximum (minimum) openness to trade because all (no) intermediate products would be imported from the foreign trading partners for the production of domestic output.

Measures of intra-industry trade emphasize the degree of symmetry (of changes) in exports and imports at the industry level. These concepts indicate whether a country is more open towards products in the same category or products in different categories. Brülhart (2002) works out three categories of indicators: static, quasi-dynamic, and dynamic measures of intra-industry trade.[16] By far the most widely applied measure of intra-industry trade is the *static* Grubel-Llyod index (Grubel and Llyod, 1975) which describes the pattern of trade among countries in one year. Several concepts exist to increase the adequacy of the Grubel-Lloyd index. For example, Nilsson (1997) proposes an indicator which takes into account measurement problems that occur due to trade between countries with large differences in economic size. *Quasi-dynamic* measures, such as first-differenced Grubel-Llyod indices, the Greenaway-Hine-Milner-Elliott measure, and measures of Dixon and Menon (1995), represent the change in the share or the amount of matched trade between two years (Greenaway et al., 1994). *Dynamic* indicators of intra-industry trade do not emphasize the change in intra-industry trade but reflect the degree of intra-sectoral (a)symmetry in changes of trade to reveal implications for factor-market adjustments. Many measures of marginal intra-industry trade are developed, such as the measure of Hamilton and Kniest (1991) and a Grubel-Llyod style measure with several extensions (Brülhart, 1994).[17]

Beside these quantity-based measures, integration in product markets is also analyzed with *price*-based indices. The law of one price in its absolute (relative) version suggests that in the absence of trade barriers, and several other assumptions, arbitrage should lead to an equalization of product prices (price changes), when stated in a common currency, wherever they are traded. A lower magnitude of the *deviation from the law of one price* would indicate a higher degree of openness since the country faces less trade restrictions.

The following outcome-based measures of openness to trade focus on the significance of bilateral integration of product markets instead of taking all international trading partners into account as with the previously illustrated techniques. A concept which covers bilateral trade

[16] Other than the term 'dynamic', the expression 'marginal' is often used in the literature.

[17] For example, Thom and McDowell (1999), Lloyd (1998), and Menon and Dixon (1997) introduce additional indices.

of goods and services on an aggregated level is the *measure of trade intensity* (see, for example, Fidrmuc, 2001 and Frankel and Rose, 1998). Trade openness is measured by the share of average bilateral trade between two trading partners to average international trade of both trading partners. Trading partners may consist of a single country, such as Poland as one of the most recent member nations of the European Union or may denote a group of countries, for example, like the 15 members of the European Union before the enlargement of the integration area on May 1, 2004. If the variable is zero (one) then the country and its trading partner trade exclusively (not at all) with each other.

Knetter and Slaughter (2001) introduce the *measure of trade thickness*. This proxy of a country's openness indicates bilateral trade by emphasizing a particular industry. Trade openness is represented by the number of a country's bilateral trade flows in an industry in relation to the number of worldwide two-way trade in the industry. If the economy is involved in every (no) bilateral trade flow in the industry then the measure of trade thickness equals one (zero). A higher value of this measure is interpreted to indicate the higher competitiveness of a country's industry on product markets, regardless of the volume of that trade.

Next, *measures of deviation* are reviewed. Indices of this category indicate the divergence of observed trade from predicted trade to reveal how restrictive a country's trade regime is. Several attempts exist to predict a country's quantity or price of traded products under the condition of potential free trade. This benchmark is calculated by taking factor endowments, geographic characteristics, interaction of agents, or the law of one price into account. Actual trade is compared to the benchmark to express the openness of trade.

In the case of *quantity*-based deviation measures, a value in excess of (less than) one indicates that a country trades more (less) than would be predicted by a model. Higher values of these indices are associated with an increase of openness towards trade across countries and time and can be interpreted as weaker distortions of trade by trade policy.

The first concepts of deviation apply the *Heckscher-Ohlin model* to generate predictions about a country's propensity to trade internationally. The relative endowments of skilled labor, unskilled labor, capital, and natural resources may have an impact on comparative advantage and, thus, on patterns and volumes of trade (see Section 2.1.2). The classical reference for such indices of openness is Leamer (1988). His ratio of actual to expected trade emphasizes the export side whereas Spilimbergo, Londoño and Szekély (1999) and Wolf (1993) accentu-

ate the import side. Chen (1999) enhances the concept of Leamer (1988) by isolating the country-size effect.

Furthermore, the *gravity model of international trade* is employed to construct measures of openness. For instance, country size and distance from major trading partners might affect trade volumes negatively and, for example, a common language might influence bilateral trade positively (see Section 2.1.2). The empirical model predicts trade using such geographic characteristics of nations.

Falvey, Foster and Greenaway (2001) construct a measure of openness to imports of advanced countries for a sample of developing countries. The extent of deviation of actual trade from that predicted is taken as an *indicator of the extent of trade restrictions on Northern imports*. They estimate the *volume of bilateral trade* between nations in the North and those in the South with a gravity equation. In contrast, Wei (2000) and Lee (1993) develop measures of openness which are also based on the gravity model of international trade but the *share of trade* is used as a dependent variable in the regression instead of volume of trade. Spilimbergo, Londoño and Szekély (1999) enhance the indices of trade openness listed before by the *endowment-corrected measure of openness* which takes factor endowments as well as gravity determinants into account to predict trade.

Lloyd and MacLaren (1998) employ a *computable general equilibrium model* to predict the volume of trade in a situation of free trade. This theoretical foundation calculates a new equilibrium of the world economy after an exogenous shock of the system – the abolition of all restricting and promoting trade policies – by taking the behavior of consumers, firms, and governments into account. The ratio of trade in the current situation to the simulated trade measures a country's integration in the world economy. Different to the interpretations of the previous deviation measures, a value of one (zero) indicates a completely open (closed) trade regime which can be classified as outward-oriented (inward-oriented). Hence, a high (low) degree of openness towards trade is interpreted as a weak (strong) distortion of trade by trade policy.

The second class of deviation measures is characterized by a *price*-based indication of openness. Actual outcomes are compared against an absolute standard, such as the law of one price in product markets and the purchasing power parity. Brahmbhatt (1998) summarizes that even among narrowly defined and highly traded products large and persistent deviations from the law of one price are present. Reasons for the lack of arbitrage in the product markets might

be, for example, transaction costs, distance, border effects, price stickiness, formal trade barriers, and the fact that product prices also contain a large component of non-traded goods and services.

Knetter and Slaughter (2001) introduce two indices of openness. The first concept is the *coefficient of variation*, which captures whether the permissible range of price dispersion is rising or falling relative to the product price itself. A falling value is interpreted as falling resale costs and, thus, increased integration of product markets. The *coefficient of variation of relative prices* describes whether relative prices within countries are converging towards a common benchmark, which would prevail in an open market.

A commonly applied price-based measure of openness is the *measure of price distortion*. It is based on the idea that a deviation from the purchasing power parity indicates a distortion in trade flows (Spilimbergo, Londoño and Szekély, 1999). Dollar's (1992) index tries to capture the degree to which the real exchange rate is distorted from its free-trade level by the trade regime. The benchmark of the measure is a price level which corresponds to a country's specific resource endowment. A comparison of the actual price level to the norm indicates whether real overvaluation or undervaluation exists.

Similar to the previous index, the *measure of black market premium* captures the distortion of the real exchange rate as a proxy of openness (see, for example, Chen, 1999). A black-market premium measures the deviation of the black-market rate from the official foreign exchange rate. The premium indicates the distortions in foreign exchange markets due to the fact that distorted trade regimes often induce distortions in the exchange rate (Spilimbergo, Londoño and Szekély, 1999). Therefore, a high level of black market premium is associated with a low degree of openness to trade.

Administrative measures directly indicate the restrictiveness of trade barriers. These openness indices describe the institutional features of a country's attitude towards international trading partners, as far as trade is concerned. The first group of measures tries to express the restrictiveness of trade policy with the *level or dispersion of tariffs*. Common concepts emphasize tariff rates and tariff revenues (see, for example, Wacziarg, 2000). A high level of trade openness is interpreted as a small distortion of international trade flows by trade policy.

Because of the declining relevance of tariff barriers in trade policy within the last decades, concepts which emphasize *non-tariff barriers* to measure openness towards trade became more important (Knetter and Slaughter, 2001). Such an index is the coverage rate of non-tariff

barriers, which expresses the percentage of goods and services affected by quotas, voluntary export restraints, etc. (see, for instance, Edwards, 1998).

The next approaches indicate openness by formally *classifying trade regimes*. The *Sachs-Warner index* has a value of zero (one) if the economy is closed (open) according to any one of a set of criteria related to tariff barriers to trade, non-tariff barriers, the treatment of exports, the type of economy and the size of a black market premium (Sachs and Warner, 1995). Another dummy variable is the *World Bank index* which is based upon a mixture of indicators such as the effective rate of protection, the use of direct controls and export incentives, and the degree of exchange rate overvaluation (World Bank, 1987, Chapter 5). A value of four represents a strongly outward-oriented economy, three indicates moderately outward-oriented, two stands for moderately inward-oriented, and one is interpreted as strongly inward-oriented. In addition, the *Heritage Foundation index* measures trade openness by classifying countries into five categories according to the level of tariffs and other distortions (see, for example, Edwards, 1998).[18]

2.1.4 Applications of trade openness in economic research

The review of applications of openness measures starts with the potential relationship between openness and *monetary variables* of an economy. As the factor-price equalization theorem of the Heckscher-Ohlin-Samuelson model suggests, *income* might be affected by openness towards trade. Under free trade, product prices equalize as well as factor returns. For example, an increase in the relative price of the relatively labor intensive commodity increases the real return to labor and reduces the real return to capital. Ben-David (2001) and Ben-David and Kimhi (2000) examine the relationship between trade liberalization and income convergence across countries and find strong evidence that a reduction of barriers on trade culminate in *per-capita income convergence* between the trade-liberating countries. Falvey (1999) points out the role of the source of comparative advantage. Where trade is based on differences in factor endowment (technology), trade liberalization has a bias towards (likely against) factor price convergence. Technology differences imply that firms employ factor inputs in different combinations to produce the same output.

[18] The presented measures of openness are evaluated in Section 3.1 as part of the argumentation for the potential necessity for new indicators which are developed in this contribution.

Increasing trade might, in addition, affect the *income distribution*. Ekholm and Knarvik (2001) expand the Heckscher-Ohlin-Samuelson model and develop a model where trade liberalization leads to the raise of *income of skilled labor* in relation to unskilled labor. When firms get access to a larger market, the relative profitability of more skill-intensive technology increases because modern firms with relatively large fixed costs may enter and traditional firms with relatively large variable costs may exit the integrated market. This increases the relative demand for skilled labor, on the assumption that fixed costs are more skill-intensive than variable costs, and thus increases their wage. Empirical studies, such as Greenaway, Hine and Wright (1999) and Morrison and Siegel (2000), report results consistent with the analysis of Ekholm and Knarvik (2001). Davis (1992) supports the outcomes by revealing the deterioration of relative *returns of unskilled labor*.[19]

Furthermore, openness towards trade might determine the *prices* of a country. In the case of consumption for example, imports as well as domestic goods and services are part of the consumer basket which is the basis to calculate a country's *price level*. A relative increase in demand of imports might lower the price level when more expensive commodities of domestic producers are substituted by cheaper imported counterparts. The price level might also decrease if imported intermediate products would be cheaper than domestic intermediates. Domestic firms would either substitute domestically produced intermediates with foreign ones or domestic producers would have to reduce their costs to offer their intermediate products at lower prices. Both decisions would result in lower production costs of firms, which would then be able to offer their final products at lower prices. Bloch and Olive (2001) point out in their empirical analysis that domestic factors are the dominant influence on domestic industry prices since domestic producers are able to differentiate their products from those of their foreign competitors, which allows price differentials to persist.

A higher degree of openness might be associated with more *co-movements of prices*. If the trade pattern is characterized by intra-industry trade then the sectoral specialization across countries is similar because industry specific shocks affect the countries in a similar way (see, for example, Alesina, Barro and Tenreyro, 2002).

[19] For additional discussions on the relationship between trade openness and income convergence refer to, for example, Bhatta (2002), Slaughter (2001), Paus and Robinson (1999), Spilimbergo, Londoño and Szekély (1999), Slaughter and Swagel (1997), Wood (1997), Davis (1996), O'Rourke, Taylor and Williamson (1996), and Rassekh (1992).

More openness towards imports might be associated with a lower *inflation rate*. If a government is biased towards inflation, as pointed out by Barro and Gordon (1983) and Kydland and Prescott (1977), and the Phillips curve parameter is assumed to be decreasing with greater openness, then an unanticipated increase in aggregate demand translates into a smaller increase in domestic output since a larger proportion leaks into imports (Romer, 1993). The relationship between openness and inflation stems from an imperfect commitment in monetary policy. The more open the economy, the less the benefits of surprise inflation, and, thus, the lower the level of inflation in the absence of complete commitment. Bleaney (1999) does not come across the robust negative correlation between openness and inflation in the 1990s as discovered by Romer (1993) and Lane (1997) in the 1970s and 1980s. Bleaney (1999) argues that the 1990s are not characterized by major commodity price shocks as was the case in the two previous decades.[20]

The outline of *real variables* which may be affected by a country's degree of international trade begins with the *output*. As described in Section 2.1.2, an outward-oriented industrialization strategy, which is characterized by a higher degree of openness, might lead to a higher *level of output*. In addition, an increase in international trade may increase *business cycles harmonization*. From the theoretical side, co-movements of outputs depend largely on whether trade is inter-industry or intra-industry. Alesina, Barro and Tenreyro (2002) argue that in the former case, increased openness may stimulate *sectoral specialization* across countries which may lower the convergence of business cycles because industry specific shocks would become country specific shocks. Whereas in the latter case, more trade likely leads to more co-movement. See Frankel and Rose (1998) for the argument that more trade favors more correlated business cycles and Krugman (1993) for the opposing argument. Choe (2001) reveals more synchronized business cycles within East Asia as trade among the countries within this region deepened.

The *ability of monetary policy to affect output* might decrease with an economy's degree of openness to international trade. A monetary expansion may at least temporarily lead to a rise in output. Due to the likely depreciation of the domestic currency, wage demand would increase more in a more open economy. Hence, the monetary expansion would be reflected

[20] Additional discussions on the findings of Romer (1993) are in Terra (1998) and Romer (1998) which do not alter the presented outcomes of interest. For further contributions refer to, for example, Smets and Wouters (2002), Cavallari (2001), Dixon and Pompermaier (1999), Karras (1999), Andersen and Hansen (1995), Lutz and Singer (1994), and Hardouvelis (1992).

more in prices, as discussed before, and less in output (see, for example, Turnovsky, 1981). Karras (2001) finds strong empirical evidence on the theoretical prediction.[21]

Is a country's *employment* affected by its degree of trade openness? Greenaway and Nelson (2001) extensively review the theoretical and empirical literature of trade effects on the labor market. Some factors of production may experience substantial costs in adjusting to trade shocks. In the case of a minimum wage above the market-clearing level, unemployment may occur due to a slowdown in international trade. Greenaway and Nelson (2001) work out three different branches of models to explain the potential openness-employment relationship: search models, efficiency wage models, and union bargaining models. All of these models build on labor market frictions

According to Davidson, Martin and Matusz (1999), opening trade between a large capital-abundant country and a small labor-abundant country raises unemployment in the large country. Some of the unemployed may not find a matching job due to labor market frictions which creates the possibility of a downward-sloping relative supply curve in the Stolper-Samuelson relationship between commodity prices and factor prices for employed factors. Shapiro and Stiglitz (1984) argue that if a firm pays a wage above the market-clearing wage, it may reduce its costs due to the induced performance of workers. If workers choose to shirk and firms are not able to control shirking, then some firms might try to induce workers' efforts by threatening termination, since workers would either become unemployed or get a lower wage at other companies. In the context of trade, Matusz (1996) shows the creation of unemployment in the low-wage sector generated by trade liberalization. The third source of labor market distortion is the existence of unions with the power to secure above market-clearing wages for their members (see, for example, Hirsch and Addison, 1986). Gaston and Trefler (1995) find that union sectors with lower tariffs are characterized by higher wages. These models highlight that at least a negative relationship between trade openness and employment is theoretically plausible. Empirical contributions show in general small and slightly negative employment effects, employment changes are positively (negatively) related to exports (imports) and trade displacement generates particularly strong pressure for sectoral relocation (see, for example, Greenaway and Nelson, 2001).

[21] Razin and Rose (1994), Buzaglo (1991), and Dyba (1990) highlight additional aspects of the potential openness-output relationship.

Razin, Sadka and Coury (2002) model the likely positive openness-*investment* relationship. They assume fixed setup cost of investments which creates economies of scale in investment. This hypothesis is supported empirically by Caballero and Engel (1999). Openness to international trade triggers a discrete price change, thus triggering terms of trade change as well as specialization, which may raise the *level of investment*. In addition, trade openness may lead to boom-bust *cycles of investment* supported by self-fulfilling expectations. Baldwin and Seghezza (1996a, 1996b) and Barro (1991) find empirical evidence that openness to trade raises investment rates.

Beside domestic investments, openness of an economy may also positively influence the *inflow of foreign direct investments*. Developing countries tried to encourage multinational enterprises via numerous incentives to increase foreign direct investments because policymakers discovered the potential important role of foreign direct investments in the process of promoting economic growth (see, for instance, Ryans et al., 1987). The development programs included incentives, such as the opening of previously closed sectors to multinational companies, streamlining procedures for receiving and approving investment applications, allowance of greater equity participation, and reduction of financial and political barriers in remitting earning to the multinational enterprises' headquarters. For most developing countries, these incentives explain very little of the observed changes in the inflows of foreign direct investments (UNCTC, 1991).

Akhter (1993) empirically finds a positive relationship between openness and the inflow of foreign direct investments due to favorable conditions in the domestic economies. Policymakers improve the countries' attractiveness to foreign direct investments when they expand the international business involvements of their country through trade policies, since this increases international trade of final and intermediate products. They also increase this attractiveness when they improve the internal political climate. Chen and Funke (2003) analyze the impact of policy uncertainty on the foreign direct investment strategies of multinational firms with a real options model. Their result is that political uncertainty can be very disadvantageous for foreign direct investment decisions. Improving the attractiveness of an economy may be the most effective route to increase the inflow of foreign direct investments.

Does trade liberalization accelerate *growth*? Early theoretical studies on the probable openness-growth connection argue that trade intervention can increase growth and welfare under certain circumstances. Beside the infant industry argument, it is the optimal level of protection for a country that can influence its terms of trade (see Section 2.1.2 and Dornbusch,

Fischer and Samuelson, 1977). Some recent studies point out conditions for a potential positive correlation between trade protection and growth. Sachs (1996) argues that trade protection is often accompanied by fiscal expansion and a variety of government interventions to support industrialization which leads to fast growth in short the term but slow growth or even economic crises the in long the term.[22]

Many recent theoretical models on trade and growth advocate a positive relation between openness and growth. They focus on channels, such as, research and development, increasing returns to scale, and technological spillovers caused by trade. Vamvakidis (2002) concludes that increases in the capital-labor ratio account for less than half of the growth rates observed in the data and that the residual is considered to represent technology improvements. The model of Romer (1990) derives the benefits of free trade primarily through scale effects which are channeled through research and development to generate innovations either in the form of new consumer products or new capital goods. International trade promotes innovation by increasing the stock of knowledge through the technological spillovers. In addition, a larger international market raises the temporary monopoly gains to innovators which results in more research and development and faster growth.[23]

Beside research and development, investments are found to be the main link between trade and growth. Baldwin and Seghezza (1996a) argue that trade fosters investment because the trading sector is more capital intensive than the non-trading sector, the production of investment goods uses imported intermediates, and competition in the international market of machinery and capital equipment lowers the price of capital.

The relationship between openness and growth is still an open question in the empirical literature. Some studies find a positive impact of openness to trade on economic growth as, for instance, Frankel and Romer (1999), Edwards (1998), and Barro and Sala-i-Martin (1995).[24] Other authors, such as Rodriguez and Rodrik (1999) and Sala-i-Martin (1997), doubt the robustness of the openness-growth connection.[25] Frankel, Romer and Cyrus (1996) enrich the discussion of the problem of simultaneity between openness and growth with their empirical

[22] Also Spilimbergo (2000) and Redding (1999) illustrate conditions where a negative openness-growth relationship might exist.

[23] Other models are, for example, from Rivera-Batiz and Romer (1991) and Grossman and Helpman (1990).

[24] Additional authors who point out the positive openness-growth relationship are, e.g., Vamvakidis (2002), Greenaway, Morgan and Wright (1998), Lee (1996), Ben-David (1993), and Dollar (1992).

[25] Clerides, Lach and Tybout (1998), Harrison (1996), and Levine and Renelt (1992) among others share the same view.

analysis based on a gravity model. They find that no reverse causality exists as proposed by Rodrik (1994) and Bradford and Chakwin (1993). An exogenous increase in investment in a developing country with a comparative disadvantage in producing capital goods would increase imports of such goods and increase exports to pay for the imports.

In general, the correlation between openness and growth has been estimated to be positive in the empirical growth literature but some recent studies have been more skeptical and found that the statistical significance of this correlation depends on the specification of the empirical model and the proxy variables for openness (see, for example, Temple, 2000).

Economic growth due to openness towards trade might promote a *process of convergence* as well as divergence between countries. The model of Baldwin, Martin and Ottaviano (2001), in which international trade is driven by lower transportation costs and market opening, predicts a global divergence process. The North, not the South, industrializes and grows fast due to agglomeration, which creates incentives for investment and innovation. In contrast to this result, Lane (2001) develops a model of growth under credit constraints in which international trade expands access to credit which predicts that openness generates convergence. Sachs and Warner (1995) empirically show that only open economies experience convergence. Ben-David (2001) outcomes suggest that fostering trade among major trading partners culminated in a convergence between the trade-liberalizing countries. Most of the recent work suggests that an increasing degree of trade openness might lead to convergence.[26]

2.2 Traditional indicators of openness

2.2.1 Characterization of trade shares

After the general view on openness based on trade, this section accentuates *shares of trade* as measures of openness based on their dominant role as proxies of openness in the empirical literature and their function as the source for the development of innovative indicators in Chapter 3 and 5, which adjust the conventional indices. Trade shares show the value of traded goods and services in relation to a country's gross domestic product (GDP), the value of all final goods and services produced by its factors of production.

[26] Further references are Bhatta (2002), Greenaway and Nelson (2001), Lutz (2001), Slaughter (2001), Ben-David and Kimhi (2000), Cameron, Proudman and Redding (1997), and O'Rourke, Taylor and Williamson (1996).

The traditional shares of trade with *international* scope indicate openness on an average level, such as the *export ratio* and *import ratio*, including for product categories like, for example, the *export ratio of commodity i* and *import ratio of commodity i*. Products (*i*) might be classified as food, other primary products, manufactures, or services. The measures of trade openness are of interest for the empirical analysis of the choice of exchange rate regimes in Chapter 4 because an openness-regime relationship might exist. On the other hand, the *total trade ratio* and *mean trade ratio* are not included in this contribution. The description of international trade with one figure for the degree of openness might conceal important information about the significance of international trade linkages because structures in trade would no longer be separable.

Moreover, *bilateral* shares of trade are applied in an empirical investigation of trade integration in the context of monetary integration within a region, such as the Euro zone (see Chapter 6). The significance of trade relationships with member states of the integration area are indicated by the *intra-regional export ratio*, the *intra-regional import ratio*, the *intra-regional export ratio of commodity i*, and the *intra-regional import ratio of commodity i*. A supplementary analysis of the trade dependence between a country and its trading partners outside the area might reveal additional insights into the country's relative integration within the region based on trade. The proxies of openness for the rest of the world are the *extra-regional export ratio*, the *extra-regional import ratio*, the *extra-regional export ratio of commodity i*, and the *extra-regional import ratio of commodity i*.

2.2.2 Measures of openness towards international trade

According to Kotcherlakota and Sack-Rittenhouse (2000), the *export ratio* (ER) expresses a country's surplus production. Its households consume, the government purchases, firms invest, and foreign residents buy the country's final goods and services produced by domestic factors of production and imported intermediate products. If foreign countries demand final goods and services, then those can no longer be sold on the home market.

The mathematical description of this index of openness begins with the value of exports as well as the value of imports. These values can be represented by the vector of export values of region k (y_k) which includes the value of product category i of region k for region l (Y_{ilkk}) as

$$(1) \qquad y_k = \left(Y_{1lkk}, Y_{2lkk}, Y_{3lkk}, Y_{4lkk}\right)^T, \quad k = 1,2, \quad l \notin k.$$

Region k and l denote home country (1) or aggregated foreign country (2). The aggregated foreign country includes all trading partners of the home country. The product category i consists of food (1), other primary products (2), manufactures (3), or services (4). This classification of goods and services separates characteristically different products from each other at a common high level of aggregation. In addition, the gross domestic product of region k is represented by Y_k.

The openness measure ER relates the value of goods and services, sold by the country to its international trading partners, (y_1) to the value of all goods and services produced by domestic factors of production for domestic and foreign expenditure (Y_1) for the period of one year and expressed as a percentage:

$$\begin{aligned} y_1 &= \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^T, \\ ER &= \frac{y_1}{Y_1} 100. \end{aligned} \tag{2}$$

A value of zero percent for the export ratio means that only domestic spending exists. The more open an economy is, the more it is able to create a surplus production.

In addition, the *import ratio* (IR) calculates a value which represents the importance of international trade linkages for an economy from its import side. Kotcherlakota and Sack-Rittenhouse (2000) interpret this measure of openness as the dependency of a country's residents on imported commodities and services which can be expressed in symbols as

$$\begin{aligned} y_2 &= \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \\ IR &= \frac{y_2}{Y_1} 100. \end{aligned} \tag{3}$$

It describes the share of imports (y_2) in national income. In the case of a value of zero percent, the import ratio indicates that domestic residents demand only domestic goods and services whereas a more open country becomes more dependent on foreign goods and services.

Besides this analysis of openness based on trade on a general level, it might be of interest, in the context of the choice of exchange rate regimes, to emphasize a specific group of commodities or services. A product category might dominate the international trade linkages for a country and, thus, it may play an outstanding role in the decision of policymakers for the choice of an appropriate exchange rate regime. The *export ratio of commodity i* (ER_i) highlights how strong the comparative advantage of a country is in a product category by indicat-

ing the share of exports of the class *i* of goods or services (Y_{i211}) of all domestic final goods and services:

$$(4) \qquad ER_i = \frac{Y_{i211}}{Y_1} 100, \quad i = 1,2,3,4.$$

A higher value of this measure of openness for a product category can be interpreted as the ability of a country to generate more surplus production with particular goods or services. Putting the different sources of the surplus production together leads to the export ratio which can be expressed as

$$(5) \qquad ER = \sum_{i=1}^{4} ER_i .$$

Furthermore, the *import ratio of commodity i* (IR_i) measures the degree of comparative disadvantage in specific commodities or services and is mathematically stated as

$$(6) \qquad IR_i = \frac{Y_{i122}}{Y_1} 100, \quad i = 1,2,3,4.$$

The more income a country spends for imports of the product category *i* (Y_{i122}) in relation to its national income, the higher the degree of trade dependence of these goods or services from international trading partners. Similar to the export side, a country's import ratio can be derived from the different product categories:

$$(7) \qquad IR = \sum_{i=1}^{4} IR_i .$$

A comparison of a nation's pattern of trade at the export side with the structure of its import side indicates, in the case of more (less) similarity, that the trade flows between the country and its trading partners can be described as intra- (inter-) industrial trade.

2.2.3 Bilateral openness indices

When policymakers of member states decide on an integration area to coordinate some policies between these countries, it is likely that the outcomes will affect the bilateral trade linkages. For example, the formation of a free-trade area might increase the trade openness among members due to the reduction of regional trade barriers (see Section 2.1.2). Furthermore, the significance of intra-regional trade might determine some decisions of policymakers within the region, such as the creation of a single currency area (see Section 2.3.3).

The changed focus on openness based on bilateral trade leads to a new definition of the vector of export values of region k (y_k) as

$$y_k = \left(Y_{1lkk}, Y_{2lkk}, Y_{3lkk}, Y_{4lkk}\right)^T, \quad k = 1,2,3, \quad l \neq k. \tag{8}$$

Analogous to the previous section, region k and l symbolize home country (1), which may now be a candidate for an integration area, such as the European Union or the Euro zone. But in this section, the region aggregated foreign country (2) is divided into the aggregated integration area (2) and the aggregated rest of the world (3). The aggregated integration area consists of the member countries of the area and the aggregated rest of the world denotes all nations which are not members of the integration area.

A country's surplus production due to final goods and services sold to member states of the integration area (y_1) is indicated by the *intra-regional export ratio* (IER) measure as

$$\begin{aligned} y_1 &= \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^T, \\ \text{IER} &= \frac{y_1}{Y_1}100. \end{aligned} \tag{9}$$

The *intra-regional import ratio* (IIR) index attempts to indicate the residents' dependency by emphasizing the value of the country's imports from the region (y_2) as share of GDP:

$$\begin{aligned} y_2 &= \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \\ \text{IIR} &= \frac{y_2}{Y_1}100. \end{aligned} \tag{10}$$

In addition, policymakers who, for example, decide whether they should peg their country's currency to a fixed exchange rate area might not only concentrate on the openness towards the members as is common in the standard framework of the cost-benefit analysis of monetary integration. They might also expand their view on trading partners outside the area. For instance, if a potential entrant of a single currency area has a similar degree of openness towards the members as they do, then this might indicate that the abandonment of a separate currency might be the suitable decision. Would the choice to join the area still be beneficial when the significance of the country's trading partners outside the area by far exceeds the importance of those inside?

On the one hand, openness to trade with countries outside a region is indicated by the *extra-regional export ratio* (EER) which represents the value of the country's exports to the rest of the world (y_1) as a share of the gross domestic product. This can be expressed in symbols as

$$y_1 = \left(Y_{1311}, Y_{2311}, Y_{3311}, Y_{4311}\right)^T,$$

(11)
$$EER = \frac{y_1}{Y_1}100.$$

On the other hand, the *extra-regional import ratio* (EIR) is a traditional proxy of trade openness towards non-members of an integration area. It is applied when the residents' dependency of imports from trading partners in the rest of the world (y_3) is of interest:

$$y_3 = \left(Y_{1133}, Y_{2133}, Y_{3133}, Y_{4133}\right)^T,$$

(12)
$$EIR = \frac{y_3}{Y_1}100.$$

Since these indices of openness accentuate a specific share of all trading partners, their sum leads to the average measures:

(13) $ER = IER + EER$ and

(14) $IR = IIR + EIR.$

A higher degree of openness towards trading partners within (outside) a region is interpreted as an increase in the significance of these countries in terms of an economy. According to the traditional openness indicators at the export (import) side, the closer link between the country and its trading partners increases surplus production (dependency on imports).

Similar to the preceding section, the openness indices of bilateral trade can be complemented to reflect the structure of trade between a country and its trading partners. The *intra-regional export ratio of commodity i* (IER_i) indicator of openness tries to point out the country's ability to generate surplus production due to exports of the class *i* of products to the member countries of an integration area (Y_{i211}) as

(15) $$IER_i = \frac{Y_{i211}}{Y_1}100, \quad i = 1,2,3,4.$$

Whereas, the *intra-regional import ratio of commodity i* (IIR_i) index attempts to indicate the dependency on imports of specific commodities or services *i* from the region (Y_{i122}) which is

(16) $$IIR_i = \frac{Y_{i122}}{Y_1}100, \quad i = 1,2,3,4.$$

A closer look at the foreign countries in the rest of the world leads to the openness measures *extra-regional export ratio of commodity i* (EER_i) and *extra-regional import ratio of commodity i* (EIR_i). They are defined in symbols as

$$EER_i = \frac{Y_{i311}}{Y_1} 100, \quad i = 1,2,3,4 \text{ and} \tag{17}$$

$$EIR_i = \frac{Y_{i133}}{Y_1} 100, \quad i = 1,2,3,4. \tag{18}$$

Y_{i311} (Y_{i133}) stands for the exports (imports) of goods or services of the product group *i* to (from) the trading partners outside an integration area. Higher values of these four proxies of openness indicate an increase in the significance of trading partners for specific tradables.

Since the openness measures towards international trade highlight trade relations on a general scope, they consist of indicators of bilateral trade. The export ratio can be expressed as

$$ER_i = IER_i + EER_i, \quad i = 1,2,3,4 \text{ and} \tag{19}$$

$$ER = \sum_{i=1}^{4} IER_i + \sum_{i=1}^{4} EER_i. \tag{20}$$

Furthermore, the relationships at the import side of a country equal those at the export side:

$$IR_i = IIR_i + EIR_i, \quad i = 1,2,3,4 \text{ and} \tag{21}$$

$$IR = \sum_{i=1}^{4} IIR_i + \sum_{i=1}^{4} EIR_i. \tag{22}$$

2.3 The choice of exchange rate regimes

2.3.1 Alternative exchange rate regimes

According to Bordo (2003) and Bubula and Ötker-Robe (2002), nowadays exchange rate regimes range from fixed arrangements over intermediate systems to floating regimes. The *fixed* exchange rate regimes consist of currency unions, currency boards, and truly fixed exchange rates. Furthermore, the *intermediate* exchange rate arrangements include adjusted pegs, crawling pegs, basket pegs, target zone, and target bands. The *floating* exchange rate regimes incorporate managed floating and free floating.

2.3.2 Criteria for the choice of an exchange rate arrangement

Juhn and Mauro (2002) categories the numerous potential determinants of the selection of exchange rate regimes by means of 'optimum currency areas' factors, other macroeconomic/external/structural factors, and political/historical factors. Table 1 presents an overview of the determinants. The table shows that the degree of openness to trade might influence the choice of exchange rate regimes.

Table 1: Overview of determinants of exchange rate regimes

Group of factors	Explanatory variables
'Optimum currency areas' factors	**trade openness**, economic development, size of economy, inflation differential, capital mobility, geographic trade concentration, international financial integration
Other macroeconomic / external / structural factors	growth, negative growth, inflation, moderate to high inflation, reserves, capital control, terms of trade volatility, variability in export growth, external variability * openness, real exchange rate volatility, product diversification, current account, growth of domestic credit, money shocks, foreign price shocks
Political / historical factors	political instability, central bank independence, party in office has majority, number of parties in coalition, coalition government

Source: derived from Juhn and Mauro (2002), p. 8

2.3.3 The standard cost-benefit analysis of monetary integration

Consider an economy which has to decide on participating in a fixed exchange rate area. To help make its choice, this economy might apply the regular framework of the cost-benefit analysis of monetary integration, derived from the theory of optimum currency areas (see, for instance, Mundell 1961, Gros and Thygesen 1998). The country has to assess the potential benefits and costs of pegging its currency to a single currency area (see, for example, De Grauwe, 2000). The outcome of these considerations strongly depends on the assessment of the candidate country's degree of trade openness towards the members of a monetary integration area. A high significance of the existing area is associated with a high degree of openness towards intra-regional trade.[27]

The potential benefits of joining a single currency area for an economy are commonly perceived to materialize through perceivable gains in efficiency and credibility. The monetary

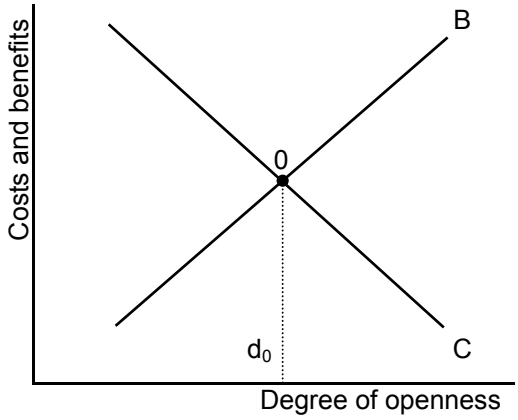
[27] Besides trade, the regional mobility of the production factors labor and capital is also relevant for an assessment of whether one region should integrate with another simply because it may serve as a shock-absorber.

efficiency gain is a result of pegging to a fixed exchange rate area instead of letting the exchange rate float, since this tends to lower inflation differences, exchange rate volatility and, hence, transaction costs. Consequently, the higher the economy's degree of trade openness with the existing integration area already is, the more the country in question will benefit from entering the single currency area. The potential costs of joining the currency area for a candidate arise mainly through additional instability. Stabilization of output and, thus, also of employment becomes more difficult for an economy once the exchange rate no longer floats, vis-à-vis the currency area – the country gives up exchange rate and monetary policy to stabilize its economy. Exchange rate policy cannot influence relative prices of domestic and foreign products and monetary policy is no longer able to enable domestic output to adjust to a product demand or supply shock. As a consequence, the costs born by the economy are lower the higher the degree of openness is because, in this case, the economy and the member countries of the integration area are supposed to respond in a similar fashion to shocks.

In most discussions about Economic and Monetary Union (EMU), it was assumed that the costs of fixing the exchange rate falls with the degree of openness. The same was valid with respect to the benefits because openness was considered to be a good proxy for exposure to exchange rate risk. Although during this debate there have been some important qualifications of the above arguments that have disputed the slope of the curves in terms of the sign and the linearity, one aspect has remained largely undisputed: the outstanding role of trade openness. This statement can be corroborated by referrals to a number of sources. A few examples are given in the following. A correct measurement of the degree of openness with respect to, for example, intra-industrial trade is also of importance in the endogenous 'optimum currency areas' approach popularized by Frankel and Rose (1998). Furthermore, McKinnon (1963) pushed the argument that the nominal exchange rate becomes a less powerful adjustment instrument if imports account for a large fraction of the gross domestic product, since the general price level contains the price for imported goods.

Figure 1 puts these considerations in a joint diagram which usually serves as a framework to decide whether an economy should join a single currency area or not (see, for example, De Grauwe 2000 and Krugman, 1990).

Figure 1: Stylized cost-benefit analysis of a monetary integration



The figure's horizontal axis measures the openness of an economy towards an integration area. Benefits of the monetary efficiency and costs of the economic stability loss for the candidate are measured by the vertical axis. The realizations of all indicators increase from zero at the diagram's origin. Schedule B displays the relation between the degree of openness and the benefits of joining the integration area. B has a positive slope because an economy's benefits rise as its degree of openness towards intra-regional trade increases. Schedule C reflects the relation between the degree of openness and the costs. Costs decrease the more the country is integrated with the area, leading to a negative slope of C. Figure 1 illustrates that the break-even degree of openness is d_0, which is determined by the intersection of B and C at point 0. When a country's degree of openness equals d_0, the country is indifferent with respect to its decision. With a level higher (lower) than d_0, the country should (not) peg its domestic currency to a fixed exchange rate area. In this case, the potential benefits are (not) high enough to outperform a candidate's potential costs of joining the integration area.

Beside the theory of optimum currency areas, several *other theories* are developed which try to explain the choice of exchange rate regimes. Similar to the previous section, the additional theories can be classified due to their accentuation of, on the one hand, macroeconomic, external, and structural factors and, on the other hand, political and historical factors. Bordo (2003), Papaioannou (2003), Juhn and Mauro (2002) and Klyuev (2001) provide a survey of the voluminous theoretical literature.

3. Innovative measures of openness to international trade[28]

3.1 Motivation: Enhancement of the traditional openness concept

Despite the concept of trade openness being conceptually simple, many approaches of empirically measuring openness have been developed. There is *no widely accepted proxy* of openness because no index provides a perfect or unambiguous indication of the importance of international trade – neither in the comparison of the extent of trade integration across countries at one point in time nor for the judgment of the present trade flows of a country against its historical development. Falvey and Gemmell (1999) point out that numerous different openness measures are employed because their corresponding rankings of openness are not strongly correlated and no index is obviously superior over other concepts. Wacziarg (2000) proposes *combining several measures* of openness since using a variety of indices may indicate different aspects of a country's trade openness. For example, Chen (1999) applies an array of five measures of openness, Spilimbergo, Londoño and Szekély (1999) use seven different indices, and Edwards (1998) employs nine alternative indicators. This approach might provide a richer picture of the degree of openness compared to applying only one single measure, particularly in cases where the estimated coefficients of the proxies of openness perform as they were expected to and are statistically significant. Furthermore, it can be tested whether results are sensitive to the use of a particular index.

Lloyd and MacLaren (1998) emphasize the construction of *summary measures* of openness as an alternative approach to the employment of an array of several indices. The main drawback of such indicators is the problem of constructing an appropriate system of weighting that avoids aggregation biases. In both cases – the use of different measures or a single summary index – the difficulty of selecting the suitable proxies is not solved, otherwise a superior single concept of openness would be employable for empirical research.

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[28] Parts of this chapter and Chapter 4 were accepted for presentation at the following conferences: "*How Do Impact Levels of International Trade on Economic Variables Influence the Measurement of the Importance of International Trade?: The Net Economic Openness Model*", paper for the conference "European Integration: Real and Financial Aspects", 2nd annual meeting, European Economics and Finance Society (EEFS) and University of Bologna, Bologna, May 14-16, 2003; "How Do Impact Levels of International Trade on Economic Variables Influence the Measurement of the Importance of International Trade?: The Net Economic Openness Model", paper accepted for the conference "METU International Conference in Economics VII", Economic Research Center (ERC), Middle East Technical University (METU), Ankara, September 6-9, 2003;

"*How Important is International Trade for a Country Really?: A Value-Added Based Approach to Measure Economic Openness*", paper for the conference "Research in Economics: Methodology, Coherence, Effectiveness", Graduate College Santa Chiara, Siena, May 15-17, 2003; "How Important is International Trade for a Country Really?: A Value-Added Based Approach to Measure Economic Openness", paper for the conference "VIII Conference on International Economics", Spanish Chapter of the International Economics and Finance Society (AEEFI) and University of Castilla-La Mancha (UCLM), Ciudad Real, June 25-27, 2003.

Shares of trade represent the traditional outcome-based concept for calculating a country's degree of openness. They are made up of a series of factors, such as comparative advantage, geographic variables, and economic policy (see Section 2.1.2). Since trade shares include all these determinants of trade and, thus, measure a country's actual exposure to trade interactions, trade shares may account quite well for the effective level of international market integration (see, for example, Wacziarg, 2000). This feature of traditional measures of openness is also the central criticism. Shares of trade are endogenous to variables being modeled. Trade and output could be driven by some common factors, such as human capital investments. These endogeneity problems with respect to growth are emphasized by Söderbom and Teal (2001) and Frankel and Romer (1999) among others. In addition, trade shares do not relate to theories which link trade, for instance, to growth. Such a theory could emphasize the role of imports in the process of growth. Developing countries might benefit due to imports of capital, intermediate commodities, and technology from more advanced countries (see, for example, Section 2.1.4, Falvey, Foster and Greenaway, 2001 and Weinhold and Rauch, 1999).

A very attractive feature of trade shares is that the last several years' data are *readily available* for most countries from their balance of payments accounts. This might be the main reason for the high popularity of traditional measures of openness in the empirical literature. Brahmbhatt (1998) finds outcome-based indices most useful in judging trends in international market integration over time. If the interest not only lies in whether or not openness is increasing or decreasing but also whether it is high or low then a standard against which actual outcomes can be compared is required. Deviation measures emphasize the additional information. Nowak-Lehmann Danzinger (2000) suggests choosing the total share of trade for time series studies and to complement this volume index of openness with a price index of openness. She states that this might be "the only viable choice" that does not provoke further argumentation. In addition, shares of trade might be "not very useful for cross-country comparisons" due to counties' size effect. Nowak-Lehmann Danzinger (2000) ignores concepts of adjusted trade shares which take such effects into account (see Section 2.1.3).

Several attempts have been made to *increase the accuracy* of how traditional proxies of openness indicate the importance of international trade relationships for a country. This has been attempted by isolating the variation in shares of trade, which is attributable to a variety of determinants of interest, such as trade policy or non-policy variables (see Section 2.1.3 and, for example, Harrison, 1996). *Measures of deviations* of observed trade volume or price from the predicted free-trade volume or price are an effort to enhance outcome measures, such as the

conventional shares of trade. For example, models based on the law of one price, Heckscher-Ohlin models, gravity models of trade, and computable general equilibrium models generate predictions of a country's propensity to international trade. Deviations of the observed trade volume or price from the potential outcome provide a measure of the restrictiveness of a country's trade regime.

Pritchett (1996) emphasizes a number of conceptual weaknesses of deviation-based indicators of trade openness, such as the lack of a well grounded theoretical model of trade intensity as well as the high sensitivity of the results to assumptions about the adopted theoretical model and the empirical specifications. Furthermore, deviation measures do not signal openness in a uniform way. Brahmbhatt (1998) comments on the intrinsic difficulty of the role of deviation indices for providing an appropriate standard against which actual outcomes can be judged. Deriving a benchmark of comparison often requires making additional assumptions about economic integration or behavior of economic agents. It is difficult to tell whether the deviation between actual and predicted outcome represents the degree of trade openness or if it is a sign that assumptions need to be questioned.

Wacziarg (2000) draws attention to some additional shortcomings of openness measures based on deviations. Determinants of potential trade may have been omitted. As a result, the predicted outcome may not adequately measure the realization that would exist under complete free trade. Furthermore, some gravity or endowment determinants of prospective trade may be strongly correlated with policy attitudes. In such a case, the deviation of actual from predicted trade may exclude some valid information about policy. Finally, if the observed outcome contains a white noise disturbance term then deviations from the prediction will also contain a white noise disturbance, which leads to an increased downward bias, which is in turn associated with a measurement error.

Knetter and Slaughter (2001) point out that deviation measures do not link outcomes back to barriers of trade. Without these linkages it is not possible to separate other factors from changed barriers that affect the quantity or price of trade. Economic growth might be such a factor. On the other hand, they emphasize that for many important issues a distinction between the causes of trade integration is not relevant. "For example, if changes in a country's relative product prices are raising domestic wage inequality, the outcome is the same for workers whether it is caused by reduced transaction costs or by growth abroad."

In addition, *administrative measures* describe the institutional features of a country's attitude towards international trade. Wacziarg (2000) summarizes some disadvantages of the policy indices. They face endogeneity problems in their relationship with growth, and the availability of administrative indices tends to be limited. Furthermore, these indicators "may not directly reflect the degree of effective protection faced by domestic agents, but only the legal framework to which they are confronted." Knetter and Slaughter (2001) add that most policy measures are suggestive and give three limitations. Most tariff measures omit the cost of prohibitive barriers, that is, a situation where tariffs or transportation costs are so high that a country's imports are zero. Many concepts completely omit all non-tariff barriers. Non-tariff barriers have, in recent years, evolved into the primary barriers of trade between countries in many product categories. Even if data of non-tariff barriers are available, they could not likely be easily quantified as a cost of moving goods or services. Also Spilimbergo, Londoño and Szekély (1999) point out the two latter shortcomings of direct indicators of trade policy.

Pritchett (1996) concludes that deviation indicators generally show a low association with a range of other measures of trade openness. Moreover, in 30 percent of comparisons, countries scored as open by one measure are scored as closed by another one. Beside this, implausible rankings of some countries reveal conceptual and empirical limitations of deviation indices (Dollar, 1992). Leamer (1988) questions the usefulness of deviation measures. An adjustment of traditional concepts by administrative measures does not lead to satisfying results either. Pritchett (1996) shows that various policy indices are only weakly correlated among themselves. No single policy measure could adequately capture a country's outward orientation. Furthermore, Harrison (1996) examines the rank correlation between seven different measures of openness based on outcome, deviation, and policy concepts. The majority of rank correlations are not statistically significant. The lack of a correlation between all the openness indices might indicate that the measures capture different aspects of trade openness.

Lastly, *outcome-based adjustments* of the established trade shares aim to improve the representation of 'openness' for cross-country comparisons. In general, the denominator of the trade shares and, thus, the gross domestic product (GDP) is corrected. For example, adjusted trade shares take the Balassa-Samuelson effect, a country's size, or its maturity into account (see Section 2.1.3). An amendment of such effects seems to advance the quality of empirical analysis based on trade openness (see, for example, Brahmbhatt, 1998). But the adjustment of traditional openness measures with such approaches might not be far-reaching enough be-

cause their construction disregards the fact that the common interpretation of the conventional trade shares is misleading.

The *export ratio* (ER) attempts to indicate a country's surplus production. In addition, it is supposed that the dependency of a country's residents on imports is measured by the import ratio (IR) (see, for example, Kotcherlakota and Sack-Rittenhouse, 2000). The interpretation of these trade shares sounds correct but these indices do not indicate what they are supposed to. Traditional shares of trade are confusing because they do not take the international redistribution of income generated by trade into account.

Exports do not exclusively create income in the country which sells goods and services to foreign countries as the export ratio states; they also engender income in the country's trading partners. We begin with the value of the final demand of goods and services (D) to prove this statement.[29] This can be expressed in symbols as

(23) $$D = C + G + I + Ex.$$

The purchases of private households is denoted C (consumption), G stands for government purchases, and the part of output used by private firms to produce future output is called I (investment). The goods and services which are sold to foreigners make up a country's exports (Ex).

These sales account only partly for the national income in a country (Y) since residents spend some of their income on imports. That is goods and services purchased from abroad, denoted by Im. The portion of purchases that generates gross domestic product in the domestic economy is

(24) $$Y = C + G + I + Ex - Im.$$

Identical to equation (2) in Section 2.1.2, the export ratio is defined by the alternative notation in this part of the study as

(25) $$ER = \frac{Ex}{Y}100.$$

The derivation of the export ratio is correct but the value of goods and services sold to foreigners in relation to the gross domestic product cannot be interpreted as indicating openness

[29] The symbols used in the following equations deviate from the notation introduced in Section 2.2 for a clearer illustration of the economic relationships.

towards trade by the means of domestic surplus output. The supply of goods and services for domestic and foreign residents (S) is produced by domestic and foreign residents:

(26) $S = Y + Im.$

Since the supply of final goods and services equals its demand, which is in symbols

(27) $S = D,$

equation (23) can be rewritten as

(28) $Y + Im = C + G + I + Ex.$

Taking into account that domestic products are consumed by residents (Y_C), purchased by the government (Y_G), invested by firms (Y_I), and exported to foreign countries (Y_{Ex}) as well as that the imported goods and services are demanded for consumption (Im_C), government purchases (Im_G), investment (Im_I), and exports (Im_{Ex}), equation (28) can be modified to

(29) $Y + Im = Y_C + Im_C + Y_G + Im_G + Y_I + Im_I + Y_{Ex} + Im_{Ex}.$

This leads to an alternative representation of the national income identity which is the sum of domestic and foreign expenditure on the goods and services produced by domestic factors of production. Therefore, equivalent to equation (24) is

(30) $Y = Y_C + Y_G + Y_I + Y_{Ex}.$

In addition, the production of domestic goods and services does not only employ domestic factors of production but also imported intermediate products. Final expenditure includes imported final goods and services which generate income abroad:

(31) $Im = Im_C + Im_G + Im_I + Im_{Ex}.$

This means that exports create income not only in the domestic economy but also in the foreign countries, which can be expressed as

(32) $Ex = Y_{Ex} + Im_{Ex}.$

With equation (30) and (32) the export ratio can be rewritten as

(33) $$ER = \frac{Y_{Ex} + Im_{Ex}}{Y_C + Y_G + Y_I + Y_{Ex}} 100.$$

The definition of the export ratio clearly indicates that the common interpretation of a country's degree of openness to international trade (based on this openness proxy) overstates the

potency of a country to build surplus production at home. Imported intermediate products which are assembled in exports (Im_{Ex}) are not part of the national income of the domestic economy. Goods and services sold to foreigners only create income for the residents when the domestic factors of production are involved in the process of production (Y_{Ex}). Moreover, the equation reveals that approaches which only adjust the denominator are too short-handed to improve the quality of the export ratio. The numerator simply represents only one share of the denominator.

The widespread explanation of the *import ratio* is criticized in a similar way to the argument of the export ratio. Residents of the home country are not dependent on all parts of imports as the index of openness suggests. They have to spend a lower portion of their income to purchase goods and services from abroad. Imports are partly produced with intermediate products delivered by other countries. These countries include the home country. Hence, international trading partners purchase intermediates from the domestic economy to assemble, for example, imports for the home country which, in turn, generates income for the domestic factors of production.[30]

First, we reproduce the definition of the import ratio in Section 2.1.2 with the alternative symbols of this part:

$$(34) \qquad IR = \frac{Im}{Y} 100.$$

It is assumed for simplicity that the value of domestic imports from foreign trading partners equals the value of foreign exports to the home country (Ex') which can be expressed as

$$(35) \qquad Im = Ex'.$$

The production process of the goods and services sold to the home country employs foreign factors of production ($Y'_{Ex'}$) as well as imported intermediate products from the domestic economy ($Im'_{Ex'}$):

$$(36) \qquad Ex' = Y'_{Ex'} + Im'_{Ex'}.$$

Finally, the import ratio can be rewritten as

[30] An additional argument against the widespread interpretation of the import ratio is that parts of the imported goods and services are assembled in exports and not at all purchased by domestic residents. Consequently, the interpretation of the degree of openness calculated with the import ratio overstates the domestic dependency. This supplementary view on the import ratio leads to a new measure of openness which is not part of this work since the newly developed openness proxies emphasize the international redistribution of income generated by trade and not the role of intermediate inputs within the international trade flows (see Wang, 2003a).

$$(37) \qquad IR = \frac{Y'_{Ex'} + Im'_{Ex'}}{Y} 100.$$

This alternative definition of the import ratio provides evidence that the degree of trade openness calculated by the import ratio misjudges the residents' dependency on imports. Domestic residents do not have to spend as much of their income as was expected by the traditional proxy of openness.

How should a country's degree of trade openness be interpreted when it *exceeds 100 percent*? For example, the export ratio (import ratio) for Singapore states a level of 177.8 (164.7) percent for the year 2002. Also Malaysia is extraordinarily open towards international trade according to the export ratio (import ratio) with a degree of openness of 113.9 (101.3) percent for the same period (World Bank, 2004). Reasons for such high values are, for example, that countries operate as an emporium of commodities and that they process the finishing of intermediate goods. Hence, the motivation of firms to export final goods and services determines a large share of imports and only a minor part of imports are sold to domestic residents.

If the *export ratio* could be interpreted as the surplus of domestic output then Singapore and Malaysia would produce domestic non-tradables with negative value because the value of goods and services sold to foreign residents surpasses the value of all domestic goods and services. This is clearly not the case because exports include some imports which do not contribute to national income in the domestic economy. The interpretation of the *import ratio* as domestic residents' dependency on imports is more plausible than that of the export ratio. Residents can spend more on imports than they earn in the production of domestic final goods and services because they have additional sources for financing imports. Foreign residents either pay a fraction of the domestic imports, due to their purchase of domestic exports, or foreigners lend domestic residents money through international borrowing of the domestic economy.

Similarly, Brahmbhatt (1998) points out that since "trade data is stated in gross terms, while GDP is stated in value added terms, this can lead to an inflation in" traditional measures of openness. The value of exports consists of the value of imported intermediates and the value of domestic factors of production. Value added denotes the income that domestic residents receive for their employment in the process of production. A *solution* could be either to state trade in value-added terms or to state national income in gross output terms. We could not find a concept in empirical literature which follows either of these ideas. A simple reason for the lack of value-added based adjustments of traditional trade shares might be that the availability of such data is limited (Brahmbhatt, 1998). Knetter and Slaughter (2001) also

ability of such data is limited (Brahmbhatt, 1998). Knetter and Slaughter (2001) also raise this problem with data on imported intermediate inputs. They introduce the measure of production fragmentation which is the ratio of value added to total output within industries. The total output of an industry denotes the value of all intermediate and final products that an industry produces within a given time for other industries as well as for consumption and investment. A decreasing value is interpreted as a raise in imported intermediate products. This index of openness excludes imports of final goods and services because it is constructed to exclusively emphasize the narrowing of production activities within countries.

In this chapter, new measures of openness to international trade are introduced which attempt to solve the problem stated by Brahmbhatt (1998). They adjust traditional shares of trade by expressing *trade in value-added terms* instead of gross terms. This value-added based approach is in clear contrast to the mainstream. Common corrections of the gross domestic product are very likely increasing the accuracy of cross-country comparisons but the fundamental difficulty of traditional openness indices is untouched. The numerator is still expressed in gross terms whereas the denominator is stated in value-added terms.

Our approach to adjust the established export ratio is called the *export-induced domestic value-added ratio* (EDR). Exports engender income in the domestic economy and in foreign economies because domestic factors of production and imported intermediate inputs are employed for the production of the output that is sold abroad. The openness measure EDR expresses the domestic value-added created by exports as a share of the country's GDP:

$$\text{EDR} = \frac{Y_{Ex}}{Y} 100. \tag{38}$$

This adjusted trade share can be interpreted as the importance of foreign trading partners for a country to generate income in the domestic economy.

Similarly, the *import-induced foreign value-added ratio* (IFR) tries to improve the precision of the import ratio in calculating a country's degree of openness. It is defined as the value-added in foreign economies created by imports in relation to the national income in the domestic economy and can be expressed in symbols as

$$\text{IFR} = \frac{Y'_{Ex'}}{Y} 100. \tag{39}$$

One interpretation of this measure is the importance of foreign trading partners for the spending of domestic residents' income.

For example, Singapore's openness to trade in the year 2002 declines to 72.2 percent (-105.6 percentage points) when the export-induced domestic value-added ratio is applied instead of the export ratio. A shift from the import ratio to the import-induced foreign value-added ratio leads to a value of 163.9 percent (-0.8 percentage points). In Malaysia's case, openness changes to 71.9 percent (-42.0 percentage points) for the EDR indicator and to 100.8 percent (-0.5 percentage points) for the IFR index (see tables 4 and 5 in Section 4.3.1). The traditional and new measures of openness indicate clearly that Singapore and Malaysia are countries which are extremely open towards international trade. International trading partners have a strong effect on the economy of these Asian countries. Moreover, the difference between the outcomes of both concepts reveals that the established proxies of openness overstate the impact of foreign countries on the domestic economy, especially for the export side in our example.

The strong position of Singapore as one of the main hubs in Asia for the regional and global redistribution of commodities and the significant role of Malaysia within the finishing process of imported intermediate inputs lead to their high degrees of trade openness and indicate the dominant focus of both countries on the re-export of imports. Consequently, consumption in these countries is a minor determinant of their demand for imports. These kinds of production process employ less domestic factors of production and thus contribute less to national income than a country which produces the exports mainly with national intermediate commodities in all processing stages. It is interesting to point out that Singapore and Malaysia create nearly the same share of national income with their exports but Malaysia is selling goods and services with considerably less value to foreign countries than Singapore. This means that the redistribution of imported final commodities in Singapore requires by much fewer production factors, such as labor and capital, than the finishing process of imported intermediate inputs in Malaysia. An explanation for the patterns of trade of Singapore and Malaysia might be, for example, their lack of natural resources. The structures of production of the two Asian economies are also the reason why the openness measures on the import side reveal similar results in the example. The economies only benefit a little from exporting intermediate inputs for final assembly with the aim of importing the final commodities.

The established measures of trade openness are not able to reflect differences between countries' economic structures because they do not distinguish between the sources of production inputs. In contrast to this, the new proxies of openness indicate the income effects of trade. As a result, traditional measures of openness to trade not only suggest that the residents of a

country generate a higher domestic income with exports but also that the domestic residents spend a higher share of their income on imports. Both value-added based indicators of openness reflect the economic activities of the countries within the world economy more accurately. We denote degrees of openness which are calculated by the traditional shares of trade as '*traditional openness*' whereas the term '*actual openness*' represents the results of the newly adjusted trade shares.

This section has presented the motivation for a value-added based adjustment of the well-established indices of trade openness. Section 3.2 lays out the principles of the input-output economics which builds the theoretical foundation for an analysis of the income effects of international trade. The chapter proceeds with an illustration of the input-output framework for the construction of value-added based measures of openness towards international trade. The innovative proxies of openness are then introduced in Section 3.4.

3.2 Economic analysis of the process of production

3.2.1 Characterization of input-output economics

The input-output economics was most contributed to by the economist *Wassily Leontief* (born in 1906). Standard references of input-output economics are Leontief (1966, 1936) and Pasinetti (1977). These works will be the main resources used to illustrate the input-output approach of economic analysis.

In the system of national accounts, only three domestic sectors are differentiated; firms, households and government, as well as the sector foreign countries. The system of national accounts relates to value added and to final demand but the *interdependences between the firms* are not recorded. This degree of aggregation is too high for some analysis of the sector firms. The sector is split up into industries with an aim to record the flows of intermediate products between the industries formed. Industries produce various goods and services that are demanded by other industries or sectors. According to their production requirements, industries demand intermediate inputs from other industries and factors of production from the sectors households, government, and foreign countries. Consequently, industries employ inputs to generate outputs. Input-output economics tries to *explain these relations*. In the first instance, the input-output table empirically lists the transactions. Subsequently, the input-output model evaluates the process of production.

Attributes of the input-output economics are in essence the same as for the system of national accounts especially since the input-output economics is often connected with the system of national accounts. The *circulation axiom* is valid, therefore we can say that the sum of flows into a system is equal to the sum of flows which leave it. These flows are expressed in *value terms* since quantities are valued with prices.[31] Furthermore, values refer to a specific period of time which is usually one year – they have a *time dimension*. Lastly, the input-output table allows an *ex post* analysis whereas the input-output model leads to an *ex ante* analysis.

3.2.2 The input-output table

Because of the complexity of real economic relationships, a *simplified economic system* must be developed which can then be analyzed. One such simplification in the input-output table is to choose, for example, firms based on their main output to build a single industry.[32] Figure 2 illustrates the design of input-output tables.[33]

[31] Input-output models which emphasize quantities and prices are also common.

[32] Additional simplifications, resulting in problems of the construction of input-output tables, and procedures which try to solve these problems are mentioned in Pasinetti (1977), pp. 40 ff. and Holub and Schnabl (1985), pp. 78 ff.

[33] The description of input-output tables is focused on those types of input-output tables which can be brought in relation to the system of national accounts. This excludes input-output tables which take energy, working hours, pollution, and so forth into account (see, for example, Fleissner et al., 1993, pp. 249 ff. and 303 ff. and Holub and Schnabl, 1985, pp. 200 ff.).

Figure 2: Scheme of an input-output table

Output to / Input from	Intermediate demand	Final demand
Intermediate inputs	Intermediate inputs matrix	Demand matrix
Primary inputs	Primary inputs matrix	

Inputs are arranged in columns and *outputs* in rows. The firms sector is subdivided in industries. Industries produce intermediate inputs for other industries (*intermediate inputs matrix*) and final goods and services which households and the government purchase, firms invest, and foreigners buy (*demand matrix*). Thus, output is split up into intermediate demand and final demand. In addition, industries employ intermediate inputs from other industries (intermediate inputs matrix) as well as domestic factors of production, such as labor and capital, and imported intermediate inputs (*primary inputs matrix*) to produce output. The sums of the columns equal the sums of the rows which lead to the *total output*. The total output consists of domestic intermediate commodities, imports and the *gross domestic product*. Consequently, the input-output table describes the interdependences between firms, determined by the structure of production, the distribution of income due to the production, and the formation of final demand supplied by the production.

Using the input-output table, it is possible to gain a general view on which industries predominantly serve as suppliers of intermediate inputs for other industries, which mainly deliver investment goods, and which essentially produce for consumption. *Inter-industry coefficients*

complete the *descriptive analysis* of the structure of an economy.[34] The entries in a column represent the value of intermediate inputs and primary inputs that the industry requires to be able to carry on its activities within a year. When these elements are divided by the total output of the industry then the inter-industry coefficients are obtained. For example, the manufacturing industry of Germany in the year 2002 requires, beside other inputs, services from domestic firms with a value of $0.1836 to produce manufactures which are worth $1. In addition, the manufacturers spend $0.0144 for imported services and they compensate skilled employees with $0.1011 for each $1 output (own calculation based on GTAP, 2003 and World Bank, 2004).

Input-output tables of the presented scheme have a *higher value of information* than the system of national accounts. Input-output tables give information about the structural characteristics of an economy which the system of national accounts is not able to deliver. Many data resources are used to ensure that input-output tables are comprehensive and consistent. The construction of input-output tables leads to several conceptual difficulties, problems of statistical recording and an extensive demand for expenditure of work. Therefore, there is a long time lag between the collection of data and the availability of the input-output tables. Since input-output tables do not characterize the present structure of an economy at the day of their publishing, they are *problematic* for an empirically substantial input-output analysis. On the other hand, the industrial interconnections of an economy do not usually change very fast. Thus, data that are several years still provide valuable information.

3.2.3 Input-output models

The input-output table is an important empirical instrument to describe interdependences within an economy. Technical coefficients allow effects on the primary inputs (final demand) back to changes of the final demand (primary inputs) to be traced. But a technical coefficient describes only partly the effects of, for example, an increase of final demand for manufactured products of $1, to refer to the previous example. This would directly add $0.1836 to services which are required in the process of production in the manufacturing.

The aim of the *input-output analysis* (also called inter-industry analysis) is to expand the descriptive and partial study of the input-output table to an analytical and total study. To fore-

[34] Holub and Schnabl (1985), pp. 152 ff. present additional instruments for a descriptive analysis of an input-output table.

cast the effects of, for example, the assumed change in demand for the whole economy, an input-output model is needed. The input-output model explains the economic interconnections based on the theory of production. An *interdependence coefficient* describes, in our example, that services would directly and indirectly add to a total of $0.3582 due to their employment in the process of production not only of the manufacturing industry but also in the supplying industries of the manufacturing and in all of their suppliers and so forth.

Most inter-industry analyses are likely to be performed with an *open static input-output model* (also open Leontief system). The term *open* indicates that in the model final demand and the value added in the various industries is separated from the industries because of their different characteristics whereas the term *closed* states a treatment of the final sector as if it were an ordinary industry. Both types of model incorporate the assumption of *constant returns to scale*, this is, the assumption that all technical coefficients are constant. Models denoted by the term *static* do not include the development in time. Investment activities are generally included in final demand rather than being part of the industries. The exogenous treatment of investment neglects the changes in the structure of the capital stock of an industry due to its investments which determines technological change and hence might affect the industry's growth of output.

Several input-output models were developed with the aim to overcome the *limitations* of the previous static models. Technical coefficients are very unlikely be constant in all industries. Returns to scale may be increasing or decreasing in an industry. *Non-linear* input-output models try to approximate the degree of nonlinearity of the production processes. Finally, the approximation of the change of technical coefficients over time due to, for example, technical progress is attempted by *dynamic* input-output models. Furthermore, input-output models are not restricted to the analysis of a whole economy. Beside *national* input-output models, *regional* input-output models are applied which put the focus on a single region of a nation.[35] *Multi-regional input-output models* describe the interdependent industries within a region (or nation) as well as the interrelation between regions (or nations).[36]

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[35] Dependent on the scope of an analysis. For example, Germany could be defined as a nation and Bavaria as a region. On the other hand, Germany might be a region of the European Union.

[36] Pasinetti (1977), pp. 55 ff. illustrates the *closed static* input-output model which Leontief (1941) presents in the first edition of his work. In the second edition, Leontief (1951) proposes the *open static* input-output model (see also, for example, Leontief, 1966, 134 ff. and Pasinetti, 1977, pp. 59 ff.). For example, Fleissner et al. (1993), pp. 159 ff. and pp. 277 ff. and Schumann (1968), pp. 86 ff. and 138 ff. give an overview of *non-linear* input-output models. *Dynamic* input-output models are emphasized, for example, in Leontief (1966), pp. 145 ff., Fleissner et al. (1993), pp. 185 ff., Pasinetti (1977), pp. 191 ff. and Schumann (1968), pp. 166 ff. Finally, the

The *advantage* of the input-output analysis is that it becomes possible to analyze the economy as an interrelated system of industries that directly and indirectly affect one another. This allows structural changes to be traced back through industrial interconnections. These linkages between the industries include all stages of a product's processing from the raw material stage to the sale of the product as a final good or service.

Leontief (1966), p. 152 points out some typical *applications* of the input-output analysis in empirical research. They are in such fields as economic projection of demand, output, employment, and investment in terms of the individual industries for a whole economy and for part of an economy. In addition, the "study of technological change and its effect on productivity, analysis of the effect of wage, profit, and tax changes on prices, study of international and interregional economic relationships, utilization of natural resources, developmental planning." For example, Germany's exports in the year 2002 amount to a value of $712,600 million which generate nearly double the value of the total output of all industries ($1,251,300 million). The production processes of the exports in the exporting firms and all the suppliers at all stages of the production require imports of $153,100 million and factors of production which creates $559,500 million of value added. Consequently, the value of imports in exports has a share of 21.5 percent, which generates income abroad (own calculation based on GTAP, 2003 and World Bank, 2004).

3.3 The input-output framework for constructing the new openness indices

3.3.1 Representation of economic interconnections

The innovative measures of trade openness in this contribution adjust the traditional shares of trade by emphasizing the value added that international trade generates. Such a correction of the trade values that are stated in gross terms requires an *analysis of income effects* due to trade. The analysis must take the process of production in an economy into account since the interdependences between industries determine the employment of inputs for the production of output in the industries. Consequently, the input-output analysis is an appropriate instrument for the development of new trade shares, as illustrated in the previous section. It answers many questions, including the following: How much income do exports generate in the domestic economy and how is the resulting income distributed among the factors of production?

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construction of *multi-regional* input-output models is described in, for example, Leontief (1966), pp. 223 ff., Fleissner et al. (1993), pp. 241 ff. and Holub and Schnabl (1985), pp. 70 ff.

What value do imports that are assembled in exports have and how are these imports structured?

We will carry out a *multi-regional input-output analysis* in an open static Leontief system which describes the economic system of the world economy not only in terms of interdependent industries within a region but also in terms of the interrelated regions' home country and aggregated foreign country.[37] The foreign country consists of all trading partners of the home country. A national input-output analysis of a country which ignores the process of production in the foreign country would restrict the construction of new proxies of openness on the export side of the economy. Consequently, it is necessary to include a national input-output analysis of the foreign country to expand the measurement of actual openness on the import side of the country of interest because only both national input-output analyses together allow the international redistribution of income created by trade to be calculated.

The decision to choose the *open static Leontief system* as the theoretical foundation for the input-output analysis and not, for example, the Straffa system was based on the two aims of this study (Straffa, 1960). The presentation of new measures of trade openness is based on the theoretical analysis of an economic system and the empirical analysis of the potential association between the degree of trade openness and the choice of exchange rate regimes. Because the latter analysis is based on empirically calculated degrees of openness, preference was given to the contribution of Leontief to the theory of production, which is inspired by essentially empirical concerns whereas the Straffa system was developed for basically theoretical purposes (see Pasinetti, 1977, pp. 32 and 71 ff.). In addition, the Global Trade Analysis Project (GTAP) data bases which are used for the empirical analysis in chapters 4 and 6 offer data which fit the Leontief system (GTAP, 2003, 1998; see McDougall and Dimaranan, 2002 and Gehlhar et al., 1997).

These data bases do not include data to construct more comprehensive non-linear or dynamic input-output models. A linear approximation of the production processes within a country is appropriate if exports induce small variations in the production of the economy. In such a case, the output effects of increasing or decreasing returns to scale are limited. In other cases, the non-linearity of the production relationships could lead to deceptive conclusions. Moreover, the measures of openness are calculated with input-output tables that are updated on a

[37] Wang (2003b) gives an alternative introduction to the input-output analysis to that one presented in Section 3.3.

yearly basis (see Section 4.3.1). For such a short period of time, the assumption of a static economy is suitable even for noticeably dynamic economic systems because the changes in technical knowledge which affect the technical coefficients can normally be neglected (see Pasinetti, 1977, pp. 69 ff.).

The *multi-regional input-output table* in this contribution systematically defines all transactions within a certain country and the foreign countries as well as between the regions. Its construction mainly follows the scheme proposed by *Isard* (1951). This method is superior to others, such as Leontief (1966), pp. 223 ff., because it incorporates less simplifying assumptions of interregional interconnections. Consequently, this allows a very detailed study of the economic interdependences but it also demands a lot of data which the GTAP (2003, 1998) data bases are able to supply. The multi-regional input-output table consists of the national input-output table of a country and the national input-output tables of trading partners of the country which are then aggregated to build a single national input-output table.

This aggregation of national input-output tables deviates from the idea of Isard (1951) of including each country of interest in the multi-regional input-output table. With the construction of a single national input-output table it is possible to significantly reduce the complexity of the creation of value-added based measures of trade openness. On the other hand, this approach could lead to an aggregation error due to a simplified representation of interdependences between regions (see, for example, Mythili, 1995, Kossov, 1970 and Theil, 1957). The quality of the approximate results could be evaluated by comparing the total output predictions with a multi-national input-output table which consists of all relevant national input-output tables. Since imports from a certain country are only a fraction of total imports, they generally induce little changes in every single trading partner. Therefore, this approximation of interconnections between the foreign countries should be legitimate.

Figure 3 illustrates the multi-regional input-output table.

Figure 3: Multi-regional input-output table with two regions

			Region *l*											
			1				2				Region *l*			
			Industry *j*								1	2		
			1	2	3	4	1	2	3	4	Demand *e*			
											1	2	1	2
Region *k*	Commodity *i*	1	X_{ij11}				X_{ij12}				Y_{ie11}		Y_{ie12}		X_{i1}
		2												
		3												
		4												
		1	X_{ij21}				X_{ij22}				Y_{ie21}		Y_{ie22}		X_{i2}
		2												
		3												
		4												
	Factor *g*	1	W_{gj1}				W_{gj2}							
		2												
		3												
		4												
		5												
			X_{j1}				X_{j2}							

The input-output table is constructed in current dollar terms which refer to a period of one year. The symbol X_{ijkk} (X_{ij11} and X_{ij22}) represents an element of the *intermediate inputs matrix* of region *k*. It denotes the value of commodity *i* which is delivered to industry *j* within region *k*. Region *k* represents either home country (1) or aggregated foreign country (2). Commodity *i* symbolizes food (1), other primary products (2), manufactures (3), or services (4). Correspondingly, industry *j* stands for food industry (1), other primary production (2), manufacturing (3), or services (4). It is assumed that each industry produces only one type of product and each product within the industry is the same. For example, manufacturing produces only manufactured products. The distribution and sale of the manufactures is fixed. Furthermore, region *k* exports the value of commodity *i* to industry *j* of region *l*, denoted by the symbol X_{ijkl} (X_{ij12} and X_{ij21}). Region *l* indicates either home country (1) or aggregated foreign country (2). Since these exports of one region are imported intermediate inputs for the other region, X_{ijkl} is an ingredient of the *primary inputs matrix* of region *l*.

The *demand matrix* of region *k* includes the value of the *i*th commodity which is produced in region *k* and demanded by the final demand component *e* of region *k*, indicated by the symbol Y_{iekk} (Y_{ie11} and Y_{ie22}). This component *e* of final demand is either in the home country (1) or in the aggregated foreign country (2). Thus, Y_{ikkk} represents the value of purchases of consumers and the government as well as the value of investment activities of firms of commod-

ity i in the region k whereas the symbol Y_{ilkk} describes the export value of commodity i of region k which the residents in region l demand. This definition of final demand can be expressed as

$$(40) \qquad \sum_{e=1}^{2} Y_{iekk} = Y_{ikkk} + Y_{ilkk}, \quad i = 1,2,3,4, \quad k = 1,2 \quad l \neq k.$$

The exports of commodity i of region k include deliveries to the production processes as well as to final demand in region l. Since it is assumed that the value of an exported commodity i equals its import value, the export value of commodity i of region k is in symbols:

$$(41) \qquad Y_{ilkk} = \sum_{j=1}^{4} X_{ijkl} + \sum_{e=1}^{2} Y_{iekl}, \quad i = 1,2,3,4, \quad k = 1,2, \quad l \neq k.$$

As an element of the *demand matrix*, the symbol Y_{iekl} (Y_{ie12} and Y_{ie21}) denotes the value of commodity i which the final demand component e of region l imports from region k. With this approximation of trade relationships between the regions, equation (40) can be rewritten as

$$(42) \qquad \sum_{e=1}^{2} Y_{iekk} = Y_{ikkk} + \sum_{j=1}^{4} X_{ijkl} + \sum_{e=1}^{2} Y_{iekl}, \quad i = 1,2,3,4, \quad k = 1,2 \quad l \neq k.$$

In contrast to the common definition of final demand, this version separates explicitly the exports of intermediate inputs from exported final products. Consequently, the value of the exported commodity i is included two times in the multi-regional input-output table. On the one hand, as part of the final demand of region k (Y_{ilkk}) and, on the other hand, as imports in region l (X_{ijkl} and Y_{iekl}). This treatment of exports enhances the approach of Isard (1951). Our multi-regional input-output table describes the interregional interdependences more accurately than the alternative scheme because imports from the other region for the final demand are included in the final sector and not simplified as intermediate inputs for the industries which then deliver the imports to the final sector.[38]

X_{ik} (X_{i1} and X_{i2}) symbolizes the value of *total output* of commodity i in region k. It is determined by the requirement of the intermediate input i by all industries j to produce output (X_{ijkk}) and the demand of the final product i by the components e of final demand (Y_{iekk}), which is represented in symbols as

[38] See, for example, Holub and Schnabl (1985), pp. 53 ff. for a discussion of different approaches of including imports in an input-output table.

$$(43) \qquad X_{ik} = \sum_{j=1}^{4} X_{ijkk} + \sum_{e=1}^{2} Y_{iekk}, \quad i = 1,2,3,4, \quad k = 1,2.$$

As noted before, the multi-regional input-output table in this study treats trade between the regions in such a way that the structure of exports are reflected in more detail as the scheme of Isard (1951). If we take equation (42) into account then the value of total output of commodity i in region k which is expressed in equation (43) becomes

$$(44) \qquad X_{ik} = \sum_{j=1}^{4} X_{ijkk} + \sum_{j=1}^{4} X_{ijkl} + Y_{ikkk} + \sum_{e=1}^{2} Y_{iekl}, \quad i = 1,2,3,4, \quad k = 1,2, \quad l \neq k.$$

The equation shows the flow of commodities i to the intermediate sector of region k and region l (X_{ijkk} and X_{ijkl}), to final demand within region k (Y_{ikkk}), and to the final sector of region l (Y_{iekl}).

Furthermore, an industry requires several inputs to carry on its activities. The sum of all inputs of the industry is called total output – the same as the sum of outputs of the industry. Industries purchase intermediate commodities from other industries (X_{ijkk}) and employ imported intermediate inputs (X_{ijkl}) as well as domestic factors of production (W_{gjk}). The symbol W_{gjk} (W_{gj1} and W_{gj2}) denotes the compensation of production factor g in industry j in region k and is the missing element of the *primary inputs matrix* of region k. Factor of production g is unskilled labor (1), skilled labor (2), capital (3), land (4), or natural resources (5). Thus, the value of *total output* of industry j in region k, denoted by X_{jk} (X_{j1} and X_{j2}), is defined in symbols as

$$(45) \qquad X_{jk} = \sum_{i=1}^{4} X_{ijkk} + \sum_{i=1}^{4} X_{ijlk} + \sum_{g=1}^{5} W_{gjk}, \quad j = 1,2,3,4, \quad k = 1,2, \quad l \neq k.$$

The value of total output in equation (43) (and equation (44)) equals the outcome in equation (45) because the value of all outputs of an industry is exactly the same value as all of its inputs:

$$(46) \qquad X_{ik} = X_{jk}, \quad i = 1,2,3,4, \quad j = i, \quad k = 1,2.$$

Finally, the multi-regional input-output table includes also the *gross domestic product* in region k, denoted by the symbol Y_k. The gross domestic product is defined as the sum of the value added in the industries which industries generate in the domestic economy due to their compensation of production factors for their employment in the production process of outputs. Because domestic residents spend a part of this income on domestic final goods and ser-

vices and the industries export part of their outputs to foreign residents, gross domestic product can be expressed in symbols as

$$(47) \qquad Y_k = \sum_{g=1}^{5}\sum_{j=1}^{4} W_{gjk} = \sum_{i=1}^{4}\sum_{e=1}^{2} Y_{iekk} - \sum_{i=1}^{4}\sum_{j=1}^{4} X_{ijlk}, \quad k = 1,2, \quad l \neq k.$$

The value of imported intermediate inputs is subtracted from the value of final demand because domestically produced final goods and services include imported intermediate inputs which do not generate value added in the home economy.

3.3.2 Calculation of income generated by trade

Now that the intra- and inter-regional economic interconnections have been described in the multi-regional input-output table, they can be evaluated by the following input-output analysis. The first step of the analysis of income effects due to exports is the forecast of the *change of total output* in the domestic economy. Any output of an industry including goods and services sold to foreign residents requires intermediate inputs from the industry and supplying industries for the production of the output. All the involved industries also require their own intermediate commodities from their suppliers and so forth. Consequently, the value of total output includes the export value and the value of all intermediate inputs to produce the exported output.

The association between the value of exports that are interpreted as a change in the value of final demand and the response of the value of total output which is determined by the interdependences of the industries is described next. We begin with the *inter-industry coefficient* (also technical coefficient of the production processes or merely production coefficient). The inter-industry coefficient a_{ijk} represents the fraction of total expenditures of industry j which is spent to purchase the commodity i in region k as

$$(48) \qquad a_{ijk} = \frac{X_{ijkk}}{X_{jk}}, \quad i, j = 1,2,3,4, \quad k = 1,2.$$

The ratio expresses the quantity of the ith commodity which is on average required in the jth industry for the production of one unit of the jth commodity in region k. Because commodities do not have negative values, it follows that

$$(49) \qquad a_{ijk} \geq 0, \quad i, j = 1,2,3,4, \quad k = 1,2.$$

Equation (48) shows the fundamental assumption of the Leontief system; the inter-industry coefficients are constant, this is, constant returns to scale are assumed. Price effects, economies of scale, or changes in technical knowledge that influence the requirement for inputs to produce output in an industry are not considered. There is no substitution between inputs. When taking into account that the technology of the production process is fixed, the amount of a commodity *i* purchased by an industry *j* in region *k* is determined only on the level of its output of commodity *j*:

$$(50) \qquad X_{ijkk} = a_{ijk} X_{jk}, \quad i, j = 1,2,3,4, \quad k = 1,2.$$

Consequently, equation (43) which defines the value of the total output of commodity *i* in region *k* can be rewritten as

$$(51) \qquad X_{ik} = \sum_{j=1}^{4} a_{ijk} X_{jk} + \sum_{e=1}^{2} Y_{iekk}, \quad i = 1,2,3,4, \quad k = 1,2.$$

Since the value of all outputs of an industry (X_{ik}) equals the value of all of its inputs (X_{jk} with $i = j$), X_{jk} can be replaced by X_{ik}, as stated in equation (46), and hence it follows that

$$(52) \qquad X_{ik} = \sum_{j=1}^{4} a_{ijk} X_{ik} + \sum_{e=1}^{2} Y_{iekk}, \quad i = 1,2,3,4, \quad k = 1,2.$$

To find out what effect a change in the value of final demand, such as the value of exported goods and services within a year, has on the value of the total output in all industries of a region, equation (52) must be rearranged. First, we rewrite the equation concisely. The column vector of the four values of the commodities *i* making up the final demand in region *k* is represented by y_k as

$$(53) \qquad y_k = \left(\sum_{e=1}^{2} Y_{1ekk}, \sum_{e=1}^{2} Y_{2ekk}, \sum_{e=1}^{2} Y_{3ekk}, \sum_{e=1}^{2} Y_{4ekk} \right)^{T}, \quad k = 1,2.$$

x_k symbolizes the column vector of the four total output values of each commodity *i* which have to be produced in region *k* (X_{ik}). It can be stated as

$$(54) \qquad x_k = \left(X_{1k}, X_{2k}, X_{3k}, X_{4k} \right)^{T}, \quad k = 1,2.$$

The technique of a region *k*'s economic system is represented by the *direct requirements table* of the production processes A_k. It is the non-negative square matrix of inter-industry coefficients of order four which relates the inputs and outputs of commodities:

$$(55) \qquad A_k = (a_{ijk}) = \begin{pmatrix} a_{11k} & a_{12k} & a_{13k} & a_{14k} \\ a_{21k} & a_{22k} & a_{23k} & a_{24k} \\ a_{31k} & a_{32k} & a_{33k} & a_{34k} \\ a_{41k} & a_{42k} & a_{43k} & a_{44k} \end{pmatrix}, \quad k = 1,2.$$

Based on these definitions, equation (52) can be rewritten as

$$(56) \qquad x_k = A_k x_k + y_k, \quad k = 1,2.$$

The system of linear equations states that the value of the total output of region *k* equals the combined value of internal and final demand. A rearrangement of x_k to the left side leads to

$$(57) \qquad x_k - A_k x_k = y_k, \quad k = 1,2.$$

By taking the identity matrix of order four (B):

$$(58) \qquad B = (b_{rs}) = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad b_{rs} = \begin{cases} 1 \text{ for } r = s \\ 0 \text{ for } r \neq s \end{cases}$$

into account it follows that

$$(59) \qquad Bx_k - A_k x_k = y_k, \quad k = 1,2$$

which leads to

$$(60) \qquad (B - A_k) x_k = y_k, \quad k = 1,2.$$

Symbol b_{rs} represents an element of the identity matrix with the row index *r* and the column index *s*. The result of the final rearrangement of the equation system (56) is the solution of the static open Leontief system which is in symbols:

$$(61) \qquad x_k = (B - A_k)^{-1} y_k, \quad k = 1,2.$$

For region *k,* it states, in value terms, the association between a given change in the structure of final demand and the response of the total output of the various industries necessary to produce not only the demanded commodities but also the required intermediate commodities in the production processes of the final goods and services. It is assumed that the supply of resources is infinite and perfectly elastic as well as that all resources are efficiently employed (see OECD, 1992). In addition, the relation between the final sector and the intermediate sector clearly shows that the values of final demand are assumed to be exogenous variables of the

input-output model whereas the values of total output are considered to be endogenous variables. But components of final demand, such as households, are involved in the process of production. The level of employment affects the demand of households. Since households are a part of the economic system, they would become endogenous variables of the input-output model. This aspect of the model's design is of minor relevance for the analysis of income effects due to exports because the spending of the induced national income by the households is not investigated.

The inverse matrix of order four in equation (61) is the *total requirements table* of the production processes $(B\text{-}A_k)^{-1}$, which is defined in symbols as

$$(62) \qquad \left(B - A_k\right)^{-1} = \left(f_{ijk}\right) = \begin{pmatrix} f_{11k} & f_{12k} & f_{13k} & f_{14k} \\ f_{21k} & f_{22k} & f_{23k} & f_{24k} \\ f_{31k} & f_{32k} & f_{33k} & f_{34k} \\ f_{41k} & f_{42k} & f_{43k} & f_{44k} \end{pmatrix}, \quad k = 1,2.$$

Its elements are the *interdependence coefficients*, denoted by f_{ijk}. The interdependence (interindustry) coefficient f_{ijk} (a_{ijk}) represents the quantity of the *i*th commodity which is required in the economic system as a whole (on average in the *j*th industry) for the production of one unit of the *j*th commodity as a final commodity (as output for intermediate and final use) in region *k*. Thus, the total requirements table $(B\text{-}A_k)^{-1}$ does not only measure the direct effects, like the direct requirements table A_k, but also the indirect effects of any changes in the various industries.

In the second and third step, the value of domestic factors of production and the value of the imported intermediate inputs that are employed in the production processes of all involved industries to produce the exports in region *k* are forecasted. The analysis reveals, on the one hand, how much income exports engender in the domestic economy (*domestic value added* induced by exports) and, on the other hand, how much income is transferred abroad due to the imported intermediate inputs that are processed in the exports (*foreign value added* induced by exports).

The *direct requirements table of domestic production factors* for region *k*, denoted by D_k, adds to the part of the direct requirements table already presented – the direct requirements table of the production processes A_k. Beside the description of the interdependences between the industries, this additional component of the table shows the structure of the production

factors employed in the industries due to the production processes in the economy which, in symbols, is

$$(63) \qquad \mathrm{D}_k = \left(\mathrm{d}_{gjk}\right) = \begin{pmatrix} \mathrm{d}_{11k} & \mathrm{d}_{12k} & \mathrm{d}_{13k} & \mathrm{d}_{14k} \\ \mathrm{d}_{21k} & \mathrm{d}_{22k} & \mathrm{d}_{23k} & \mathrm{d}_{24k} \\ \mathrm{d}_{31k} & \mathrm{d}_{32k} & \mathrm{d}_{33k} & \mathrm{d}_{34k} \\ \mathrm{d}_{41k} & \mathrm{d}_{42k} & \mathrm{d}_{43k} & \mathrm{d}_{44k} \\ \mathrm{d}_{51k} & \mathrm{d}_{52k} & \mathrm{d}_{53k} & \mathrm{d}_{54k} \end{pmatrix}, \quad k = 1,2.$$

This matrix consists of coefficients known as *technical coefficients of the domestic production factors* (d_{gjk}). The coefficient expresses the share of total expenditure of an industry j which is spent to compensate the factor of production g in region k:

$$(64) \qquad \mathrm{d}_{gjk} = \frac{\mathrm{W}_{gjk}}{\mathrm{X}_{jk}}, \quad g = 1,2,\ldots,5, \quad j = 1,2,3,4, \quad k = 1,2.$$

It is assumed that the coefficients are constant, the primary inputs are not substitutable, the production factors are not constrained, and the factors of production are efficiently employed. From the economic meaning of the coefficient it follows that

$$(65) \qquad \mathrm{d}_{gjk} \geq 0, \quad g = 1,2,\ldots,5, \quad j = 1,2,3,4, \quad k = 1,2.$$

Next, the change in the exogenous vector of final demand values of region k is determined by the vector of export values of the various commodities i sold from region k to region l. It can be written in symbols as

$$(66) \qquad \mathrm{y}_k = \left(\mathrm{Y}_{1lkk}, \mathrm{Y}_{2lkk}, \mathrm{Y}_{3lkk}, \mathrm{Y}_{4lkk}\right)^{\mathrm{T}}, \quad k = 1,2, \quad l \neq k.$$

The commodities which are represented by the vector of export values y_k require not only the production of these commodities sold by foreign residents, but also intermediate commodities in the industries at the different levels of the stages of production within the economy, that is, the change of total output of the various industries expressed in value terms. This association is stated in the system of equations (61). In addition to the intermediate commodities, domestic factors of production (and imported intermediate commodities) are employed in the production process of the exports. The compensation of the different factors of production g in region k is defined by the column vector of income of domestic production factors q_k as

$$(67) \qquad \mathrm{q}_k = \left(\mathrm{Q}_{1k}, \mathrm{Q}_{2k}, \mathrm{Q}_{3k}, \mathrm{Q}_{4k}, \mathrm{Q}_{5k}\right)^{\mathrm{T}}, \quad k = 1,2.$$

Using the direct requirements table of domestic production factors D_k, the income of the production factors q_k due to the direct and indirect employment in the production of exports in region k is

(68) $$q_k = D_k x_k, \quad k = 1,2.$$

Hence it follows that the *export-induced domestic value added* of region k represents the total income of the different production factors g in region k generated by exports.

Lastly, the *direct requirements table of imported intermediate products* for region k (C_{lk}) completes the direct requirements table and is defined in symbols as

(69) $$C_{lk} = \left(c_{ijlk}\right) = \begin{pmatrix} c_{11lk} & c_{12lk} & c_{13lk} & c_{14lk} \\ c_{21lk} & c_{22lk} & c_{23lk} & c_{24lk} \\ c_{31lk} & c_{32lk} & c_{33lk} & c_{34lk} \\ c_{41lk} & c_{42lk} & c_{43lk} & c_{44lk} \end{pmatrix}, \quad k = 1,2, \quad l \notin k.$$

Its elements – the *technical coefficients of the imported intermediate inputs*, denoted by c_{ijlk}, – express the quantity of the ith commodity imported from region l which is essential in the jth industry for the production of one unit of the jth commodity in region k. The ratio can be written as

(70) $$c_{ijlk} = \frac{X_{ijlk}}{X_{jk}}, \quad i, j = 1,2,3,4, \quad k = 1,2, \quad l \notin k.$$

The assumptions about the employment of the imported intermediate commodities in the production process of output are identical to those for the production factors presented earlier. In addition, only positive values of the coefficient are economically plausible:

(71) $$c_{ijlk} \geq 0, \quad i, j = 1,2,3,4, \quad k = 1,2, \quad l \notin k.$$

We will now introduce the last vector of the input-output analysis of income effects due to international trade which represents the value of imported intermediate commodities i in region k bought from region l. The column vector p_{lk} is expressed in symbols as

(72) $$p_{lk} = \left(P_{1lk}, P_{2lk}, P_{3lk}, P_{4lk}\right)^{\mathrm{T}}, \quad k = 1,2, \quad l \notin k.$$

The demand for exports induces the production of these final commodities as well as inducing the intermediate commodities to produce goods and services that foreign residents desire. This change in total output requires, beside domestic inputs, intermediate commodities from abroad as determined by the structure of production within the industries:

(73) $$p_{lk} = C_{lk} x_k, \quad k = 1,2, \quad l \neq k.$$

Finally, the *export-induced foreign value added* of region *k* indicates the value of all imported intermediate commodities *i* of region *k* which are included in the region's exports.

3.4 Value-added based measures of openness towards international trade

3.4.1 Outline of adjusted shares of trade

Section 3.1 presented arguments for the necessity to correct traditional measures of openness and illustrated their problematic interpretation. In addition, the section introduced two new adjusted trade shares based on a value-added concept. The missing theoretical framework for an analysis of the international trade linkages was laid out in Section 3.3. In the following, the *construction* of value-added based indicators of trade openness is illustrated which applies the instruments of the previously introduced multi-regional input-output analysis of income effects due to international trade.[39]

The new proxies of openness, the *export-induced domestic value-added ratio* and the *import-induced foreign value-added ratio*, are supplemented by several value-added based indicators to reveal a more comprehensive insight into the structure of international trade. This should support the assessment of the relevance of international trade for an economy and thereby the supplementary measures might improve the empirical analysis of the likely association between the degree of trade openness and the choice of exchange rate regimes (see Chapter 4).

A change in the analysis focus from the income that exports engender in the exporting economy towards the income that is transferred abroad, due to imported intermediate inputs embodied in the exports, leads to the ratio known as the *export-induced foreign value-added ratio* and the *import-induced domestic value-added ratio* measure. These four proxies of openness emphasize a specific fraction of the trade-induced value-added as a share of national income. Besides, the *export-induced domestic value-added ratio of production factor g* index, the *import-induced foreign value-added ratio of production factor g*, the *export-induced foreign value-added ratio of intermediate commodity i*, and the *import-induced domestic value-added ratio of intermediate commodity i* accentuate the structure of these parts of national income.

[39] Parts of the Section 3.3 are included in Wang (2003b).

3.4.2 The significance of domestic value added due to trade

Trade generates value added in a country as a result of its exports (q_1). The exports within the period of one year (y_1) require not only the production of the export products, but also intermediate commodities in the production processes of the exporting industries and their supplying industries. This production of final commodities and additional intermediate commodities is stated by the change of total output (x_1), which is expressed in value terms. In addition to the intermediate commodities, the directly and indirectly involved industries employ primary inputs, such as domestic factors of production. The compensation of the production factors equals the change in the industries' value added (q_1). If we express this part of national income as a share of the whole national income in the domestic economy (Y_1) we obtain the *export-induced domestic value-added ratio* (EDR) openness indicator, which can be written in symbols as[40]

$$
\begin{aligned}
&y_1 = \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^{T}, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad q_1 = D_1 x_1, \\
&\mathrm{EDR} = \frac{q_1}{Y_1} 100.
\end{aligned}
\tag{74}
$$

Since the numerator represents a part of the denominator, the range of the value-added based index of openness is between zero and 100 percent. The adjusted trade ratio can be interpreted in such a way that a higher degree of openness means that a country depends more on foreign countries to create income in the domestic economy.

Furthermore, a fraction of national income in the domestic economy is created by imports. The channel for this association is that the trading partners entail intermediate commodities from the country under investigation (p_{12}), due to their production structures, to produce the imports of the country (y_2). The *import-induced domestic value-added ratio* measure, abbreviated to IDR, expresses the value of exports created by imports in relation to the gross domestic product (Y_1) as a percentage:

$$
\begin{aligned}
&y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^{T}, \quad x_2 = \left(B - A_2\right)^{-1} y_2, \quad p_{12} = C_{12} x_2, \\
&\mathrm{IDR} = \frac{p_{12}}{Y_1} 100, \quad i = 1,2,3,4.
\end{aligned}
\tag{75}
$$

[40] The system of equations (74) expresses equivalent to equation (38) in Section 3.1 the export-induced domestic value-added ratio but the equation system includes additionally the method to forecast the export-induced change in the income of the production factors based on the theory of production.

The value of exported intermediate commodities that are assembled in imports is equal to the importing country's import value. This import makes up a share of the importing country's national income. The usage of this income is not analyzed further. For example, a part of the income is spent for imports. These imports represent a fraction of the next openness measure.

3.4.3 The significance of value added abroad due to trade

A further attempt to indicate openness towards international trade with more accuracy than the traditional shares of trade is the *import-induced foreign value-added ratio* (IFR). This indicator calculates the degree of openness on a country's import side for the period of one year with the focus on income that imports generate abroad. Identical to the exports of the country, the exports of its foreign trading partners (y_2) engender income for the production factors which are directly and indirectly involved in the production process of the output (q_2). The contribution of this foreign income to national income of the domestic economy (Y_1) can be expressed in symbols as[41]

$$\begin{aligned} & y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \quad x_2 = \left(B - A_2\right)^{-1} y_2, \quad q_2 = D_2 x_2, \\ & \mathrm{IFR} = \frac{q_2}{Y_1} 100. \end{aligned} \tag{76}$$

It is possible that the non-negative level of openness calculated by the IFR measure surpasses 100 percent. Such a situation indicates that domestic residents spend more of their income on imported intermediate commodities embodied in exports than they are compensated for by the industries. The domestic economy must be able to close its financial deficiency by means of exports or international borrowing. The higher the degree of openness, the more important foreign trading partners for the spending of domestic residents' income are.

The construction of the *export-induced foreign value-added ratio* (EFR) openness measure is based on the separation of imported intermediate commodities which are part of exports (p_{21}) from total imports. For their production, exports (y_1) require not only domestic production factors but also intermediate commodities delivered from domestic and foreign industries. Since domestic residents have to purchase imported intermediate commodities (p_{21}), part of their income is transferred abroad. The EFR index represents how much of the value of ex-

[41] The system of equations (76) explains theoretically the value of the denominator of equation (39).

ports is redistributed to foreign countries in relation to the national income (Y_1) as a percentage:

$$y_1 = \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad p_{21} = C_{21} x_1,$$

(77)

$$EFR = \frac{p_{21}}{Y_1} 100, \quad i = 1,2,3,4.$$

Consequently, the EFR measure indicates the importance of foreign countries as suppliers of intermediate commodities to produce exports through the share of income which is spent for their purchase.

Each of the four innovative measures of openness towards international trade calls attention to a specific aspect of the role of international trade for an economy, which the corresponding two traditional indices are not able to express. Since the value-added based concept amends the traditional approach by means of an elaboration of the international redistribution of trade-generated income, the traditional trade shares consist of the adjusted shares of trade. The export ratio (import ratio) measure puts emphasis on the value of exports (imports). Domestic factors of production as well as imported intermediate inputs are required within the production process of exported (imported) goods and services in the producing country. The compensation of production factors creates income in the producing country which is represented by the export-induced domestic value-added ratio (import-induced foreign value-added ratio). Furthermore, the export-induced foreign value-added ratio (import-induced domestic value-added ratio) index stresses that the purchase of imported intermediate inputs transfers income abroad. These associations of the traditional trade shares and the adjusted counterparts can be expressed in symbols as

(78) $ER = EDR + EFR$ and

(79) $IR = IFR + IDR.$

Where a production structure only requires (both directly and indirectly) domestic inputs to produce exports, the traditional openness, expressed by ER and IR, equals the equivalent actual openness (EDR and IFR). The more foreign inputs that are embodied into the exports of the producing country, the larger the deviation of the traditional openness from the actual openness. Even the simple example of Singapore and Malaysia in Section 3.1 can reveal new insights into the structure of international trade linkages between these Asian countries and their trading partners.

3.4.4 The significance of income of production factors due to trade

The structure of the previously introduced systems of equations (74) to (77) indicates that the multi-regional input-output analysis of international trade allows effects of trade on specific primary inputs of the production processes to be forecasted. If the significance of exports (y_1) for the income of a single factor of production g (Q_{g1}), such as labor or capital, is of interest then the *export-induced domestic value-added ratio of production factor g* openness measure, abbreviated by EDR_g, may be useful. The EDR_g measure indicates openness by relating the change of income of a production factor due to exports to national income (Y_1) as

$$\begin{aligned} &y_1 = \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad q_1 = D_1 x_1, \\ &EDR_g = \frac{Q_{g1}}{Y_1} 100, \quad g = 1,2,\ldots,5. \end{aligned} \tag{80}$$

This openness index discloses whether the relative importance of a concrete production factor which is directly and indirectly embodied in the export commodities raises or falls. For example, a decrease in the export-induced compensation of skilled labor over time might be caused by a change in the production processes within some industries of the exporting country. A change in the preferences of foreign customers towards high-technology products or 'value-added services' affects the pattern of trade between the domestic country and the foreign countries. This in turn, might result in offshore outsourcing of data processing services and services in research and development from a mature, highly industrialized country to countries in Central and Eastern Europe and India. Firms in the high-technology business have to lower their costs of production to stay competitive in international product markets. Consequently, the firms would require less domestic skilled labor and more foreign skilled labor which are employed to produce imported intermediate inputs.

In addition, the *import-induced foreign value-added ratio of production factor g* (IFR_g) indicator of openness is defined by the import-generated income of the foreign factor of production g (Q_{g2}) as a share of gross domestic product in the domestic economy (Y_1), which can be expressed in symbols as

$$\begin{aligned} &y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \quad x_2 = \left(B - A_2\right)^{-1} y_2, \quad q_2 = D_2 x_2, \\ &IFR_g = \frac{Q_{g2}}{Y_1} 100, \quad g = 1,2,\ldots,5. \end{aligned} \tag{81}$$

This proxy of openness indicates the relevance of a concrete foreign production factor for the production of the imported goods and services.

The export-induced domestic value-added ratio as well as the index import-induced foreign value-added ratio openness measure consists of the corresponding structural openness measures:

$$\text{EDR} = \sum_{g=1}^{5} \text{EDR}_g \quad \text{and} \tag{82}$$

$$\text{IFR} = \sum_{g=1}^{5} \text{IFR}_g . \tag{83}$$

3.4.5 The significance of the value of imported intermediates due to trade

Lastly, the subsequent value-added based indices of openness highlight the import (export) value of a specific intermediate commodity *i* induced by exports (imports). The dependency of the domestic industries upon the intermediate input *i* from abroad (P_{i21}) to produce exports (y_1) is indicated by the *export-induced foreign value-added ratio of intermediate commodity i* (EFR_i) as a percentage of the gross domestic product (Y_1) as

$$\begin{aligned} & y_1 = \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad p_{21} = C_{21} x_1, \\ & \text{EFR}_i = \frac{P_{i21}}{Y_1} 100, \quad i = 1,2,3,4. \end{aligned} \tag{84}$$

Analogous to this, the *import-induced domestic value-added ratio of intermediate commodity i* (IDR_i) index of openness expresses the value of the intermediate commodity *i* sold to foreign industries so that these industries are able to supply the domestic demand for imports (P_{i12}) as a share of the gross domestic product in the domestic economy (Y_1) as a percentage:

$$\begin{aligned} & y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \quad x_2 = \left(B - A_2\right)^{-1} y_2, \quad p_{12} = C_{12} x_2, \\ & \text{IDR}_i = \frac{P_{i12}}{Y_1} 100, \quad i = 1,2,3,4. \end{aligned} \tag{85}$$

In addition, the export-induced foreign value-added ratio (import-induced domestic value-added ratio) index is composed of the openness measures which accentuate the various imported (exported) intermediate commodities for the production of exports (imports), which can be written as

(86) $$\mathrm{EFR} = \sum_{i=1}^{4} \mathrm{EFR}_i \text{ and}$$

(87) $$\mathrm{IDR} = \sum_{i=1}^{4} \mathrm{IDR}_i .$$

Equivalent to the associations of traditional trade shares and adjusted trade shares expressed in the equations (78) and (79) are

(88) $$\mathrm{ER} = \sum_{g=1}^{5} \mathrm{EDR}_g + \sum_{i=1}^{4} \mathrm{EFR}_i \text{ and}$$

(89) $$\mathrm{IR} = \sum_{g=1}^{5} \mathrm{IFR}_g + \sum_{i=1}^{4} \mathrm{IDR}_i .$$

4. The relationship between the degree of openness and the choice of exchange rate regimes: An empirical re-assessment

4.1 Motivation: Is actual openness a better forecaster for the commitment to exchange rate regimes than traditional openness?

After the conceptual weaknesses of the traditional shares of trade are laid out, it is now of interest whether the differences between the results of the traditional and actual openness concept are systematic and significant. If this is the case, the question arises as to whether actual openness is a better determinant for the choice of exchange rate arrangements than traditional openness.

The presentation of the empirical re-assessment of the potential relationship between the degree of openness and the choice of exchange rate regimes continues in Section 4.2 with a literature review of empirical studies. Section 4.3 displays the data set of the empirical analysis. It consists of the degrees of openness calculated based on the traditional and actual openness of 56 countries for the period of 1989 and 2002. The Global Trade Analysis Project (GTAP) Data Base Version 5.4 and 4 (GTAP, 2003, 1998) serve as sources of data for the structure of economic linkages within and between nations for the years 1997 and 1995. In addition, the World Development Indicators (WDI) 2004 data base (World Bank, 2004) is used to obtain the structure of international trade for the years between 1989 and 2002. Subsequent to this, the data base of Levy-Yeyati and Sturzenegger (2002) provides the data source for the exchange rate arrangements which match 53 out of the 56 countries between 1989 and 2000.

The analysis of the degree of openness as a potential determinant for commitment exchange rate regimes begins in Section 4.4 where the characterization of actual openness towards international trade is presented. This includes a regression analysis of 682 observations of 56 countries' degrees of openness for the period between 1989 and 2002. In Section 4.5, the analysis of the influence the swap from measures of the established method to the value-added based method has on the quality of trade openness to explain the choice of exchange rate regimes is demonstrated. The regression analysis contains 525 observations of 54 countries for the period between 1989 and 2000.

4.2 Survey on empirical studies

The literature review of empirical studies on the choice of exchange rate regimes should disclose whether the degree of openness is a vital predictor of the choice of exchange rate systems, as is concluded by the cost-benefit framework of the theory of optimum currency areas

(see Section 2.3.3). Juhn and Mauro (2002) and Weil (1983) conclude from their survey of previous empirical contributions that the literature is *inconclusive*. Many different methodologies are applied, such as a discriminant analysis, ordinary least squares, (ordered, two-stage) probit, and (ordered, non-ordered, multinominal, two-stage) logit. Furthermore, several alternative classifications of exchange rate regimes are used which might impede consistent test results (see Section 4.3.2 and Bordo, 2003).

Nearly all of the reviewed studies, which date back to 1978, include *trade openness* as a potential predictor in their estimations. Trade openness is in most cases positively correlated with the likelihood to choose a fixed exchange rate regime and openness is, on the whole, statistical significant. In addition, all of these studies selected the traditional openness concept to measure the degree of openness towards international trade. Other explanatory variables, besides trade openness, include, for example, inflation differential, capital mobility, economic growth, external debt, political instability, and central bank independence (see Section 2.3.2). They are also in most cases statistically significant.

Consequently, openness towards trade is often used in empirical studies as an explanation of the selection of exchange rate arrangements. Since the degrees of openness are calculated by the established openness concept, which shows a poor *accuracy* in indicating the importance of international trade, the innovative value-added based measures of trade openness might increase the quality of test results.

4.3 The data set

4.3.1 Degrees of openness based on traditional and actual openness

The data collection process for the calculation of the degrees of openness on the *export side* begins with the *aggregation* of data in the Global Trade Analysis Project (GTAP) Data Base Version 5.4 (GTAP, 2003). The data base represents the economic conditions for 78 regions and the economic linkages between these countries for the year 1997 in US dollar terms (see Table A-1). In addition, these interdependences are described for 57 commodities (see Table A-2). The industries employ five different factors of production; unskilled labor, skilled labor, capital, land, and natural resources. For the construction of the national input-output tables, the 78 regions are aggregated to 66 individual countries and the 'rest of the world' region, which consists of 12 regions. The latter regions are made up of non-separable member countries of different integration areas that are not analyzed. Subsequently, the 57 commodities are

aggregated to form four commodities; food, other primary products, manufactures, and services (see Table A-3). The aggregation level of the production factors remains unchanged.

Furthermore, the structures of trade described in the World Development Indicators (WDI) 2004 data base are aggregated to fit the four commodities (World Bank, 2004). Food stays food, agricultural raw materials and fuel become other primary products, manufactures, ores and metals become manufactures, and commercial service stays services. The trade flows of the GTAP (2003) data base are substituted by those of the WDI (2004) data base because of the inability of the GTAP data base to correctly represent international trade for some economies.[42] The WDI data base is employed to improve the quality of calculated degrees of openness towards international trade and to forecast degrees of openness for all years within the period between 1989 and 2002, except 1997 where data are not available from the GTAP data base. Consequently, the 14 national input-output tables for all years of each of the 66 countries consist of the aggregated data of the GTAP data base for the year 1997 and of the WDI data base for the years 1989 to 2002. The linear *transformation* of the national economy production structure from the base year 1997 for the missing years within the period is based on the exogenously given final demand structure. Data of private consumption, purchases of the government, investments, and the gross domestic product for the years 1989 to 2002 are all from the WDI (2004) data base.

For each country and each year, twelve *measures of trade openness* are computed by means of the multi-regional input-output analysis of international trade. This leads to a data base of degrees of openness that consists of approximately 20,000 entries. If a degree of openness is computed on the basis of negative inter-industry coefficients, which was seldom the case, then the entry is omitted from the data base. A negative inter-industry coefficient has no economic meaning but could occur in cases where the trade patterns of the GTAP data base deviate too much from those of the WDI data base. Where this occurs, the test results of the regression analysis of the potential association between the degree of openness and the choice of exchange rate regimes should benefit from such a comprehensive pool of data.

The process of data collection is similar for the trade openness indices on the *import side,* where 77 of the 78 regions form the 'rest of the world' region and the exports (imports) of the country of interest are the imports (exports) of the 'rest of the world' region. In addition, for

[42] To construct the GTAP data base (see Gehlhar et al., 1997), missing values of trade flows are simulated in a world trade model, where the value of total exports equals the value of total imports.

31 countries, data were available from the GTAP Data Base Version 4, with its base year 1995, to compute earlier years in the period with more accuracy then with the GTAP Data Base Version 5.4 with base year 1997. The computation of the degrees of openness is similar to the earlier version of the GTAP data base as described for the latest available version.

The tables 2 to 5 display the degrees of openness on the export and import side based on the traditional and actual openness concepts of 56 countries for the years 1989 to 2002. Moreover, the presentation of the data base of trade openness is complemented in the tables A-4 to A-11.

Table 2: Openness based on the ER measure of 56 countries, 1989-2002, % of current GDP

Country name	Code	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	ARG	15.23	10.37	7.47	6.58	6.77	7.35	9.56	10.28	10.50	10.35	9.77	10.88	11.48	27.71
Australia	AUS	15.00	16.00	16.60	17.18	17.88	17.79	18.46	18.91	19.45	19.29	18.03	21.13	21.61	20.13
Austria	AUT	38.86	39.64	39.22	37.56	36.09	36.38	38.02	39.58	43.26	44.19	46.30	52.35	55.05	55.52
Bangladesh	BGD	5.84	6.53	6.57	7.86	9.00	9.92	11.07	10.41	12.07	12.23	12.46	14.19	13.56	13.45
Belgium	BEL	76.35	73.34	72.47	68.48	73.78	78.67	76.43	77.84	85.28	87.12	92.09	107.34	108.44	..
Brazil	BRA	8.35	7.55	8.55	10.19	9.70	8.85	7.46	6.73	7.24	7.39	10.33	10.79	13.32	..
Canada	CAN	25.36	25.50	24.90	27.00	29.96	33.86	37.38	38.16	38.99	40.70	42.04	44.65	42.78	40.36
Chile	CHL	34.70	33.51	31.75	29.32	26.17	28.20	29.52	27.99	28.82	27.59	28.72	30.71	33.91	34.57
China	CHN	16.64	19.13	20.91	22.48	23.79	25.33	23.90	21.02	23.10	21.97	22.31	25.84	25.79	28.86
Colombia	COL	17.63	20.66	21.27	17.98	17.17	12.17	12.69	13.10	12.75	12.94	15.89	18.00	17.49	17.04
Croatia	HRV	..	..	..	..	56.23	47.45	36.41	38.75	40.16	39.25	39.92	44.72	47.09	46.58
Czech Republic	CZE	..	..	..	..	55.79	51.16	53.69	52.26	55.53	58.66	60.20	69.51	71.20	65.34
Denmark	DNK	36.19	37.19	38.78	37.80	36.23	36.82	36.67	37.00	37.45	37.23	40.47	47.02	47.73	48.69
Estonia	EST	..	..	..	..	..	45.74	56.28	72.98	91.68	88.17	85.29	103.56	102.44	97.12
Finland	FIN	23.59	22.78	21.96	26.27	32.27	35.12	36.99	37.76	39.27	39.09	37.91	43.19	40.52	38.93
France	FRA	24.18	24.01	24.23	24.23	24.05	24.11	24.73	25.00	27.16	27.91	28.24	31.28	30.77	29.20
Germany	DEU	29.64	27.98	25.77	24.18	22.31	23.24	24.35	25.35	28.03	29.14	29.79	34.02	35.69	35.92
Greece	GRC	18.12	17.39	17.51	18.18	17.75	18.51	17.55	16.85	16.91	..	22.99	27.42	25.26	22.96
Hungary	HUN	37.47	38.36	37.54	37.34	30.26	33.13	40.07	47.63	54.33	60.96	63.63	73.13	72.99	63.83
India	IND	6.81	7.13	8.47	10.03	9.72	9.62	10.52	10.45	10.72	10.75	11.16	13.32	13.34	14.49
Indonesia	IDN	23.73	24.64	24.90	26.88	25.75	25.31	25.10	24.74	27.90	55.68	37.96	44.12	42.50	36.79
Ireland	IRL	61.39	57.06	57.97	59.93	64.77	69.65	74.39	73.62	74.17	93.44	91.30	98.61	102.71	95.76
Italy	ITA	19.71	19.83	18.51	19.14	22.22	23.82	26.90	25.70	26.26	26.12	24.89	27.68	27.38	26.21
Japan	JPN	10.59	10.79	10.29	10.19	9.45	9.43	9.58	10.17	11.34	11.41	10.67	11.49	11.27	12.07
Korea	KOR	32.10	29.36	27.64	27.67	27.39	27.87	30.07	29.33	33.87	49.45	41.82	43.70	42.19	39.67
Latvia	LVA	..	..	..	..	..	30.05	41.35	50.05	47.89	47.83	41.13	42.77	41.99	41.76
Lithuania	LTU	..	..	..	..	..	40.35	49.53	52.53	50.91	44.75	38.26	43.06	47.78	50.81
Malawi	MWI	18.71	24.12	23.03	23.59	16.90	31.15	30.04	21.28	22.73	26.63	27.74	24.21	28.97	27.74
Malaysia	MYS	71.77	75.57	78.52	77.23	79.81	91.30	96.02	92.51	94.14	117.35	121.67	124.39	116.20	113.91
Malta	MLT	76.55	80.04	80.54	87.56	91.54	93.44	90.57	83.40	81.74	85.20	87.23	98.88	84.19	81.66
Mexico	MEX	18.66	18.24	16.09	14.95	14.93	16.87	31.13	32.05	30.18	30.52	30.72	30.96	27.60	27.23
Morocco	MAR	21.18	23.78	20.73	20.88	21.83	24.51	26.98	25.41	27.62	27.11	28.83	30.83	31.94	33.33
Mozambique	MOZ	8.66	9.30	12.63	16.40	15.75	15.98	17.74	16.55	14.75	13.32	14.00	18.07	26.39	..
Netherlands	NLD	55.61	54.52	54.92	53.05	54.44	57.81	59.69	61.97	67.84	66.74	67.07	76.15	73.95	71.45
New Zealand	NZL	26.26	27.08	28.84	30.60	30.20	30.52	29.60	28.48	27.90	29.18	30.04	34.82	35.78	33.18
Peru	PER	20.62	15.00	17.10	11.73	12.20	12.25	12.34	12.94	14.04	13.07	14.73	15.94	15.73	16.14
Philippines	PHL	24.48	24.86	26.66	27.03	28.91	31.29	36.18	40.19	48.58	56.57	54.34	58.53	50.13	50.45
Poland	POL	..	29.67	22.87	22.84	21.28	23.59	30.27	26.10	23.31	24.61	23.05	26.71	26.01	26.98
Portugal	PRT	30.01	30.01	26.50	24.39	25.74	27.29	28.87	29.05	30.01	29.85	28.81	30.92	30.25	29.05
Russian Federation	RUS	..	..	..	..	..	19.23	23.17	26.01	25.29	32.20	43.25	44.33	36.89	34.72
Singapore	SGP	181.89	178.35	169.68	162.23	160.40	171.43	177.04	170.86	163.53	160.65	170.99	180.07	176.07	177.76
Slovak Republic	SVK	..	..	..	..	56.00	58.74	57.24	53.11	55.93	58.96	59.84	71.52	..	..
Slovenia	SVN	..	..	..	63.08	58.95	60.06	55.17	55.30	57.12	56.52	52.16	58.53	59.59	53.55
Spain	ESP	17.48	16.31	16.22	16.31	18.97	21.85	23.55	24.76	25.79	27.38	26.08	29.99	30.04	27.73
Sri Lanka	LKA	26.82	29.07	27.93	31.55	33.65	33.61	35.31	34.83	36.38	36.10	35.32	38.92	38.65	35.91
Sweden	SWE	31.48	29.79	28.12	28.23	32.33	38.28	39.84	38.79	41.99	42.77	43.11	46.76	46.42	43.53
Switzerland	CHE	37.26	35.90	34.64	35.32	35.48	35.31	34.69	35.85	39.35	39.95	41.60	45.56	43.75	43.30
Tanzania	TZA	10.90	10.85	9.76	12.74	17.87	20.62	23.75	21.34	15.92	13.40	12.96	13.64	14.92	15.82
Thailand	THA	35.18	34.44	36.17	37.38	38.32	39.23	42.35	39.85	52.00	58.35	59.65	68.70	68.01	66.27
Turkey	TUR	16.71	13.86	14.43	15.08	14.38	22.20	21.32	20.16	24.32	25.40	23.56	24.09	31.96	26.84
Uganda	UGA	..	..	6.65	6.18	8.46	11.84	9.80	12.10	11.48	10.36	11.85	11.29	11.79	11.58
United Kingdom	GBR	23.40	24.13	23.08	23.45	25.00	26.13	27.71	28.97	28.31	26.62	26.33	27.98	26.89	25.73
United States	USA	8.79	9.16	9.61	9.69	9.59	9.92	10.67	10.85	11.15	10.55	10.34	10.78	9.94	9.31
Uruguay	URY	23.39	23.15	19.64	19.42	18.90	19.73	18.64	18.70	19.02	18.47	16.38	17.17	16.93	21.54
Venezuela	VEN	32.60	38.32	30.59	25.36	26.53	30.05	25.88	34.80	25.69	19.29	20.72	27.10	22.94	29.53
Zambia	ZMB	35.74	42.71	34.02	..	..	..	..	..	26.26	34.96	37.26	24.08	..	..

Source: World Bank (2004)

Table 3: Openness based on the IR measure of 56 countries, 1989-2002, % of current GDP

Country name	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	8.78	4.92	6.35	8.82	9.70	11.02	10.49	11.52	13.34	13.49	11.97	11.99	10.56	13.08
Australia	18.98	17.86	17.29	18.30	19.30	19.88	20.93	20.16	20.24	21.93	21.46	23.04	21.83	22.08
Austria	39.32	39.09	39.10	37.82	36.74	38.04	39.89	42.22	45.73	45.85	48.02	54.05	56.22	55.08
Bangladesh	15.70	13.85	12.81	13.79	14.39	16.16	20.27	18.89	19.09	18.44	19.60	20.97	20.92	19.55
Belgium	75.65	74.00	73.26	68.92	68.31	71.74	71.34	73.88	78.88	80.91	85.60	100.70	101.87	..
Brazil	5.57	6.29	7.21	7.61	8.41	8.39	9.51	8.92	9.83	9.69	12.26	12.50	14.79	13.99
Canada	26.26	26.21	26.22	27.90	30.81	33.66	34.56	34.81	38.00	40.15	40.03	40.80	38.86	37.64
Chile	32.85	32.05	29.44	30.13	30.87	28.81	29.78	31.04	31.35	33.07	28.02	30.58	34.13	34.09
China	18.31	16.19	17.99	21.48	26.77	24.29	22.36	19.77	18.89	17.59	19.87	24.16	24.42	26.94
Colombia	16.46	18.05	16.15	17.23	21.65	17.72	18.07	17.53	17.81	18.17	16.24	17.74	19.83	19.71
Croatia	..	..	..	..	52.83	44.02	46.99	47.56	55.88	47.30	49.14	50.86	54.64	58.39
Czech Republic	..	..	..	..	53.23	53.50	57.58	58.70	61.15	59.66	61.73	73.03	73.95	67.86
Denmark	33.82	32.54	33.26	31.54	30.04	32.08	33.18	32.74	34.67	36.36	36.96	41.85	41.97	43.08
Estonia	..	..	..	..	..	50.10	61.73	85.95	110.08	103.74	94.70	115.20	112.33	111.56
Finland	26.35	25.17	23.74	26.33	28.38	30.39	30.10	31.37	32.38	31.50	30.84	35.33	33.59	31.73
France	24.22	24.15	24.10	23.10	22.33	22.37	22.76	23.20	24.72	25.79	26.29	30.56	29.84	27.75
Germany	26.19	26.08	27.07	25.34	22.69	23.52	24.29	24.88	27.29	28.26	29.33	34.13	34.13	32.41
Greece	27.06	26.83	27.19	26.69	26.95	24.88	25.43	25.76	25.63	..	32.77	38.59	33.63	31.32
Hungary	35.90	38.00	39.73	36.59	38.94	42.11	42.69	48.76	55.09	64.15	67.98	79.31	76.34	67.87
India	8.99	9.32	9.82	12.37	10.64	10.80	12.61	12.69	13.11	13.82	14.37	14.83	13.91	14.72
Indonesia	21.38	24.21	25.19	25.29	23.99	24.37	26.62	25.38	26.84	40.86	25.21	31.73	32.07	27.82
Ireland	57.67	54.63	55.34	55.08	55.53	62.07	65.53	65.20	66.11	84.07	77.39	83.61	83.16	76.00
Italy	21.20	20.74	19.57	19.98	19.80	21.17	23.75	21.49	23.05	23.47	23.47	27.36	26.55	25.71
Japan	9.67	10.46	9.27	8.56	7.71	7.90	8.65	10.18	10.69	9.92	9.46	10.41	11.01	11.12
Korea	31.63	31.59	31.64	30.22	28.49	29.86	32.78	34.45	36.52	37.03	36.15	41.82	41.07	39.25
Latvia	..	..	..	..	..	26.57	41.70	58.88	59.55	64.22	53.71	54.51	55.42	56.49
Lithuania	..	..	..	..	..	44.88	63.73	65.87	67.81	61.56	52.39	54.18	58.53	62.47
Malawi	46.16	44.82	48.06	59.68	38.93	54.58	43.82	33.30	39.47	38.99	47.40	40.95	40.08	47.12
Malaysia	69.76	78.80	87.62	79.71	82.32	96.00	104.13	94.99	96.94	98.79	100.57	109.51	102.68	101.26
Malta	98.66	106.34	105.45	105.50	112.11	114.47	108.94	103.92	95.18	95.63	97.79	115.07	95.03	91.32
Mexico	19.76	20.40	20.03	21.09	19.89	22.70	29.68	31.20	31.63	34.11	33.32	33.73	30.67	29.82
Morocco	27.38	30.44	28.31	29.88	29.03	31.23	34.41	30.02	32.32	32.89	32.51	39.05	37.11	37.40
Mozambique	43.39	44.01	46.42	59.40	61.88	61.65	45.61	37.95	31.44	30.62	38.45	41.93	46.22	..
Netherlands	54.26	52.65	52.67	51.67	50.17	54.60	55.11	57.09	62.43	61.58	63.83	72.50	68.71	66.16
New Zealand	27.76	29.23	27.89	31.44	29.74	30.77	30.58	29.27	29.33	31.26	33.58	36.18	34.70	33.77
Peru	14.87	14.07	16.68	14.66	15.87	15.76	17.45	17.81	18.30	18.51	18.51	17.94	17.65	17.50
Philippines	29.87	33.20	32.32	33.62	40.23	42.51	47.50	52.49	64.00	63.83	52.64	53.76	51.23	50.68
Poland	..	24.50	27.97	26.73	27.71	26.15	32.63	33.17	32.18	33.82	34.02	36.65	33.55	33.96
Portugal	39.46	40.68	37.35	34.90	34.15	35.74	36.31	37.08	38.92	40.07	40.55	43.74	41.58	37.07
Russian Federation	..	..	..	..	..	16.69	20.52	22.34	23.13	27.48	27.00	23.52	23.96	24.27
Singapore	189.37	189.20	175.40	166.37	167.16	167.27	175.11	168.22	163.00	147.39	163.12	174.46	166.61	164.66
Slovak Republic	..	..	..	..	60.54	53.79	55.21	63.88	65.28	69.87	63.90	73.85	..	..
Slovenia	..	..	..	57.25	59.50	58.74	58.26	57.74	59.05	59.28	57.10	63.55	61.35	57.47
Spain	21.03	20.18	20.00	20.01	19.05	21.18	23.11	23.69	24.91	27.89	27.40	33.32	32.43	29.49
Sri Lanka	39.15	41.21	42.17	44.31	46.95	49.41	49.73	47.56	47.25	45.84	46.94	53.79	44.87	42.65
Sweden	31.83	29.92	27.15	27.06	29.10	33.88	34.18	32.68	35.58	37.55	37.55	42.05	41.04	37.41
Switzerland	37.54	35.37	33.31	31.83	30.50	30.84	30.95	32.06	35.17	36.28	37.00	41.39	40.67	37.65
Tanzania	28.55	30.95	36.92	40.23	49.39	42.99	45.84	34.99	26.67	27.86	26.43	23.57	25.02	24.91
Thailand	41.77	45.88	46.27	45.76	46.72	48.23	53.25	50.42	56.99	47.39	52.21	63.97	66.79	64.06
Turkey	16.83	16.66	15.87	16.48	18.28	20.60	23.83	27.61	30.23	27.98	26.98	31.63	32.41	30.48
Uganda	9.67	11.22	13.19	26.35	25.71	32.80	28.20	30.83	31.73	32.87	29.48	33.93	37.23	38.60
United Kingdom	28.03	27.05	24.66	25.45	26.83	27.86	29.01	29.89	28.78	28.43	28.53	30.77	29.89	28.48
United States	10.63	10.69	10.25	10.48	10.80	11.55	12.24	12.37	12.71	12.71	13.48	14.93	13.73	13.54
Uruguay	18.40	18.34	18.11	19.76	21.53	22.06	20.08	20.31	20.99	21.01	19.44	20.86	20.51	21.26
Venezuela	22.20	20.02	26.88	29.97	28.08	23.49	22.29	20.57	20.72	20.49	17.50	16.86	18.02	16.50
Zambia	32.89	48.35	34.65	..	..	..	..	..	28.15	42.69	35.76	40.79	..	..

Source: World Bank (2004)

Table 4: Openness based on the EDR measure of 56 countries, 1989-2002, % of current GDP

Country name	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	[a]14.42	[a]10.07	[a]7.15	[a]6.20	[a]6.32	[a]6.78	[a]8.87	9.68	9.71	9.54	9.14	10.19	10.85	26.03
Australia	[a]13.05	[a]14.03	[a]14.64	[a]15.07	[a]15.56	[a]15.43	[a]15.88	16.37	16.88	16.57	15.42	17.95	18.57	17.23
Austria	28.57	29.27	28.92	27.86	26.91	26.89	27.92	28.69	31.11	31.90	33.12	36.53	38.20	38.95
Bangladesh	4.58	5.20	5.41	6.42	7.33	..	8.55	8.06	9.40	9.62	..	..	10.53	..
Belgium	..	..	..	..	..	..	..	..	47.68	..	50.32	55.77	56.15	..
Brazil	[a]7.90	[a]7.08	[a]7.96	[a]9.47	[a]8.95	[a]8.17	[a]6.81	6.19	6.62	6.78	9.30	9.66	11.79	..
Canada	[a]19.09	[a]19.25	[a]18.85	[a]20.32	[a]22.23	[a]24.83	[a]27.57	28.41	28.20	29.08	30.29	32.31	31.28	..
Chile	[a]27.46	[a]26.41	[a]25.41	[a]23.41	[a]20.70	[a]22.80	[a]23.80	22.29	22.98	21.75	23.37	24.40	26.54	..
China	[a]13.88	[a]16.37	[a]17.52	[a]18.30	[a]18.43	[a]20.27	[a]19.54	17.26	19.24	18.47	18.31	20.43	20.36	22.46
Colombia	[a]17.47	[a]20.44	[a]21.05	[a]17.79	[a]16.95	[a]12.04	[a]12.55	11.94	11.53	11.68	14.63	16.51	15.81	15.43
Croatia	..	..	..	..	42.48	36.95	26.93	29.35	29.92	30.22	30.18	33.42	34.96	34.40
Czech Republic	..	..	..	..	38.04	34.73	35.18	33.94	35.58	38.41	39.04	42.65	43.62	40.82
Denmark	[a]26.77	[a]27.94	[a]29.14	[a]28.74	[a]27.68	[a]27.73	[a]27.42	27.86	27.77	27.19	29.83	34.15	34.68	35.23
Estonia	..	..	..	..	..	..	37.75	44.37	51.97	51.38	51.51	59.68	59.41	55.89
Finland	[a]17.78	[a]17.27	[a]16.90	[a]20.10	[a]24.94	[a]26.97	[a]28.80	27.92	29.04	29.20	28.28	31.60	29.73	28.81
France	19.81	19.69	19.90	20.10	20.05	20.02	20.51	20.61	22.22	22.79	22.95	24.59	24.33	23.40
Germany	[a]24.27	[a]22.85	[a]20.75	[a]19.68	[a]18.44	[a]19.18	[a]20.03	20.51	22.41	23.27	23.63	26.16	27.65	28.20
Greece	15.72	15.11	15.19	15.82	15.43	16.34	15.43	14.78	14.84	..	19.85	22.94	21.55	..
Hungary	26.60	26.91	25.42	26.14	19.88	21.50	26.94	31.26	34.56	37.20	38.17	42.16	42.84	38.37
India	[a]6.35	[a]6.60	[a]7.81	[a]9.08	[a]8.92	[a]8.85	[a]9.56	9.15	9.38	9.40	9.65	11.44	11.62	12.56
Indonesia	[a]20.69	[a]20.92	[a]20.80	[a]22.55	[a]21.74	[a]21.32	[a]20.77	20.31	22.95	44.93	32.33	36.22	34.72	30.47
Ireland	37.60	35.27	35.87	37.81	41.58	43.47	46.61	46.66	47.20	58.70	58.56	62.03	..	..
Italy	15.21	15.45	14.56	15.10	17.70	18.74	20.80	20.28	20.42	20.25	19.16	20.49	20.44	19.68
Japan	[a]9.59	[a]9.69	[a]9.35	[a]9.33	[a]8.72	[a]8.69	[a]8.76	9.08	10.09	10.29	9.61	10.18	9.91	..
Korea	[a]22.44	[a]20.19	[a]18.89	[a]19.25	[a]19.46	[a]19.65	[a]20.83	20.47	23.55	36.30	30.12	29.87	28.98	27.49
Latvia	..	..	..	..	..	23.62	29.61	32.78	31.35	30.51	27.73	28.87	27.81	27.23
Lithuania	..	..	..	..	..	26.41	30.27	32.33	30.83	27.80	24.55	27.17	30.14	..
Malawi	15.09	19.73	18.80	..	..	23.76	24.68	18.21	18.94	22.44	22.41	20.08	24.03	..
Malaysia	..	..	[a]46.50	[a]47.68	[a]48.83	[a]53.01	[a]53.78	57.71	58.26	75.46	78.37	77.17	73.37	71.87
Malta	46.60	47.88	48.42	54.18	55.23	..	..	50.94	51.81	..	55.63	..	53.02	..
Mexico	[a]15.62	[a]15.28	[a]13.21	[a]11.65	[a]11.67	[a]12.82	[a]23.09	24.09	22.27	21.79	22.13	22.28	20.08	20.02
Morocco	[a]17.52	[a]19.23	[a]16.98	[a]17.06	[a]18.02	[a]19.88	[a]21.65	20.59	21.99	21.60	22.97	23.38	24.73	25.89
Mozambique	..	..	..	..	..	11.84	14.07	13.55	12.55	..	..	..	21.61	..
Netherlands	34.41	34.08	34.65	33.38	34.94	36.29	37.81	38.98	42.27	41.94	41.34	45.50	44.95	43.78
New Zealand	[a]22.03	[a]22.44	[a]24.14	[a]25.16	[a]25.11	[a]25.21	[a]24.39	23.68	23.09	23.82	24.17	27.74	28.88	26.80
Peru	18.88	13.70	15.37	10.58	10.91	10.91	10.80	11.34	12.28	11.40	12.88	13.99	13.87	14.27
Philippines	[a]17.42	[a]16.93	[a]18.53	[a]18.69	[a]18.94	[a]20.80	[a]23.97	24.01	28.49	36.03	37.06	39.73	32.87	33.12
Poland	..	24.46	17.96	18.09	16.70	19.01	23.72	20.09	17.93	18.81	17.41	19.84	19.68	20.35
Portugal	22.91	22.67	20.35	18.98	20.36	21.40	22.61	22.57	23.06	22.88	21.87	22.81	22.63	..
Russian Federation	..	..	..	..	..	..	..	24.10	23.34	29.34	40.18	41.60	34.56	..
Singapore	64.49	..	61.79	60.41	59.43	67.86	68.30	66.79	64.13	70.70	70.06	70.59	70.46	72.23
Slovak Republic	..	..	..	..	..	40.25	38.99	33.62	35.22	36.50	38.73	44.70	..	..
Slovenia	..	..	..	41.12	37.04	38.21	34.52	34.74	35.74	35.37	32.53	35.36	36.92	33.30
Spain	14.06	13.16	13.11	13.20	15.60	17.73	18.83	19.74	20.42	21.27	20.30	22.10	22.42	21.20
Sri Lanka	[a]18.39	[a]19.44	[a]18.19	[a]20.58	[a]21.63	[a]21.35	..	..	24.27	..	23.40	..	26.09	23.81
Sweden	[a]23.46	[a]22.45	[a]21.65	[a]21.80	[a]24.76	[a]28.81	[a]30.16	28.03	30.03	30.29	30.56	32.04	32.16	30.74
Switzerland	28.25	27.49	26.76	27.66	28.12	27.94	27.37	28.13	30.47	30.89	32.18	34.51	33.12	..
Tanzania	..	..	..	..	..	..	..	..	13.91	11.45	11.29	11.92	12.99	..
Thailand	[a]30.67	[a]29.53	[a]31.05	[a]32.30	[a]32.99	[a]33.67	[a]35.77	27.16	34.78	42.19	41.65	44.94	43.56	..
Turkey	[a]14.19	[a]11.74	[a]12.39	[a]12.83	[a]12.07	[a]18.33	[a]17.19	15.93	19.12	20.45	18.79	18.48	24.61	20.72
Uganda	..	..	..	..	..	10.61	8.75	10.25	9.80	8.72	10.17	8.96	9.21	8.94
United Kingdom	[a]18.57	[a]19.35	[a]18.78	[a]19.03	[a]20.21	[a]21.09	[a]22.29	23.31	22.94	21.60	21.38	22.40	21.58	20.82
United States	[a]8.05	[a]8.39	[a]8.84	[a]8.90	[a]8.78	[a]9.05	[a]9.69	9.65	9.89	9.39	9.12	9.33	8.67	8.14
Uruguay	[a]20.45	[a]20.14	[a]17.01	[a]16.77	[a]16.17	[a]16.83	[a]16.10	16.33	16.50	16.01	14.28	14.74	14.62	18.63
Venezuela	28.88	34.87	26.57	21.23	22.52	26.43	22.61	31.56	22.72	16.43	18.52	24.93	20.64	27.12
Zambia	..	..	..	..	..	..	..	..	21.50	27.01	30.47	16.77	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

Table 5: Openness based on the IFR measure of 56 countries, 1989-2002, % of current GDP

Country name	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	[a]8.78	[a]4.92	[a]6.35	[a]8.81	[a]9.69	[a]11.02	[a]10.48	11.51	13.33	13.47	11.96	11.98	10.55	13.05
Australia	[a]18.94	[a]17.82	[a]17.26	[a]18.26	[a]19.26	[a]19.84	[a]20.88	20.11	20.18	21.87	21.40	22.97	21.76	22.02
Austria	39.23	38.99	39.01	37.73	36.66	37.95	39.80	42.12	45.62	45.73	47.88	53.88	56.04	54.90
Bangladesh	15.70	13.85	12.81	13.79	14.39	..	20.27	18.88	19.09	18.44	..	..	20.91	..
Belgium	..	..	..	..	..	..	..	..	78.36	..	85.00	99.89	101.04	..
Brazil	[a]5.56	[a]6.28	[a]7.19	[a]7.59	[a]8.39	[a]8.38	[a]9.50	8.90	9.81	9.67	12.23	12.46	14.74	..
Canada	[a]26.11	[a]26.07	[a]26.09	[a]27.74	[a]30.62	[a]33.42	[a]34.28	34.48	37.63	39.75	39.61	40.33	38.44	..
Chile	[a]32.83	[a]32.04	[a]29.42	[a]30.12	[a]30.86	[a]28.80	[a]29.76	31.01	31.33	33.05	28.01	30.56	34.10	..
China	[a]18.23	[a]16.11	[a]17.89	[a]21.35	[a]26.61	[a]24.14	[a]22.23	19.64	18.76	17.47	19.73	23.96	24.22	26.69
Colombia	[a]16.46	[a]18.04	[a]16.14	[a]17.22	[a]21.64	[a]17.72	[a]18.07	17.52	17.80	18.16	16.23	17.72	19.81	19.70
Croatia	..	..	..	..	52.82	44.01	46.98	47.55	55.87	47.29	49.13	50.85	54.63	58.38
Czech Republic	..	..	..	..	53.18	53.45	57.52	58.65	61.09	59.60	61.66	72.93	73.85	67.78
Denmark	[a]33.76	[a]32.48	[a]33.20	[a]31.48	[a]29.98	[a]32.02	[a]33.12	32.68	34.61	36.30	36.89	41.75	41.88	42.99
Estonia	..	..	..	..	..	..	61.72	85.94	110.07	103.73	94.69	115.18	112.31	111.55
Finland	[a]26.32	[a]25.15	[a]23.72	[a]26.30	[a]28.34	[a]30.35	[a]30.06	31.32	32.33	31.45	30.79	35.27	33.53	31.68
France	23.97	23.90	23.86	22.87	22.11	22.14	22.51	22.94	24.42	25.46	25.95	30.12	29.42	27.39
Germany	[a]25.59	[a]25.51	[a]26.53	[a]24.87	[a]22.31	[a]23.11	[a]23.84	24.45	26.76	27.68	28.73	33.33	33.29	31.61
Greece	27.05	26.82	27.17	26.67	26.94	24.87	25.42	25.74	25.62	..	32.74	38.55	33.60	..
Hungary	35.88	37.98	39.71	36.57	38.93	42.10	42.67	48.73	55.05	64.09	67.92	79.22	76.26	67.81
India	[a]8.98	[a]9.31	[a]9.81	[a]12.36	[a]10.64	[a]10.79	[a]12.60	12.67	13.09	13.81	14.36	14.81	13.89	14.70
Indonesia	[a]21.34	[a]24.16	[a]25.13	[a]25.23	[a]23.94	[a]24.32	[a]26.57	25.33	26.78	40.70	25.15	31.63	31.98	27.75
Ireland	57.60	54.57	55.27	55.02	55.46	61.99	65.43	65.11	66.01	83.92	77.25	83.45	..	..
Italy	21.05	20.59	19.44	19.85	19.65	21.00	23.53	21.30	22.83	23.26	23.26	27.08	26.29	25.47
Japan	[a]9.51	[a]10.29	[a]9.12	[a]8.42	[a]7.60	[a]7.78	[a]8.52	10.04	10.53	9.77	9.32	10.24	10.84	..
Korea	[a]31.49	[a]31.46	[a]31.51	[a]30.10	[a]28.38	[a]29.74	[a]32.65	34.30	36.34	36.77	35.93	41.55	40.83	39.02
Latvia	..	..	..	..	..	26.57	41.69	58.87	59.54	64.22	53.71	54.50	55.42	56.48
Lithuania	..	..	..	..	..	44.87	63.72	65.87	67.80	61.55	52.39	54.17	58.52	..
Malawi	46.16	44.82	48.06	..	..	54.58	43.82	33.30	39.47	38.99	47.40	40.95	40.08	..
Malaysia	..	..	[a]87.36	[a]79.48	[a]82.09	[a]95.70	[a]103.79	94.64	96.58	98.34	100.09	108.95	102.21	100.81
Malta	98.65	106.33	105.44	105.49	112.10	..	..	103.91	95.18	..	97.78	..	95.03	..
Mexico	[a]19.72	[a]20.36	[a]20.00	[a]21.06	[a]19.86	[a]22.66	[a]29.58	31.04	31.48	33.95	33.16	33.56	30.54	29.69
Morocco	[a]27.38	[a]30.43	[a]28.30	[a]29.87	[a]29.02	[a]31.23	[a]34.40	30.02	32.31	32.88	32.50	39.03	37.10	37.39
Mozambique	..	..	..	..	..	61.65	45.61	37.95	31.44	..	..	..	46.22	..
Netherlands	53.92	52.31	52.34	51.37	49.86	54.24	54.73	56.68	61.94	61.10	63.33	71.84	68.13	65.65
New Zealand	[a]27.75	[a]29.22	[a]27.87	[a]31.42	[a]29.73	[a]30.75	[a]30.57	29.26	29.31	31.25	33.56	36.15	34.68	33.75
Peru	14.87	14.07	16.67	14.66	15.87	15.76	17.45	17.80	18.30	18.51	18.50	17.93	17.65	17.49
Philippines	[a]29.86	[a]33.19	[a]32.31	[a]33.60	[a]40.20	[a]42.48	[a]47.47	52.45	63.93	63.74	52.57	53.68	51.16	50.61
Poland	..	24.47	27.94	26.71	27.69	26.13	32.59	33.13	32.15	33.78	33.98	36.61	33.52	33.92
Portugal	39.42	40.64	37.32	34.87	34.13	35.71	36.28	37.05	38.88	40.03	40.52	43.70	41.54	..
Russian Federation	..	..	..	..	..	..	..	22.22	23.01	27.32	26.78	23.31	23.78	..
Singapore	188.34	..	174.51	165.58	166.37	166.42	174.22	167.39	162.24	146.70	162.33	173.55	165.80	163.85
Slovak Republic	..	..	..	..	..	53.78	55.19	63.86	65.26	69.85	63.87	73.82	..	..
Slovenia	..	..	..	57.23	59.48	58.72	58.24	57.72	59.03	59.26	57.08	63.52	61.33	57.45
Spain	20.97	20.13	19.95	19.96	19.00	21.11	23.02	23.60	24.81	27.77	27.29	33.16	32.28	29.37
Sri Lanka	[a]39.15	[a]41.21	[a]42.16	[a]44.30	[a]46.95	[a]49.40	..	..	47.24	..	46.93	..	44.87	42.64
Sweden	[a]31.75	[a]29.85	[a]27.09	[a]27.00	[a]29.03	[a]33.78	[a]34.08	32.58	35.47	37.43	37.43	41.90	40.90	37.29
Switzerland	37.41	35.26	33.21	31.74	30.41	30.75	30.86	31.97	35.05	36.16	36.87	41.23	40.52	..
Tanzania	..	..	..	..	..	..	..	..	26.67	27.85	26.43	23.57	25.02	..
Thailand	[a]41.70	[a]45.81	[a]46.19	[a]45.68	[a]46.63	[a]48.14	[a]53.14	50.32	56.85	47.26	52.06	63.75	66.57	..
Turkey	[a]16.81	[a]16.65	[a]15.86	[a]16.47	[a]18.26	[a]20.58	[a]23.81	27.57	30.19	27.95	26.94	31.59	32.35	30.43
Uganda	..	..	..	..	..	32.80	28.20	30.83	31.73	32.87	29.48	33.93	37.23	38.60
United Kingdom	[a]27.80	[a]26.82	[a]24.46	[a]25.25	[a]26.60	[a]27.61	[a]28.74	29.51	28.43	28.11	28.21	30.40	29.55	28.16
United States	[a]10.37	[a]10.43	[a]9.99	[a]10.21	[a]10.53	[a]11.25	[a]11.88	11.95	12.25	12.27	13.03	14.42	13.30	13.15
Uruguay	[a]18.40	[a]18.34	[a]18.11	[a]19.76	[a]21.52	[a]22.05	[a]20.08	20.30	20.99	21.01	19.44	20.86	20.51	21.26
Venezuela	22.17	19.99	26.84	29.93	28.04	23.46	22.27	20.54	20.70	20.47	17.48	16.83	17.99	16.48
Zambia	..	..	..	..	..	..	..	..	28.15	42.68	35.76	40.79	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

4.3.2 Classifications of exchange rate arrangements

The classification of exchange rate regimes is carried out by means of two different approaches (see Bordo, 2003 and Bubula and Ötker-Robe, 2002). The first classifies exchange rate regimes *de jure*. A list of exchange rate arrangements, as in Section 2.3.1, is established and the countries are then classified by what policy makers of the countries say they will do. This approach is justified on the grounds that announcing a regime has vital credibility effects. The International Monetary Fund (IMF) with the annual reports on "Exchange Arrangements and Exchange Restrictions" and several authors like Ghosh et al. (2003) have taken this method.

The second approach classifies exchange rate arrangements *de facto*. It is assumed that for various reasons, such as 'fear of floating' and the lack of credibility, policy makers deviate from what they have said with what they actually do. This method tries to adjust for this problem, inferring a de facto classification system. Prominent contributions are from Levy-Yeyati and Sturzenegger (2001) and Calvo and Reinhart (2000).

We have chosen the widely accepted data base of Levy-Yeyati and Sturzenegger (2002) as the source of data for the exchange rate regimes of 172 countries between the years 1974 and 2000. Their data base groups exchange rate regimes in two different ways. The 5-way classification consists of 'inconclusive' (1), 'float' (2), 'dirty' (3), 'dirty/crawling peg' (4), and 'fix' (5), whereas the 3-way classification is made of 'float' (1), 'intermediate' (2) (which includes dirty and crawling pegs), and 'fix' (3).

4.4 Characterization of actual openness towards international trade

4.4.1 Methodology

The empirical analysis of the differences between the concept of traditional openness and actual openness tries to disclose whether indicating openness using value-added based openness indices rather than the traditional ones leads to *systematic effects* on the degree of openness towards international trade. After a first characterization of the alternative methods of measuring trade openness by means of a *visual analysis* of the degrees of openness of 53 countries for the year 2001, the visual analysis is complemented by a more sophisticated analysis of 682 observations of 56 countries' degrees of openness between the years 1989 and 2002. This begins with a *frequency distribution analysis* that highlights key characteristics of the outcomes of the traditional and actual openness indices by means of standard statistical meas-

ures. The countries' rank order of openness is accentuated by a *correlation analysis* using the Spearman measure. Finally, a *regression analysis* based on the ordinary least squares method estimates the elasticity of the degree of actual openness due to a change in the level of traditional openness.

4.4.2 Results and interpretation

The *visual analysis* of the results of the traditional and actual openness measures is based on 53 countries out of the 56 countries in the full sample for the year 2001. This is because no data was available for Ireland, Slovak Republic, and Zambia in the most recent year that had the most cross-country data available. On its left-hand side, Table 6 lists the degrees of openness calculated by the two measures of openness (the value-added based and traditional openness concept) on the export and import side of the countries. On the right-hand side, the rank order of the four openness indices is displayed. These rank orders begin with one for the country with the lowest degree of openness and increase in rank up until the most integrated economy.

Table 6: Actual and traditional openness to international trade for 53 countries, 2001

Percent of GDP, 2001	Export side		Import side		Rank order, 2001	Export side			Import side	
Country name	EDR	ER	IFR	IR	Country name	EDR	ER	Country name	IFR	IR
Argentina	10.8	11.5	10.5	10.6	United States	1	1	Argentina	1	1
Australia	18.6	21.6	21.8	21.8	Japan	3	2	Japan	2	2
Austria	38.2	55.1	56.0	56.2	Argentina	5	3	United States	3	3
Bangladesh	10.5	13.6	20.9	20.9	Uganda	2	4	India	4	4
Belgium	56.2	108.4	101.0	101.9	Brazil	7	5	Brazil	5	5
Brazil	11.8	13.3	14.7	14.8	India	6	6	Peru	6	6
Canada	31.3	42.8	38.4	38.9	Bangladesh	4	7	Venezuela	7	7
Chile	26.5	33.9	34.1	34.1	Tanzania	8	8	Colombia	8	8
China	20.4	25.8	24.2	24.4	Peru	9	9	Uruguay	9	9
Colombia	15.8	17.5	19.8	19.8	Uruguay	10	10	Bangladesh	10	10
Croatia	35.0	47.1	54.6	54.6	Colombia	11	11	Australia	11	11
Czech Republic	43.6	71.2	73.8	73.9	Australia	12	12	Russian Federation	12	12
Denmark	34.7	47.7	41.9	42.0	Venezuela	17	13	China	13	13
Estonia	59.4	102.4	112.3	112.3	Greece	18	14	Tanzania	14	14
Finland	29.7	40.5	33.5	33.6	China	15	15	Italy	15	15
France	24.3	30.8	29.4	29.8	Poland	13	16	France	16	16
Germany	27.6	35.7	33.3	34.1	Mozambique	20	17	United Kingdom	17	17
Greece	21.6	25.3	33.6	33.6	United Kingdom	19	18	Mexico	18	18
Hungary	42.8	73.0	76.3	76.3	Italy	16	19	Indonesia	19	19
India	11.6	13.3	13.9	13.9	Mexico	14	20	Turkey	21	20
Indonesia	34.7	42.5	32.0	32.1	Malawi	23	21	Spain	20	21
Italy	20.4	27.4	26.3	26.6	Spain	21	22	Poland	23	22
Japan	9.9	11.3	10.8	11.0	Portugal	22	23	Finland	24	23
Korea	29.0	42.2	40.8	41.1	France	24	24	Greece	25	24
Latvia	27.8	42.0	55.4	55.4	Morocco	26	25	Germany	22	25
Lithuania	30.1	47.8	58.5	58.5	Turkey	25	26	Chile	26	26
Malawi	24.0	29.0	40.1	40.1	Chile	28	27	New Zealand	27	27
Malaysia	73.4	116.2	102.2	102.7	Germany	29	28	Morocco	28	28
Malta	53.0	84.2	95.0	95.0	New Zealand	31	29	Uganda	29	29
Mexico	20.1	27.6	30.5	30.7	Russian Federation	39	30	Canada	30	30
Morocco	24.7	31.9	37.1	37.1	Sri Lanka	27	31	Malawi	31	31
Mozambique	21.6	26.4	46.2	46.2	Finland	33	32	Switzerland	32	32
Netherlands	45.0	73.9	68.1	68.7	Latvia	30	33	Sweden	34	33
New Zealand	28.9	35.8	34.7	34.7	Korea	32	34	Korea	33	34
Peru	13.9	15.7	17.6	17.7	Indonesia	41	35	Portugal	35	35
Philippines	32.9	50.1	51.2	51.2	Canada	35	36	Denmark	36	36
Poland	19.7	26.0	33.5	33.6	Switzerland	38	37	Sri Lanka	37	37
Portugal	22.6	30.2	41.5	41.6	Sweden	36	38	Mozambique	38	38
Russian Federation	34.6	36.9	23.8	24.0	Croatia	42	39	Philippines	39	39
Singapore	70.5	176.1	165.8	166.6	Denmark	40	40	Croatia	40	40
Slovenia	36.9	59.6	61.3	61.3	Lithuania	34	41	Latvia	41	41
Spain	22.4	30.0	32.3	32.4	Philippines	37	42	Austria	42	42
Sri Lanka	26.1	38.7	44.9	44.9	Austria	44	43	Lithuania	43	43
Sweden	32.2	46.4	40.9	41.0	Slovenia	43	44	Slovenia	44	44
Switzerland	33.1	43.7	40.5	40.7	Thailand	46	45	Thailand	45	45
Tanzania	13.0	14.9	25.0	25.0	Czech Republic	47	46	Netherlands	46	46
Thailand	43.6	68.0	66.6	66.8	Hungary	45	47	Czech Republic	47	47
Turkey	24.6	32.0	32.3	32.4	Netherlands	48	48	Hungary	48	48
Uganda	9.2	11.8	37.2	37.2	Malta	49	49	Malta	49	49
United Kingdom	21.6	26.9	29.5	29.9	Estonia	51	50	Belgium	50	50
United States	8.7	9.9	13.3	13.7	Belgium	50	51	Malaysia	51	51
Uruguay	14.6	16.9	20.5	20.5	Malaysia	53	52	Estonia	52	52
Venezuela	20.6	22.9	18.0	18.0	Singapore	52	53	Singapore	53	53

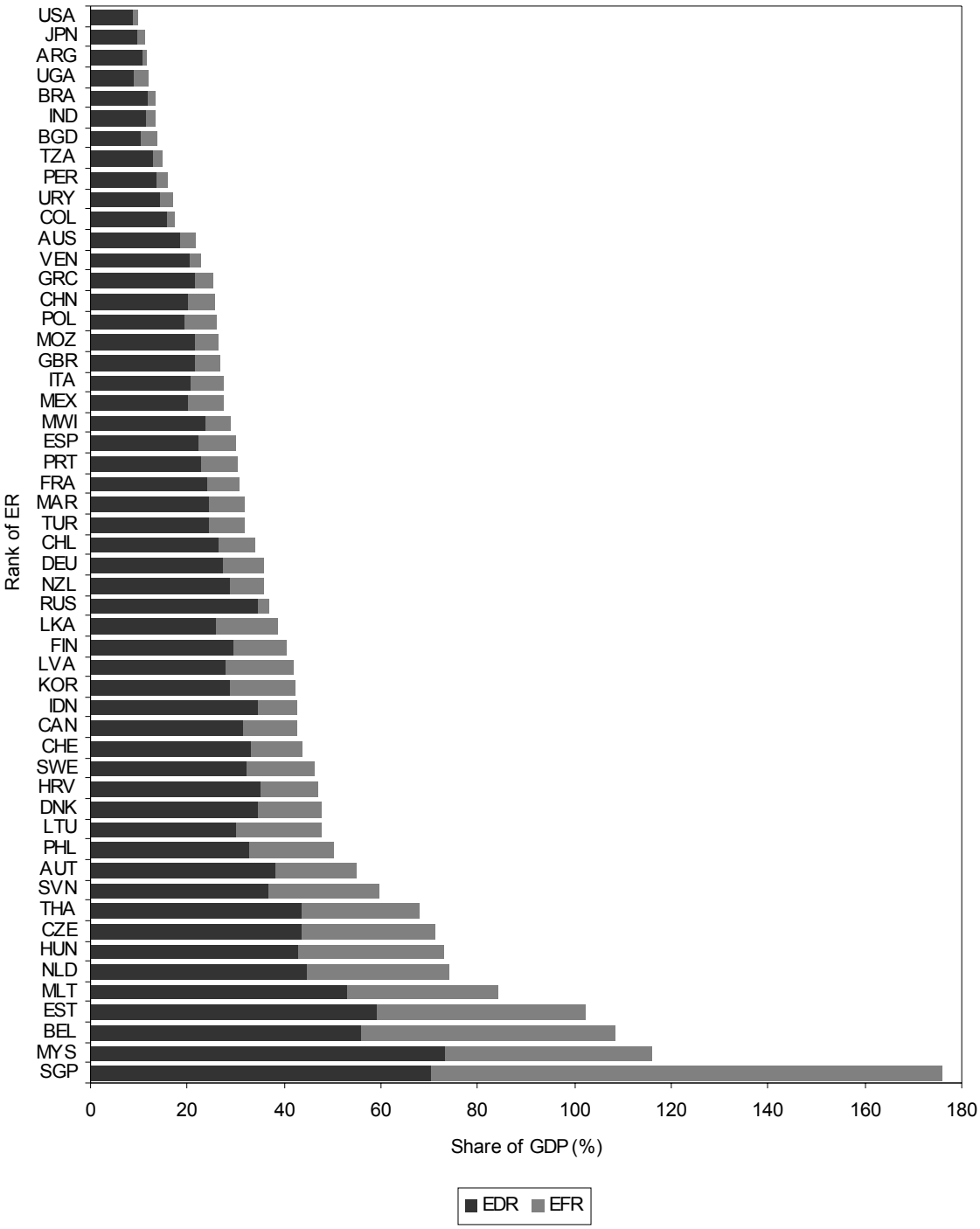
Source: own calculation based on GTAP (2003) and World Bank (2004)

A degree of openness of zero percent of the gross domestic product indicates a closed economy which finds itself in a status of complete autarky. The higher the empirical value is, the more significant the international trading partners for the country due to trade. The figures of Table 6 are to be interpreted as follows: For example, Argentina's role within the world economy is expressed in the degrees of openness based on the two openness concepts. The value of the countries exports (imports) account for 11.5 (10.6) percent of all of the domestically produced commodities (ER and IR). Argentina's rank order reveals that it is considerably closed towards exports (imports) with a rank of 3 (1). A substitution of the measurement of trade openness based on the traditional openness concept to the value-added based approach leads to degrees of openness which reflect the income effects of international trade due to the production structures in Argentina and abroad.

Openness on the export side declines to 10.8 percent (-0.7 percentage points) of the gross domestic product because the production process of exports involves domestic factors of production and imported intermediate commodities (EDR). Imported intermediates transfer income abroad based on their purchase. Since Argentina employs relatively more domestic factors of production in industries to create exports than other countries do, its rank increases to 5 (from 3). This inconspicuous result is very interesting. The innovative actual openness concept gives a totally new insight into the *production structures* of economies. It is now possible to quantify the effects of the outcomes of the interdependences of industries within an economy. A country that consists of firms which mainly import intermediate or final commodities for the purpose of the re-export of commodities creates a small fraction of income in the domestic economy and transfers most income to its foreign trading partners. This is not the case in Argentina since its position in the rank order even rises. Argentina mainly exports domestic resources. The type of production in Argentina also justifies why the openness on the import side declines to only 10.5 (-0.1 percentage points) of the national income and why there is no change (1) in the rank (EDR). Only rarely does Argentina import commodities that it exported as intermediate commodities and which were processed by foreign trading partners.

Figures 4 and 5 illustrate the empirical realizations of the degrees of openness of the 53 countries in the year 2001, listed in Table 6, on the export side and import side, respectively. The horizontal axes arrange the countries in increasing order of their position within the rank order of the traditional openness measures. The vertical axes display the empirical outcomes of the traditional and actual openness concept, respectively.

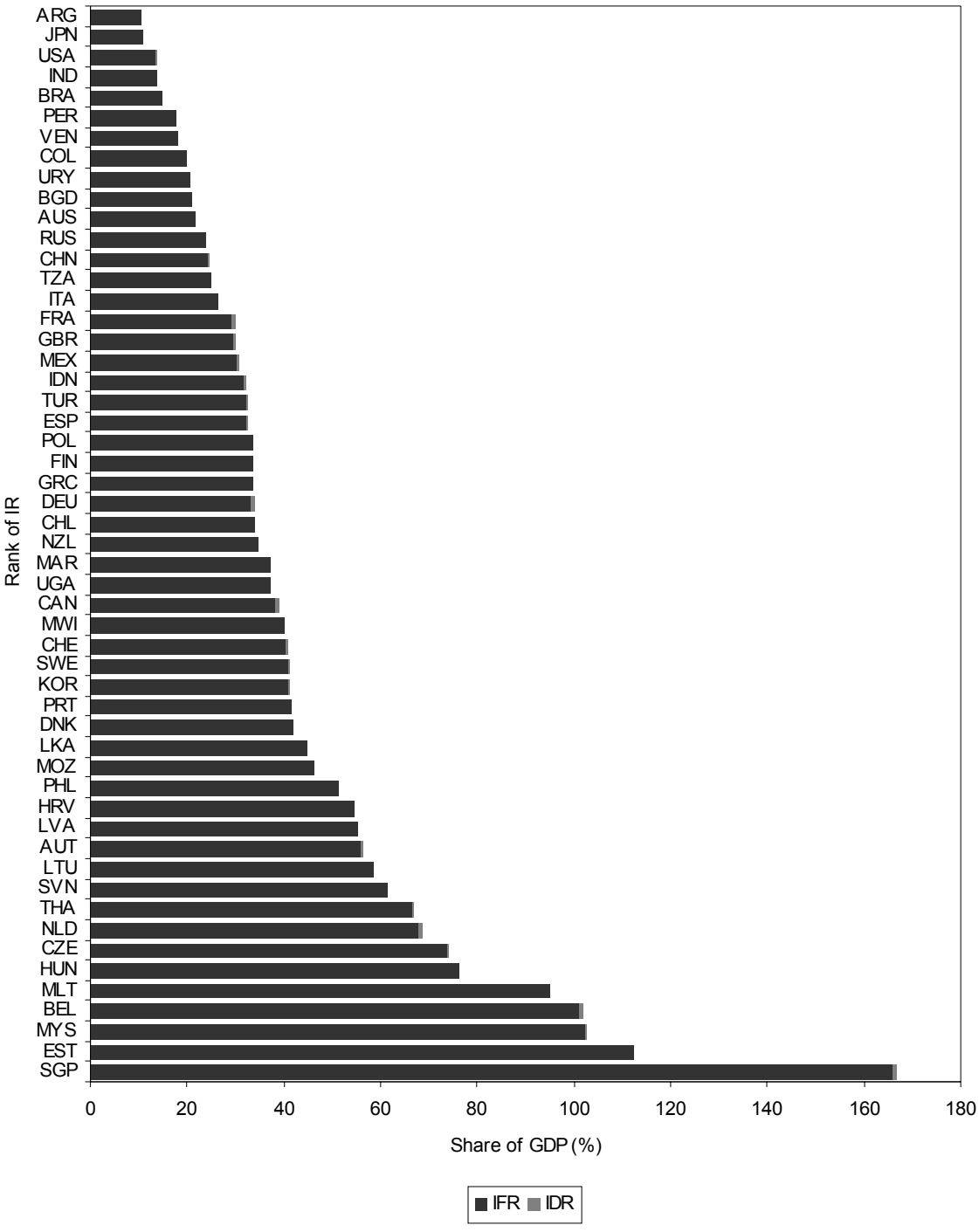
Figure 4: Actual and traditional openness on the export side for 53 countries, 2001



Source: own calculation based on GTAP (2003) and World Bank (2004)

The first and most striking result of the diagram is that the degrees of openness towards international trade, measured by the actual openness concept (EDR), are in all cases lower than if they are calculated on the basis of the traditional IER measure. The EFR index indicates the proportion of income that is transferred abroad for the purchase of intermediate commodities, which are assembled in exports.

Figure 5: Actual and traditional openness on the import side for 53 countries, 2001

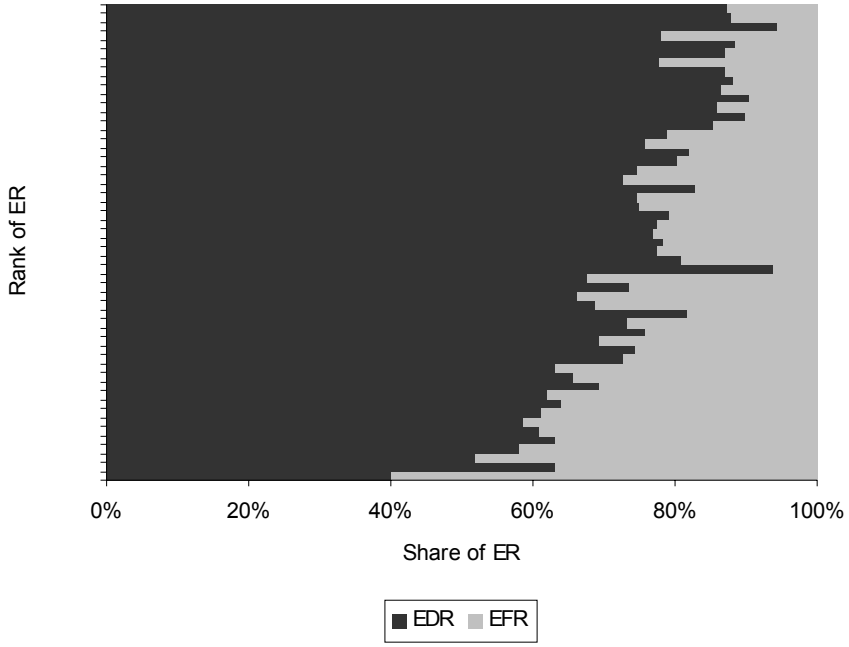


Source: own calculation based on GTAP (2003) and World Bank (2004)

Figure 5 reveals that the degrees of trade openness on the import side are not significantly smaller when they are measured with the actual openness method (IFR) rather than the traditional method (IR). The IDR index indicates that all countries export intermediate commodities (which are imported again due to intermediate or final commodities) to only a very small fraction. Consequently, this creates nearly no income in the domestic economy.

Subsequent to this, Figure 6 gives an alternative impression of the structure of traditional openness towards international trade. Identical to the previous tables, the horizontal axis of the diagram puts the countries in increasing order of their ER values. The vertical axis shows the outcomes of the new EDR and EFR measures, expressed as shares of the traditional ER index.

Figure 6: Structure of traditional openness on the export side of 53 countries, 2001



Source: own calculation based on GTAP (2003) and World Bank (2004)

The figure clearly discloses the tendency of a decreasing share of domestic factors of production embodied in exports (EDR) the more commodities a country exports in relation to all produced commodities (ER). The interpretation of this result might be that the more open an economy is, the more likely it is that a country's production structure is determined by an increased share of firms that re-export imported intermediate and final commodities. The import side of the economies is not illustrated because of the small differences between the actual and traditional openness concept.

After this overview of 56 countries for the year 2001, the section proceeds with a *frequency distribution analysis* of the indicators of the traditional and actual openness concept for the same 56 countries but for the years between 1989 and 2002, which leads to 682 observations. Table 7 lists the results of the analysis with standard statistical measures.The Jarque-Bera test of a normality distribution is also included (Jarque and Bera, 1987). Like always, a small

probability value leads to a rejection of the null hypothesis that the underlying distribution of the observations is a normal distribution.

Table 7: Frequency distribution analysis of openness of 56 countries, 1989-2002

Sample 1 682 Observations 682	Export side		Import side	
	EDR	ER	IFR	IR
Mean	24.986	35.964	38.123	38.241
Median	22.284	28.072	30.858	30.911
Maximum	78.374	181.89	188.34	189.37
Minimum	4.5769	5.8391	4.9210	4.9239
Range	73.798	176.05	183.42	184.44
Standard deviation	13.267	28.404	27.893	27.979
Variation coefficient	0.5310	0.7898	0.7316	0.7316
Skewness	1.3695	2.6804	2.5187	2.5316
Kurtosis	5.3521	12.242	11.187	11.273
Jarque-Bera	370.38	3244.0	2625.5	2673.6
Probability	0.0000	0.0000	0.0000	0.0000

Source: own calculation based on GTAP (2003, 1998) and World Bank (2004)

Table 7 discloses that all empirical realizations of the degree of openness indicate a lower importance of the international trading partners if they are based on the actual concept instead the established openness concept. Both methods describe the same economic situation a country faces but the new approach clearly reveals that exports create less income in the producer country than suggested by the standard trade shares. Second, the EDR measure has the tendency to increase with the ER index because exports employ production factors. The more exports are produced, the more factors of production are involved in the production process.

Third, the shape of the distribution of the EDR index, in contrast to that of the ER indicator, reflects that the imported intermediate products that a country demands to produce exports, as a share of the gross domestic product, become increasingly important the more open an economy is. Consequently, the actual openness reveals that a more open economy's fraction of domestic factors of production (out of the total production inputs) need be less than that of a less open country. In addition, countries are more similarly open when the value-added based openness concept is applied to calculate their degrees of openness instead of the conventional approach.

Next, Table 8 lists the results of the rank order *correlation analysis* which characterizes the different rank orders of the 56 countries by means of the Spearman measure of rank order correlation.

Table 8: Rank order correlation analysis of openness of 56 countries, 1989-2002

Sample 1 682 Observations 682	ER	IR
EDR	0.986251	/
IFR	/	0.999933

Source: own calculation based on GTAP (2003, 1998) and World Bank (2004)

The outcomes of the Spearman measure indicate a very strong correlation between the indices of the traditional and actual openness approach. This is the case on the export side because the traditional openness concept increasingly overestimates the effect of trade on the domestic economy the more commodities a country exports in relation to the gross domestic product. In more open economies, the focus of firms to re-export imports determines a larger fraction of imports than in less open countries. Firms which redistribute final commodities or process the finishing of imported intermediate commodities employ less domestic factors of production and thus contribute less to national income than other firms which produce the exports primarily with national intermediate commodities in all processing stages.

In contrast to the established openness concept, the actual openness concept is able to clearly describe the situation that open countries consist of more re-exporting firms than closed countries since this kind of production structure is less able to create income in the domestic economy. This result indicates that the measures of actual openness account for the same aspects of openness to trade as the indices of traditional openness but they do it with more accuracy.

There is almost no variation in the ranking of the countries on the import side because the traditional openness index almost adequately indicates the amount of income that domestic residents have to spend for imports. The actual openness index improves the traditional one by taking the redistribution of income generated by exports into account. However, but the value of exported intermediates which are assembled in imports is extremely small for all countries.

Consequently, this means that the innovative value-added based openness measures describe the same aspects of international trade as the established concept of openness. Since the main drawback of most approaches which try to adjust the traditional trade shares is the very poor correlation with the established indices, the outcome presented here clearly indicates the advantage of our new concept of actual openness over many alternative openness methods (see Section 3.1).

Finally, the *regression analysis* accentuates the openness-elasticity of the actual openness indices. The following specifications of the regression equations are useful:

(90) $\log \mathrm{EDR}_t = \hat{c}_1 + \hat{c}_2 \log \mathrm{ER}_t + \hat{u}_t, \quad t = 1,2,\ldots,682$ and

(91) $\log \mathrm{IFR}_t = \hat{c}_1 + \hat{c}_2 \log \mathrm{IR}_t + \hat{u}_t, \quad t = 1,2,\ldots,682.$

The index t represents the economy with the number t in the sample. The estimator $\hat{c}_2$ in equation (90) measures the induced percentage change of EDR_t when ER_t increases by one percent. Equation (91) is to be interpreted in the same way. The ordinary least squares (OLS) method is applied after making sure that the standard assumptions of functionality, of no autocorrelation, normality and homoscedasticity of the residuals are valid for the chosen specifications. The final estimation results are demonstrated in Table 9.

Table 9: Regression analysis of openness of 56 countries, 1989-2002

Sample 1 682 Observations 682	ER	IR
EDR	0.790373***	/
IFR	/	1.002259***

Source: own calculation based on GTAP (2003, 1998) and World Bank (2004)
Note: *** 1 percent significance level

The upper left-hand value of the table supports the result of Table 7; the domestic production factors are increasingly less embodied in the production process of exports in relation to imported intermediate commodities the more open an economy towards trade is. An increase of exports in relation to the gross domestic product (ER) of 1.0 percent raises the wealth at home only 0.79 percent (EDR). The value added of exports at home is lower than the traditional openness concept suggests because a part of the induced income is transferred abroad by means of imported intermediate commodities. As a consequence, the innovative value-added based openness method is able to quantify the magnitude of the different sources of production inputs by taking production linkages in the exporting sectors and their supplying sectors into account. The lower right-hand value of Table 9 indicates that an increase of the IFR index of 1.0 percent occurs when the IR raises 1.0 percent. This outcome meets that of Table 7. The following table reproduces Table 9 in detail for the EDR measure, presenting all relevant estimation results for a representative dependent variable.

Table 10: Estimation results of openness on the export side

Dependent Variable	LOG(EDR)	Sample		1 682
Method	Least Squares	Included observations		682
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.430713	0.017293	24.90626	0.0000
LOG(ER)	**0.790373**	0.005053	156.4205	0.0000
R-squared	0.972959	Mean dependent var		3.086267
Adjusted R-squared	0.972920	S.D. dependent var		0.522511
S.E. of regression	0.085985	Akaike info criterion		-2.066362
Sum squared resid	5.027514	Schwarz criterion		-2.053092
Log likelihood	706.6294	F-statistic		24467.39
Durbin-Watson stat	1.999062	Prob(F-statistic)		0.000000

Source: own calculation based on GTAP (2003, 1998) and World Bank (2004)

4.5 Influence of the actual openness concept on the explanation of the choice of exchange rate regimes

4.5.1 Methodology

The following regression analysis tests whether the swap from measures of the established method to the value-added based method for calculating the degree of openness affects the quality of trade openness to explain the choice of exchange rate regimes. This simple comparative test of four traditional and four actual openness indices is performed on the basis of the ordinary least squares method and includes 525 (514) observations for the 5- (3-) way classification of exchange rate arrangements of 54 out of 56 countries within the years 1989 and 2000. The countries Hungary and Malta are not included since no data of exchange rate regimes are available from the data base of Levy-Yeyati and Sturzenegger (2002). In addition, for a few countries some years are missing where an exchange rate regime was not reported by Levy-Yeyati and Sturzenegger (2002).

4.5.2 Test results and interpretation

The test of the potential association between the degree of openness and the choice of exchange rate regimes is performed for the traditional openness concept with measures which include all traded commodities (ER and IR) as well as only manufactured commodities (ER_3 and IR_3). The latter openness measures are chosen since some studies do not take the trade of services into account. For the actual openness concept, the EDR and IFR openness indices are used, which also consist of all tradables. Measures which accentuate the significance of international trade for domestic non-skilled labor (EDR_1) and capital (EDR_3) are chosen in order to reveal whether a left-wing (right-wing) government that is in favor of non-skilled

to reveal whether a left-wing (right-wing) government that is in favor of non-skilled labor (capital) has an impact on the selection of exchange rate arrangements.

The specifications of the regression equations for the EDR measure are:

(92) $\text{ERR5}_t = \hat{c}_1 \text{EDR}_t + \hat{u}_t, \quad t = 1,2,\ldots,525$ and

(93) $\text{ERR3}_t = \hat{c}_1 \text{EDR}_t + \hat{u}_t, \quad t = 1,2,\ldots,514.$

Equation (92) represents the test for the 5-way classification of exchange rate regimes and, in turn, equation (93) specifies the test for the 3-way classification of exchange rate arrangements. The index *t* stands for the observation with the number *t* in the sample. The estimator $\hat{c}_1$ is positive if trade openness is positively correlated with the likelihood to choose a fixed exchange rate regime. In addition, the specifications for the alternative seven indices of trade openness are similar to equations (92) and (93).

Table 11 displays the final estimation results of the relationship between trade openness and the choice of exchange rate systems.

Table 11: Regression analysis of exchange rate regimes of 54 countries, 1989-2000

ERR5: Observ. 525 ERR3: Observ. 514	ERR5		ERR3	
EDR	0.1184***	(38.980)	0.0688***	(37.531)
ER	0.0653***	(27.593)	0.0378***	(26.930)
IFR	0.0654***	(29.445)	0.0380***	(28.609)
IR	0.0652***	(29.422)	0.0379***	(28.585)
ER3	0.0946***	(24.367)	0.0551***	(23.867)
EDR1	0.3344***	(36.910)	0.1955***	(36.175)
EDR3	0.2419***	(34.040)	0.1396***	(32.343)
IR3	0.0932***	(26.443)	0.0541***	(25.723)

Source: own calculation based on Levy-Yeyati and Sturzenegger (2002), GTAP (2003, 1998) and World Bank (2004)
Note: *** 1 percent significance level, t-statistics in parentheses

All the estimators in Table 11 have positive signs as expected and are statistically significant. This result matches most studies (see, for example, Juhn and Mauro 2002). The t-statistics measure is chosen as a simple proxy for the quality of prediction of the alternative trade openness indices. It indicates that all measures of the actual openness concept outperform the counterparts of the traditional approach in predicting the exchange rate regime selection. In addition, the t-statistics are higher for the 5-way classification of exchange rate regimes than for the 3-way classification of exchange rate regimes in all cases except for IR3. Table 12

reproduces Table 11 in detail for the EDR-ERR_5 specification, presenting all relevant estimation results for a one dependent variable.

Table 12: Estimation results of the EDR measure

Dependent Variable	ERR5	Sample		1 525
Method	Least Squares	Included observations		525
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
EDR	**0.118361**	0.003036	38.97992	0.0000
R-squared	-0.967774	Mean dependent var		3.502857
Adjusted R-squared	-0.967774	S.D. dependent var		1.357230
S.E. of regression	1.903886	Akaike info criterion		4.127574
Sum squared resid	1899.385	Schwarz criterion		4.135695
Log likelihood	-1082.488	Durbin-Watson stat		0.585225

Source: own calculation based on Levy-Yeyati and Sturzenegger (2002), GTAP (2003, 1998) and World Bank (2004)

5. New indices of bilateral trade openness[43]

5.1 Value-added based adjustment of traditional shares of trade

The standard *cost-benefit analysis of monetary integration* states that if a potential client country trades extensively with the member countries of a single currency area then adopting the anchor currency might be a sound strategy (see Section 2.3.3). In general, the traditional measures of trade openness are applied in the analysis which accentuate the *bilateral trade* relationships within the region, such as the intra-regional export ratio and the intra-regional import ratio (see Section 2.2.3). As described in Section 3.1, the conventional international shares of trade show evident limitations in appropriately indicating the significance of international trade linkages. Since the bilateral trade shares of the traditional concept of openness put emphasis on a specific part of international trade without any conceptual differences, these bilateral openness proxies demonstrate the same drawbacks as the international ones. The same adjustment approaches of the traditional international trade shares can be found in economic literature for the bilateral counterparts. Consequently, we feel legitimized to *expand the innovative value-added based method of measuring openness*, presented in Chapter 3, in such a way that bilateral trade flows can be taken into account with the aim of improving the indication quality of openness towards bilateral trade.

In addition to openness indices which exclusively describe the association of trade between a potential member and participating countries of a currency union (as proposed by the common cost-benefit analysis of monetary integration), *extra-regional measures of openness* are constructed to highlight the significance of countries outside the monetary integration area. A comparison of the similarity of intra- and extra-regional trade patterns and levels of the poten-

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[43] The following papers which were accepted at conferences are partly based on Chapters 5 and 6: "*Economic Integration Models and Monetary Integration Analysis: A Reassessment of MERCOSUR*", paper for the conference "57th International Atlantic Economic Conference", International Atlantic Economic Society (IAES), Lisbon, March 10-14, 2004; "Economic Integration Models and Monetary Integration Analysis: A Reassessment of MERCOSUR", paper for the conference "Second Annual Conference", Euro-Latin Study Network on Integration and Trade (ELSNIT), Inter-American Development Bank (IDB), Florence, October 29-30, 2004;

"*How to Improve Performance of the Cost-Benefit Analysis of Monetary Integration?: An Application of the Value-Added Based Economic Integration Model*", paper for the conference "Regional Cooperation and Economic Integration: European and East Asian Experiences", 4th international conference, Inha University and University of Le Havre, Incheon, October 8-9, 2003; "How to Improve Performance of the Cost-Benefit Analysis of Monetary Integration?: An Application of the Value-Added Based Economic Integration Model", paper for the conference "Economic Policies in the New Millennium", international conference, Faculty of Economics at the University of Coimbra (FEUC), Coimbra, April 16-17, 2004;

"*Integration of the CEECs in the EU and their Participation in the EMU: A VEO and AGE Analysis*", paper for the conference "Input-Output and General Equilibrium: Data, Modeling, and Policy Analysis", Economic Modeling (EcoMod) Network and International Input-Output Association (IIAO), Brussels, September 2-4, 2004.

tial aspirant country and the member nations of the integration area might be a valid simplified method to assess whether the currency adoption of the potential entrant might result in positive net benefits for the domestic economy or not.

For example, if a Central and Eastern European country (CEEC) which became a member country of the European Union (EU) on May 1, 2004 is more tightly and intra-regionally integrated due to trade than the 15 pre-accession member countries of the EU and if the CEEC is less strongly oriented to extra-regional trading partners than the other member nations of the EU, then there is a chance that the potential adoption of the euro could lead to positive net benefits for the CEEC. This hypothesis is based on the assumption that the member countries of the Economic and Monetary Union (EMU) that adopted the euro gain net benefits due to their abandonment of their national currency (see Wang, 2004b).

Contrary to this, the common cost-benefit analysis of monetary integration postulates to empirically calculate the net benefits (see Section 2.3.3). If the degree of openness towards intra-regional trade of the potential client country surpasses its break-even degree of openness then the net benefits are positive. This method assumes that it is possible to exactly identify the cost and the benefit function of monetary integration that are necessary to determine the break-even degree of openness.[44]

The consideration of irrevocably fixed exchange rates might, in both methods, be influenced by the choice of an appropriate measure of trade openness. A deviation in the calculated degree of trade openness due to the change of, for example, the traditional shares of trade towards the value-added based shares of trade is likely. This might affect the outcome of the cost-benefit analysis of monetary integration and even result in a revision of the recommendation for a country to adopt the currency of a single currency area (see Wang, 2004a, 2003c).

This chapter presents the construction of the newly adjusted trade shares which are applied in Chapter 6 for an empirical analysis of the above mentioned CEECs prospective adaptation of the euro. In Section 5.2, the multi-regional input-output table with three regions – the candidate country, the integration area, and the rest of the world – as well as the multi-regional input-output analysis of bilateral trade are illustrated. These offer the instruments necessary to design the innovative measures of openness. Section 5.3 puts emphasis on the measurement

[44] Since the attempt to calculate a sound break-even degree of openness is beyond the scope of this contribution, the net benefits due to monetary integration are discussed on the basis of the simplified method in Section 6.

of the ‘actual openness’. Furthermore, Section 5.4 includes the presentation of the association between actual openness and traditional openness.

5.2 An extended input-output framework

5.2.1 The multi-regional input-output table with three regions

The indication of actual openness in the case of bilateral trade is based on the *multi-regional input-output analysis* of income effects due to bilateral trade. Wang (2004a, 2004b, 2003c) introduce correspondingly the following input-output analysis. This analysis extends the multi-regional input-output analysis of international trade as presented in Chapter 3 by means of *separating foreign countries into two groups* – member countries of an integration area, such as the EU or EMU, and countries which form the rest of the world. Since the analysis of bilateral trade is based on the same theoretical foundation as the analysis of international trade, it is performed in an open static Leontief system (see Leontief 1966, 1951). The GTAP (2003, 1998) data bases serve as sources of data for the empirical analysis in Chapter 6 because they fit to the Leontief system with the level of detail required.

In addition, the adapted Isard system is the source of the *multi-regional input-output table* with three regions in this study (see Section 3.3.1 and Isard, 1951). These three regions consist of a certain country, the ‘home country’, the trading partners of the country which participate in an integration area, represented by the ‘integration area’ region, and those foreign countries which are non-members of the integration area (the ‘rest of the world’ region). Each region is represented by a distinct national input-output table. The two latter regions’ national input-output tables consist of aggregations of the national input-output tables of the countries within the regions. The multi-regional input-output table is illustrated in Figure 7.

Figure 7: Multi-regional input-output table with three regions

			Region *l*									Region *l*									
			1				2				3				1			2			3			
			Industry *j*												Demand *e*									
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	1	2	3	
Region *k*	Commodity *i*	1	X_{ij11}				X_{ij12}				X_{ij13}				Y_{ie11}			Y_{ie12}			Y_{ie13}			X_{i1}
		2	X_{ij21}				X_{ij22}				X_{ij23}				Y_{ie21}			Y_{ie22}			Y_{ie23}			X_{i2}
		3	X_{ij31}				X_{ij32}				X_{ij33}				Y_{ie31}			Y_{ie32}			Y_{ie33}			X_{i3}
	Factor *g*	1	W_{gj1}				W_{gj2}				W_{gj3}													
		2																						
		3																						
		4																						
		5																						
			X_{j1}				X_{j2}				X_{j3}													

The input-output table is built in current dollar terms which refer to a period of one year. It is assumed that each industry produces a homogenous product by using a homogenous technology. Furthermore, it is assumed that the value of an exported commodity equals its import value in the receiving countries.

Our illustration of the multi-regional input-output table begins with the output of commodities. The value of *total output* of commodity *i* of region *k* (X_{ik}) is determined by the value of the intermediate commodity *i* for all industries *j* in region *k* to produce output (X_{ijkk}) and the value of the final commodity *i* for the components *e* of final demand of region *k*, including exports, (Y_{iekk}) as

$$X_{ik} = \sum_{j=1}^{4} X_{ijkk} + \sum_{e=1}^{3} Y_{iekk}, \quad i = 1,2,3,4, \quad k = 1,2,3. \tag{94}$$

Commodity *i* represents food (1), other primary products (2), manufactures (3), or services (4). In the same way, industry *j* stands for food industry (1), other primary production (2), manufacturing (3), or services (4). Region *k* symbolizes the home country (1), the integration area (2), or the rest of the world (3). The 'integration area' region stands for all regional trad-

ing partners of the home country and the 'rest of the world' region includes those economies outside the region. Demand *e* is that of the home country (1), in the integration area (2), or in the rest of the world (3).

Additionally, industries need input to produce the output of commodities. The value of *total output* of industry *j* of region *k* (X_{jk}) is made up of the value of the received intermediate commodities *i* (X_{ijkk}), the value of imported intermediate inputs *i* from the regions *l* (X_{ijlk}), and the value of employed production factors *g* (W_{gjk}) in industry *j* of region *k*, which can be written as

$$X_{jk} = \sum_{i=1}^{4} X_{ijkk} + \sum_{i=1}^{4} \sum_{l \neq k} X_{ijlk} + \sum_{g=1}^{5} W_{gjk}, \quad j = 1,2,3,4, \quad k = 1,2,3. \tag{95}$$

Region *l* denotes home country (1), integration area (2), or rest of the world (3). Production factor *g* stands for unskilled labor (1), skilled labor (2), capital (3), land (4), or natural resources (5). Since the value of an industry's output, expressed in equation (94), equals the value of required inputs in the same industry, as represented in equation (95), it follows that

$$X_{ik} = X_{jk}, \quad i = 1,2,3,4, \quad j = i, \quad k = 1,2,3. \tag{96}$$

The *gross domestic product* in region *k* (Y_k) coincides with the compensation of all production factors in region *k* (W_{gjk}) as well as the value of final demand (Y_{iekk}) less the value of imported intermediate commodities (X_{ijlk}) in region *k*, which is defined in symbols as

$$Y_k = \sum_{g=1}^{5} \sum_{j=1}^{4} W_{gjk} = \sum_{i=1}^{4} \sum_{e=1}^{3} Y_{iekk} - \sum_{i=1}^{4} \sum_{j=1}^{4} \sum_{l \neq k} X_{ijlk}, \quad k = 1,2,3. \tag{97}$$

The value of imported intermediate inputs is subtracted from the value of final demand because domestically produced final goods and services include imported intermediate inputs which do not generate value added in the domestic economy.

5.2.2 Input-output analysis of bilateral trade relationships

The input-output analysis is an appropriate instrument for forecasting the income effects of exports. In the first step, the influence of exports on industries' total output is described. Then, the analysis emphasizes the relationship between the induced total output and the necessary primary inputs to produce the additional commodities. Consequently, the explanation of the linkages between the final sector and the intermediate sector as well as the interdepend-

ences within the intermediate sector requires certain assumptions to be made about the production processes within an economy.

A proportional relationship between total output of an industry and its essential intermediate commodities is assumed. Returns to scale are presumed to be constant in the production processes. That is, inter-industry coefficients are supposed to be independent from the input of production. The change in final demand is exogenously given to forecast the response of industries' total output. Finally, it is assumed that a specific level of total output is only achievable by a fixed combination of production factors. Consequently, it is not possible to substitute factors. An efficient employment of production factors is only achievable if all industries produce the amount of intermediate commodities that are required for the production for final demand.

The illustration of the association between exports and total output begins with the *inter-industry coefficient*, denoted by a_{ijk}. The inter-industry coefficient expresses the quantity of commodity i which is required on average in industry j for the production of one unit of commodity j in region k, which is in symbols:

$$(98) \qquad a_{ijk} = \frac{X_{ijkk}}{X_{jk}}, \quad i, j = 1,2,3,4, \quad k = 1,2,3.$$

Since negative values of the inter-industry coefficient have no economic meaning, it follows that

$$(99) \qquad a_{ijk} \geq 0, \quad i, j = 1,2,3,4, \quad k = 1,2,3.$$

The output level of commodity j of industry j in region k exclusively determines the amount of a commodity i purchased by industry j, which can be expressed as

$$(100) \qquad X_{ijkk} = a_{ijk} X_{jk}, \quad i, j = 1,2,3,4, \quad k = 1,2,3.$$

It follows that the value of total output of commodity i in region k, as stated in equation (94), can be rewritten as

$$(101) \qquad X_{ik} = \sum_{j=1}^{4} a_{ijk} X_{jk} + \sum_{e=1}^{3} Y_{iekk}, \quad i = 1,2,3,4, \quad k = 1,2,3.$$

By taking equation (96) into account, which states that the value of total output of an industry's commodity equals the value of total output of its inputs, equation (101) results in

(102) $$X_{ik} = \sum_{j=1}^{4} a_{ijk} X_{ik} + \sum_{e=1}^{3} Y_{iekk}, \quad i = 1,2,3,4, \quad k = 1,2,3.$$

Next, we build a system of equations, based on equation (102), to represent the total output of all commodities *i* in region *k* and solve the problem that X_{ik} is located at the left and right-hand side of the equation. The column vector of the values of commodities *i* demanded by the final demand in region *k* (y_k) can be defined as

(103) $$y_k = \left(\sum_{e=1}^{3} Y_{1ekk}, \sum_{e=1}^{3} Y_{2ekk}, \sum_{e=1}^{3} Y_{3ekk}, \sum_{e=1}^{3} Y_{4ekk} \right)^{T}, \quad k = 1,2,3.$$

Correspondingly, the column vector of the values of total output of commodities *i* required to be produced in region *k* (X_{ik}) to supply final commodities for final demand is introduced as

(104) $$x_k = \left(X_{1k}, X_{2k}, X_{3k}, X_{4k} \right)^{T}, \quad k = 1,2,3.$$

The *direct requirements table* of the production processes in region *k* (A_k) represents the non-negative square matrix of inter-industry coefficients of order four as

(105) $$A_k = \left(a_{ijk} \right) = \begin{pmatrix} a_{11k} & a_{12k} & a_{13k} & a_{14k} \\ a_{21k} & a_{22k} & a_{23k} & a_{24k} \\ a_{31k} & a_{32k} & a_{33k} & a_{34k} \\ a_{41k} & a_{42k} & a_{43k} & a_{44k} \end{pmatrix}, \quad k = 1,2,3.$$

Derived from the definitions in equations (103) to (105), equation (102) can be transformed into a system of linear equations as

(106) $$x_k = A_k x_k + y_k, \quad k = 1,2,3.$$

Bringing both vectors of the value of total output of region *k* (x_k) to the left side of the sign of equality leads to

(107) $$x_k - A_k x_k = y_k, \quad k = 1,2,3.$$

The identity matrix of order four (B) can be defined in symbols as

(108) $$B = \left(b_{rs} \right) = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad b_{rs} = \begin{cases} 1 \text{ for } r = s \\ 0 \text{ for } r \neq s. \end{cases}$$

b_{rs} symbolizes an element of the identity matrix with the row index *r* and the column index *s*. Thus, equation (107) can be rearranged as

$$(109) \qquad \mathrm{B}x_k - \mathrm{A}_k x_k = y_k, \quad k = 1,2,3$$

and then as

$$(110) \qquad (\mathrm{B} - \mathrm{A}_k)x_k = y_k, \quad k = 1,2,3$$

which results in the solution of the system of equations (106):

$$(111) \qquad x_k = (\mathrm{B} - \mathrm{A}_k)^{-1} y_k, \quad k = 1,2,3.$$

$(\mathrm{B}\text{-}\mathrm{A}_k)^{-1}$ is an inverse matrix of order four and represents the *total requirements table* of the production processes. It is defined as

$$(112) \qquad (\mathrm{B} - \mathrm{A}_k)^{-1} = (f_{ijk}) = \begin{pmatrix} f_{11k} & f_{12k} & f_{13k} & f_{14k} \\ f_{21k} & f_{22k} & f_{23k} & f_{24k} \\ f_{31k} & f_{32k} & f_{33k} & f_{34k} \\ f_{41k} & f_{42k} & f_{43k} & f_{44k} \end{pmatrix}, \quad k = 1,2,3.$$

The elements of the table are the *interdependence coefficients*, denoted by f_{ijk}. The interdependence coefficient f_{ijk} stands for the quantity of commodity *i*, which is required in the economic system as a whole, for the production of one unit of commodity *j* as a final commodity in region *k*.

Assume that the home country's exporting industries sell goods and services to the member countries of an integration area.[45] These exports generate income equivalent to the value of the exports – the *export-induced value added*. According to equations (94) and (95), these exports need intermediate inputs from domestic industries for their production, imported intermediate commodities from industries inside and outside the integration area, and production factors of the home country. Consequently, exports do not only create income in the home country but also abroad via imported intermediate inputs. The production structures of exporting industries and their supplying industries reflect the international competitive position of these industries and thus the degree of the economy's participation in the international division of labor. The *export-induced domestic value added* represents the value of required factors of production to produce exports in the country of interest. On the other hand, the *export-induced foreign value added* characterizes the value of the country's demand for im-

[45] This view can be applied analogously to the trading partners in the rest of the world.

ported intermediate products, which are included in the production process of the exports, from the participating states of the integration area or the countries in the rest of the world.

The next step in the analysis of income effects due to bilateral trade links the change in total output of region k (x_k) to the induced income of production factors g in region k. Such a forecast requires a description of the structure of the production factors employed in the industries. The *direct requirements table of domestic production factors* for region k, denoted by D_k, is defined as

$$(113) \qquad D_k = (d_{gjk}) = \begin{pmatrix} d_{11k} & d_{12k} & d_{13k} & d_{14k} \\ d_{21k} & d_{22k} & d_{23k} & d_{24k} \\ d_{31k} & d_{32k} & d_{33k} & d_{34k} \\ d_{41k} & d_{42k} & d_{43k} & d_{44k} \\ d_{51k} & d_{52k} & d_{53k} & d_{54k} \end{pmatrix}, \quad k = 1,2,3.$$

The elements of the matrix are the *technical coefficients of the domestic production factors* (d_{gjk}) which indicate the value of production factor g necessary for the production of one unit output of industry j in region k:

$$(114) \qquad d_{gjk} = \frac{W_{gjk}}{X_{jk}}, \quad g = 1,2,\ldots,5, \quad j = 1,2,3,4, \quad k = 1,2,3.$$

Because negative coefficients represent no economic meaning, it follows that

$$(115) \qquad d_{gjk} \geq 0, \quad g = 1,2,\ldots,5, \quad j = 1,2,3,4, \quad k = 1,2,3.$$

The column vector of export values of region k (y_k) is defined as

$$(116) \qquad y_k = (Y_{1lkk}, Y_{2lkk}, Y_{3lkk}, Y_{4lkk})^T, \quad k = 1,2,3, \quad l \neq k.^{46}$$

In addition, the compensation of production factors g can be expressed by means of the column vector of the income of production factors in region k (q_k) as

$$(117) \qquad q_k = (Q_{1k}, Q_{2k}, Q_{3k}, Q_{4k}, Q_{5k})^T, \quad k = 1,2,3.$$

The income of the production factors generated by exports (q_k) is forecasted by relating the employment of the production factors to the industries' total output (x_k) via the direct requirements table of domestic production factors (D_k), which is expressed in symbols as

[46] Depending on the focus of the analysis, either economies in one of the regions l or all foreign countries are taken into account to define the export vector.

(118) $$q_k = D_k x_k, \quad k = 1,2,3.$$

This leads to the *export-induced domestic value added* of region k which represents the income of all production factors g in region k created by exports.

Lastly, the value of imported intermediate commodities that the home country creates through its exports is of interest. This is the value added that exports of the country k generate abroad in region l represented by the *export-induced foreign value added* of region k in region l. The *direct requirements table of imported intermediate products* for region k (C_{lk}) is defined as

(119) $$C_{lk} = \left(c_{ijlk}\right) = \begin{pmatrix} c_{11lk} & c_{12lk} & c_{13lk} & c_{14lk} \\ c_{21lk} & c_{22lk} & c_{23lk} & c_{24lk} \\ c_{31lk} & c_{32lk} & c_{33lk} & c_{34lk} \\ c_{41lk} & c_{42lk} & c_{43lk} & c_{44lk} \end{pmatrix}, \quad k = 1,2,3, \quad l \neq k.$$

The elements of the matrix of order are known as the *technical coefficients of the imported intermediate inputs* (c_{ijlk}). These ratios express the quantity of commodity i imported from region l which is required in industry j for the production of one unit of commodity j in region k, which can be written as

(120) $$c_{ijlk} = \frac{X_{ijlk}}{X_{jk}}, \quad i, j = 1,2,3,4, \quad k = 1,2,3, \quad l \neq k.$$

Identical to the previously presented technical coefficients, only positive values of the ratios incorporate an economic meaning:

(121) $$c_{ijlk} \geq 0, \quad i, j = 1,2,3,4, \quad k = 1,2,3, \quad l \neq k.$$

The column vector of the value of imported intermediate commodities i in region k bought from region l is defined in symbols as

(122) $$p_{lk} = \left(P_{1lk}, P_{2lk}, P_{3lk}, P_{4lk}\right)^{T}, \quad k = 1,2,3, \quad l \neq k.$$

By taking the requirement of imported intermediate commodities from the region l in the production processes of the industries in region k (C_{lk}) into account, exports (y_k) determine the change of the value of imported intermediate inputs (p_{lk}) via a change in industries' total output (x_k), which can be expressed as

(123) $$p_{lk} = C_{lk} x_k, \quad k = 1,2,3, \quad l \neq k.$$

The *export-induced foreign value added* of region *k* in region *l* stands for the value of all imported intermediate commodities *i* of region *k* purchased from region *l* which are employed in the production process of region *k*'s exports.

5.3 Actual openness of bilateral trade

5.3.1 Value-added based measures of openness towards an integration area

In the following, the innovative concept of *actual openness towards bilateral trade* is presented. First, emphasis is placed on the *construction* of value-added based indices of openness towards an integration area and then on the trade shares for bilateral trade with trading partners in the rest of the world. The introduction of the indices is based on the instruments of the multi-regional input-output analysis of income effects due to bilateral trade. Since the indices of bilateral trade openness and the measures of openness to international trade have the same theoretical foundation, the value-added based indicators of openness towards international trade can be derived from these proxies of openness. Sections 5.3 and 5.4 considerably enhance the construction of new measures of trade openness as presented in Wang (2004a, 2004b, 2003c) because not only are trading partners in the rest of the world added to those in an integration area but the association of actual openness and traditional openness is also accentuated in this study.

The *intra-regional export-induced domestic value-added ratio* index, abbreviated by IEDR, indicates the importance of a country's trading partners within an integration area due to the income that its exports to the member countries generate within one year as a share of the gross domestic product in the country as a percentage. In addition, the *intra-regional export-induced domestic value-added ratio of production factor g* ($IEDR_g$) accentuates the intra-regional export for the income of a specific factor of production *g*. The openness indices are defined in symbols as

$$y_1 = \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad q_1 = D_1 x_1,$$

$$\text{IEDR}_g = \frac{Q_{g1}}{Y_1} 100, \text{ and} \tag{124}$$

$$\text{IEDR} = \sum_{g=1}^{5} \text{IEDR}_g .$$

Additionally, the degree of openness towards an integration area can be calculated by concentrating on the import side of a country. In this case, the *intra-regional import-induced intra-*

regional value-added ratio (IIIR) indicator puts the export-induced regional value added of the integration area (q_2 and p_{23}) in relation to the national income in the domestic economy as

$$
\begin{aligned}
& y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^{\mathrm{T}}, \quad x_2 = \left(\mathrm{B} - A_2\right)^{-1} y_2, \quad q_2 = D_2 x_2, \\
& y_3 = \left(Y_{1133}, Y_{2133}, Y_{3133}, Y_{4133}\right)^{\mathrm{T}}, \quad x_3 = \left(\mathrm{B} - A_3\right)^{-1} y_3, \quad p_{23} = C_{23} x_3, \\
& \mathrm{IIIR} = \frac{q_2}{Y_1} 100 + \frac{p_{23}}{Y_1} 100.
\end{aligned} \tag{125}
$$

The '*export-induced regional value added*' consists of the income created in the member countries of the integration area via direct and indirect imports of the home country from the integration area. q_2 represents the export-induced domestic value added of the integration area due to exports to the home country and p_{23} symbolizes the export-induced foreign value added of the rest of the world in the integration area. Trading partners outside the integration area require intermediate commodities from countries in the integration area (and the home country) to produce exports for the home country. This generates value added in the integration area that is not due to the imports of the home country from the integration area.

A detailed analysis of the effect of imports from the integration area on the income of an explicit factor of production in the integration area brings about the *intra-regional import-induced intra-regional value-added ratio of production factor g* (IIIR_g) openness measure, which is defined as

$$
\begin{aligned}
& y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^{\mathrm{T}}, \quad x_2 = \left(\mathrm{B} - A_2\right)^{-1} y_2, \quad q_2^{\alpha} = D_2 x_2, \\
& y_3 = \left(Y_{1133}, Y_{2133}, Y_{3133}, Y_{4133}\right)^{\mathrm{T}}, \quad x_3 = \left(\mathrm{B} - A_3\right)^{-1} y_3, \quad p_{23} = C_{23} x_3, \\
& y_2 = \left(P_{123}, P_{223}, P_{323}, P_{423}\right)^{\mathrm{T}}, \quad x_2 = \left(\mathrm{B} - A_2\right)^{-1} y_2, \quad q_2^{\beta} = D_2 x_2, \\
& \mathrm{IIIR}_g = \frac{Q_{g2}^{\alpha}}{Y_1} 100 + \frac{\dfrac{Q_{g2}^{\beta}}{\sum_{g=1}^{5} Q_{g2}^{\beta}} \sum_{i=1}^{4} P_{i23}}{Y_1} 100, \text{ and} \\
& \mathrm{IIIR} = \sum_{g=1}^{5} \mathrm{IIIR}_g.
\end{aligned} \tag{126}
$$

The export-induced foreign value added of the rest of the world in the integration area is not able to directly indicate the induced income of each production factor. It is assumed that the assumption of a linear distribution of this export-generated value added among the production factors is valid due to the relative weight of the production factors.

5.3.2 Value-added based measures of openness towards the rest of the world

In some cases of the evaluation of a country's level of trade integration with member countries of an integration area, it might be valuable to compare the degree of trade openness against a benchmark. Such a benchmark could be the actual openness towards intra-regional trade of other aspirant countries or participating countries. It might also be of interest to investigate how much actual openness towards intra-regional trade deviates from actual openness towards the rest of the world (see Section 5.1). The *extra-regional export-induced domestic value-added ratio* (EEDR) might be such a point of reference. This ratio emphasizes the impact of the home country's exports to the rest of the world on the income of the domestic production factors. The adjusted trade share is supplemented by the *extra-regional export-induced domestic value-added ratio of production factor g* ($EEDR_g$) which adds the view on the induced income of a single production factor *g*:

$$y_1 = \left(Y_{1311}, Y_{2311}, Y_{3311}, Y_{4311}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad q_1 = D_1 x_1,$$

$$EEDR_g = \frac{Q_{g1}}{Y_1} 100, \text{ and} \tag{127}$$

$$EEDR = \sum_{g=1}^{5} EEDR_g .$$

The concept of actual openness distinguishes between participants of an integration area and non-members (also on a country's import side) by means of the *extra-regional import-induced extra-regional value-added ratio* (EIER). The EIER index expresses openness to trade through the export-induced regional value added of the economies in the rest of the world (q_3 and p_{32}) as a share of the gross domestic product:

$$y_3 = \left(Y_{1133}, Y_{2133}, Y_{3133}, Y_{4133}\right)^T, \quad x_3 = \left(B - A_3\right)^{-1} y_3, \quad q_3 = D_3 x_3,$$

$$y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \quad x_2 = \left(B - A_2\right)^{-1} y_2, \quad p_{32} = C_{32} x_2, \tag{128}$$

$$EIER = \frac{q_3}{Y_1} 100 + \frac{p_{32}}{Y_1} 100.$$

The *export-induced regional value added* states that income is created in a region, such as the countries in the rest of the world in the case of the EIER measure, through direct (q_3) and indirect (p_{32}) imports of the home country from the region. q_3 symbolizes the export-induced domestic value added of the rest of the world due to trade with the home country. The integration area needs, to a certain extent, imported intermediate commodities from the rest of the world to produce exports for the home country which in turn generates income in the rest of

the world. This is the export-induced foreign value added of the integration area in the rest of the world, denoted by p_{32}.

Finally, the *extra-regional import-induced extra-regional value-added ratio of production factor g* ($EIER_g$) index highlights the income effect of imports from the rest of the world on the factor of production *g* in the rest of the world:

$$
\begin{aligned}
&y_3 = \left(Y_{1133}, Y_{2133}, Y_{3133}, Y_{4133}\right)^T, \quad x_3 = \left(B - A_3\right)^{-1} y_3, \quad q_3^{\alpha} = D_3 x_3, \\
&y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \quad x_2 = \left(B - A_2\right)^{-1} y_2, \quad p_{32} = C_{32} x_2, \\
&y_3 = \left(P_{132}, P_{232}, P_{332}, P_{432}\right)^T, \quad x_3 = \left(B - A_3\right)^{-1} y_3, \quad q_3^{\beta} = D_3 x_3,
\end{aligned} \tag{129}
$$

$$
EIER_g = \frac{Q_{g3}^{\alpha}}{Y_1} 100 + \frac{\dfrac{Q_{g3}^{\beta}}{\sum_{g=1}^{5} Q_{g3}^{\beta}} \sum_{i=1}^{4} P_{i32}}{Y_1} 100, \text{ and}
$$

$$
EIER = \sum_{g=1}^{5} EIER_g .
$$

The $IIIR_g$ index faces the same conceptual weakness as the $EIER_g$ measure because of the assumption of a linear distribution of the induced value added among the production factors by means of the relative weight of the production factors.

5.3.3 Derivation of the actual openness of international trade

The aggregation level of trade flows is determined by the scope of the analysis of trade along the attributes orientation and coverage (see Section 2.1.3). The orientation ranges from bilateral trade between two countries to international trade between a country and all foreign countries whereas the coverage is in between, for example, a specific commodity and the sum of all tradables. Thus, the *actual openness of international trade* consists of the actual openness of intra-regional trade and the actual openness of extra-regional trade.

This means for the *export-induced domestic value-added ratio* (EDR) *of production factor g* (EDR_g) that the adjusted trade share can be defined as

$$
EDR_g = IEDR_g + EEDR_g, \quad g = 1,2,\ldots,5 \text{ and} \tag{130}
$$

$$
EDR = IEDR + EEDR. \tag{131}
$$

Equally, the *import-induced foreign value-added ratio* (IFR) *of production factor g* (IFR_g) measure contains

(132) $\mathrm{IFR}_g = \mathrm{IIIR}_g + \mathrm{EIER}_g, \quad g = 1,2,\ldots,5$ and

(133) $\mathrm{IFR} = \mathrm{IIIR} + \mathrm{EIER}.$

5.4 Composition of traditional openness

5.4.1 Traditional openness indices of bilateral trade

Traditional openness expresses the importance of foreign trading partners by means of trade shares that relate the value of trade in gross terms to the gross domestic product of the home country. In a different way, actual openness accentuates income that trade generates in the exporting country. The exporting country can be the home country as well as its trading partners to express openness on the export side and import side of the home country. Before we can illustrate the association between traditional openness and actual openness, it is necessary to introduce additional value-added based measures of openness towards bilateral trade. These indices take into account the fact that an exporting country requires imported intermediate inputs in the production processes of the industries in the country.

The *intra-regional export-induced intra-regional value-added ratio* (IEIR) *of intermediate commodity i* (IEIR_i) openness index stands for the value of imported intermediate commodities *i* of the home country from the integration area, which are necessary to produce the exports of the home country for the integration area, in relation to the gross domestic product in the home country as a percentage:

$$\mathrm{y}_1 = \left(\mathrm{Y}_{1211}, \mathrm{Y}_{2211}, \mathrm{Y}_{3211}, \mathrm{Y}_{4211}\right)^{\mathrm{T}}, \quad \mathrm{x}_1 = \left(\mathrm{B} - \mathrm{A}_1\right)^{-1} \mathrm{y}_1, \quad \mathrm{p}_{21} = \mathrm{C}_{21}\mathrm{x}_1,$$

(134) $$\mathrm{IEIR}_i = \frac{\mathrm{P}_{i21}}{\mathrm{Y}_1} 100, \text{ and}$$

$$\mathrm{IEIR} = \sum_{i=1}^{4} \mathrm{IEIR}_i.$$

Analogously, the *intra-regional export-induced extra-regional value-added ratio* (IEER) *of intermediate commodity i* (IEER_i) index expresses how much the value of exports of the home country to the integration area is redistributed to the rest of the world in relation to the national income in the home country, which can be written in symbols as:

$$y_1 = \left(Y_{1211}, Y_{2211}, Y_{3211}, Y_{4211}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad p_{31} = C_{31} x_1,$$

$$\text{(135)} \qquad IEER_i = \frac{P_{i31}}{Y_1} 100, \text{ and}$$

$$IEER = \sum_{i=1}^{4} IEER_i.$$

The IEER index indicates the total value of the induced imported intermediate commodities of the home country from the rest of the world whereas the $IEER_i$ points out the value of a specific imported intermediate commodity *i*.

In addition, bilateral trade relationships between the home country and the integration area also include exported intermediate commodities of the home country to the integration area which are induced by the imports of the home country from the integration area. The *intra-regional import-induced domestic value-added ratio* (IIDR) *of intermediate commodity i* ($IIDR_i$) indicator expresses the significance of this part of intra-regional trade as

$$y_2 = \left(Y_{1122}, Y_{2122}, Y_{3122}, Y_{4122}\right)^T, \quad x_2 = \left(B - A_2\right)^{-1} y_2, \quad p_{12} = C_{12} x_2,$$

$$\text{(136)} \qquad IIDR_i = \frac{P_{i12}}{Y_1} 100, \text{ and}$$

$$IIDR = \sum_{i=1}^{4} IIDR_i.$$

The *extra-regional export-induced intra-regional value-added ratio* (EEIR) *of intermediate commodity i* ($EEIR_i$) index points out the role of the transfer of value added generated by extra-regional exports of the home country to the integration area as

$$y_1 = \left(Y_{1311}, Y_{2311}, Y_{3311}, Y_{4311}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad p_{21} = C_{21} x_1,$$

$$\text{(137)} \qquad EEIR_i = \frac{P_{i21}}{Y_1} 100, \text{ and}$$

$$EEIR = \sum_{i=1}^{4} EEIR_i.$$

Exports of the home country to the rest of the world require inputs, such as imported intermediates commodities from the integration area, in the process of production, which transfers income abroad.

In the same way, the importance of the transfer of income to the rest of the world, which exports of the home country to the rest of the world create, is indicated by the *extra-regional export-induced extra-regional value-added ratio* (EEER) *of intermediate commodity i* ($EEER_i$) measure:

$$y_1 = \left(Y_{1311}, Y_{2311}, Y_{3311}, Y_{4311}\right)^T, \quad x_1 = \left(B - A_1\right)^{-1} y_1, \quad p_{31} = C_{31} x_1,$$

(138) $$EEER_i = \frac{P_{i31}}{Y_1} 100, \text{ and}$$

$$EEER = \sum_{i=1}^{4} EEER_i.$$

Finally, the *extra-regional import-induced domestic value-added ratio* (EIDR) *of intermediate commodity i* ($EIDR_i$) index represents the role of exported intermediate products of the home country to the rest of the world, which are demanded from industries in the rest of the world to assemble imports of the home country from the rest of the world:

$$y_3 = \left(Y_{1133}, Y_{2133}, Y_{3133}, Y_{4133}\right)^T, \quad x_3 = \left(B - A_3\right)^{-1} y_3, \quad p_{13} = C_{13} x_3,$$

(139) $$EIDR_i = \frac{P_{i13}}{Y_1} 100, \text{ and}$$

$$EIDR = \sum_{i=1}^{4} EIDR_i.$$

The value-added based measures of trade openness presented in the previous section, together with those indices of this section, fully describe the importance of a country's bilateral trade relationships in terms of their income effects of trade. Consequently, total openness consists of actual openness and the importance of traded intermediate commodities.

This means that for the *intra-regional export ratio* (IER), a degree of trade openness based on this openness measure can be split up into the outcomes of the intra-regional export-induced domestic value-added ratio (IEDR), the intra-regional export-induced intra-regional value-added ratio (IEIR), and the intra-regional export-induced extra-regional value-added ratio (IEER). Exports to the integration area generate income for factors of production in the home country and in both regions due to imported intermediate inputs, which can be expressed in symbols as

(140) $$IER = \sum_{g=1}^{5} IEDR_g + \sum_{i=1}^{4} IEIR_i + \sum_{i=1}^{4} IEER_i \text{ and}$$

$$IER = IEDR + IEIR + IEER.$$

Traditional openness, as indicated by the *intra-regional import ratio* (IIR) measure, consists of the value added that imports induce in the integration area (IIIR) and the value added that is transferred to the home country (IIDR):

$$\text{IIR} = \sum_{g=1}^{5} \text{IIIR}_g + \sum_{i=1}^{4} \text{IIDR}_i \text{ and} \tag{141}$$
$$\text{IIR} = \text{IIIR} + \text{IIDR}.$$

The *extra-regional export ratio* (EER) index is composed of value added which exports from the home country to the rest of the world create. This export-induced value added partly remains in the home country due to the compensation of production factors (EEDR). Another part of the induced value added is distributed to the integration area (EEIR) and another part to the rest of the world (EEER) on account of the imported intermediate inputs of the home country from the foreign countries. This association between traditional openness and actual openness can be written as

$$\text{EER} = \sum_{g=1}^{5} \text{EEDR}_g + \sum_{i=1}^{4} \text{EEIR}_i + \sum_{i=1}^{4} \text{EEER}_i \text{ and} \tag{142}$$
$$\text{EER} = \text{EEDR} + \text{EEIR} + \text{EEER}.$$

Finally, it is possible to express the outcome of the *extra-regional import ratio* (EIR) proxy of openness in terms of the value added which imports of the home country from the rest of the world engender in the rest of the world (EIER) and in the home country (EIDR):

$$\text{EIR} = \sum_{g=1}^{5} \text{EIER}_g + \sum_{i=1}^{4} \text{EIDR}_i \text{ and} \tag{143}$$
$$\text{EIR} = \text{EIER} + \text{EIDR}.$$

5.4.2 Traditional concepts of openness to international trade

Traditional shares of trade put emphasis on the gross value of trade whereas the newly adjusted trade shares correct the representation of trade towards value-added terms. The export-induced domestic value-added ratio (import-induced foreign value-added ratio) measure highlights that the compensation of production factors creates income in the producing country. Furthermore, the export-induced foreign value-added ratio (import-induced domestic value-added ratio) index stresses that the purchase of imported intermediate inputs transfers income to the foreign countries. Consequently, the *export ratio* (ER) and the *import ratio* (IR) index can be expressed in symbols as

$$\mathrm{ER} = \left(\sum_{g=1}^{5} \mathrm{IEDR}_g + \sum_{g=1}^{5} \mathrm{EEDR}_g \right) + \left(\sum_{i=1}^{4} \mathrm{IEIR}_i + \sum_{i=1}^{4} \mathrm{IEER}_i + \sum_{i=1}^{4} \mathrm{EEIR}_i + \sum_{i=1}^{4} \mathrm{EEER}_i \right),$$

(144) $$\mathrm{ER} = \sum_{g=1}^{5} \mathrm{EDR}_g + \sum_{i=1}^{4} \mathrm{EFR}_i, \text{ and}$$

$$\mathrm{ER} = \mathrm{EDR} + \mathrm{EFR}.$$

$$\mathrm{IR} = \left(\sum_{g=1}^{5} \mathrm{IIIR}_g + \sum_{g=1}^{5} \mathrm{EIER}_g \right) + \left(\sum_{i=1}^{4} \mathrm{IIDR}_i + \sum_{i=1}^{4} \mathrm{EIDR}_i \right),$$

(145) $$\mathrm{IR} = \sum_{g=1}^{5} \mathrm{IFR}_g + \sum_{i=1}^{4} \mathrm{IDR}_i, \text{ and}$$

$$\mathrm{IR} = \mathrm{IFR} + \mathrm{IDR}.$$

6. Central and Eastern European countries' (CEECs) adoption of the euro: A re-evaluation with value-added based indices of openness

6.1 Motivation: Influence of actual openness on results of the cost-benefit analysis of monetary integration

After Chapter 4 empirically analyzed the potential linkage between the degree of openness and the choice of exchange rate regimes on the international level, this chapter accentuates the regional level. The degree of openness towards intra-regional trade is a crucial parameter for a state that is deciding whether or not it should join a fixed exchange rate area in the common cost-benefit framework of the theory of optimum currency areas (see Section 2.3.3). In the following comparative analysis it is of interest what impact an alternative calculation of the degree of openness (the value-added based approach as opposed to the traditional openness concept) has on the outcomes of the cost-benefit analysis of monetary integration and consequently on the recommendation of accession for policy makers.

The analysis addresses the ongoing debate in economic research as to when the Central and Eastern European countries (CEECs), which became member states of the Economic and Monetary Union (EMU) in May 1, 2004, are able to adopt the euro as their national currency (see, for example, Gilson, 2004 and Tanasie, 2004). In the following analysis, it is assumed that the new entrants of the EMU will enduringly meet the demanded Maastricht criteria and that the CEECs will not devaluate their currencies in the Exchange Rate Mechanism (ERM) II for at least two years, until the year 2008. Where the forecasts of economic conditions in the CEECs are different in other years, the outcomes of the following analysis with respect to the degree of openness, which is the only determinant for the choice of a sound exchange rate regime in the cost-benefit analysis of monetary integration (see Wang, 2004b) will not be fundamentally altered. The year 2008 is chosen because it seems to be the earliest realistic date for the Central and Eastern European economies to adopt the euro. Wang (2004a, 2003c) analyzes if the participating members of NAFTA and MERCOSUR should supplement their trade integration with a monetary integration by means of building a single currency area in each region.

The chapter proceeds in Section 6.2 with a characterization of the innovative concept of actual openness by means of a comparative analysis of the integration of trade between the Central and Eastern European economies and the 15 pre-accession member countries of the European Union. Then in Section 6.3, the computable general equilibrium (CGE) analysis is introduced. The Global Trade Analysis Project (GTAP) model is applied to forecast the Central and East-

ern European countries' potential degrees of openness to trade. Subsequently, Section 6.4 presents a scenario of the economic situation of the CEECs' trade integration in the European Union for the year 2008. Subsequent to this, in Section 6.5 the analysis of the Central and Eastern European economies' potential entrance into the euro zone is performed within a standard cost-benefit analysis of monetary integration.

6.2 Comparison of the EU members' degrees of openness based on traditional and actual openness towards bilateral trade

6.2.1 The data set

As a starting point of the empirical analysis, we calculate and present the empirical realizations of the degree of openness of the *25 member countries of the European Union* ('EU-25') for the year 1997 according to the different indices of openness discussed.[47] Beside the eight Central and Eastern European countries ('CEEC-8'), this includes Cyprus and Malta as the latest participating countries of the European Union, who joined the prevailing 15 members of the EU in May 1, 2004.[48] In addition, the sample of Wang (2004a, 2003c) consists of the member countries of MERCOSUR, NAFTA, and the pre-accession EU for the same year.[49]

The *GTAP* (2003) *data base* is the source of data for the calculation of the trade shares of the traditional and actual openness concept with the base year 1997 (see Dimaranan and McDougall, 2002). In contrast to Chapter 4, the WDI data base does not serve as a source of data to adjust the trade structure of the GTAP data base or for the computation of the CEECs' degrees of openness for a period of several years (World Bank, 2004). The GTAP's (2003) unadjusted patterns of trade are used to calculate the degrees of openness, despite their weakness in accurately describing the economic relationships between some countries – a result of the comparison of the base year 1997 with the year 2008, where 2008 is a realistic date for the CEECs' accession to the euro zone in Section 6.5.[50]

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[47] The label 'EU-25' denotes the members of the European Union since May 1, 2004. EU-25 represents Austria, Belgium, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, and the United Kingdom.

[48] The CEECs which joined the European Union are the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia. They are denoted as 'CEEC-8'.

[49] Members of the MERCOSUR (Mercado Común del Sur) integration area are Argentina, Brazil, Paraguay, and Uruguay. Canada, Mexico, and the United States form the North American Free Trade Agreement (NAFTA).

[50] The 'euro zone' consists of twelve member countries of the Economic and Monetary Union, which are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.

Table 13 presents the *outcomes* of the four measures of openness of both the value-added based and traditional openness concept on the export and import side of the countries under investigation. The results of six additional value-added based indices are illustrated in Table A-12, which are separated from those in Table 13 for a better comparison of the established openness measures and their counterparts of the innovative openness concept.

Table 13: Actual and traditional openness to bilateral trade of the EU-25, 1997

Percent of GDP, 1997		Intra-regional trade				Extra-regional trade			
		Export side		Import side		Export side		Import side	
Country name	Code	IEDR	IER	IIIR	IIR	EEDR	EER	EIER	EIR
Austria	AUT	17.12	24.38	26.41	26.48	11.13	14.70	16.30	16.33
Belgium	BEL	25.73	50.06	43.90	44.17	14.51	24.56	31.38	31.53
Denmark	DNK	16.97	22.99	19.16	19.20	10.95	14.21	13.15	13.17
Finland	FIN	16.97	23.31	17.68	17.71	11.95	16.05	14.50	14.52
France	FRA	12.48	15.17	12.64	12.80	9.02	10.71	10.65	10.75
Germany	DEU	12.71	15.84	12.85	13.13	9.41	11.54	12.55	12.76
Greece	GRC	7.14	8.30	14.86	14.87	6.72	7.75	12.70	12.71
Ireland	IRL	30.03	51.04	38.31	38.38	16.94	28.00	33.36	33.40
Italy	ITA	10.75	13.98	12.02	12.14	9.45	11.94	10.87	10.96
Luxembourg	LUX	26.97	52.47	50.25	50.27	14.94	25.72	33.41	33.41
Netherlands	NLD	27.13	43.86	28.62	28.84	13.32	19.40	28.21	28.39
Portugal	PRT	16.35	22.06	26.86	26.89	6.73	8.48	15.19	15.20
Spain	ESP	12.85	16.92	15.62	15.69	7.76	9.68	11.68	11.73
Sweden	SWE	16.84	23.62	20.74	20.81	14.10	19.29	14.68	14.72
United Kingdom	GBR	10.98	13.74	12.76	12.92	10.38	12.69	14.98	15.14
Czech Republic	CZE	24.21	40.12	41.21	41.26	10.58	15.82	22.27	22.28
Estonia	EST	32.16	62.35	74.24	74.25	23.28	41.80	55.10	55.11
Hungary	HUN	22.49	39.19	39.03	39.06	11.67	18.02	23.80	23.82
Latvia	LVA	24.25	45.20	60.09	60.09	19.81	34.32	44.45	44.45
Lithuania	LTU	17.69	33.41	42.53	42.53	19.06	30.96	38.98	38.98
Poland	POL	12.32	17.42	24.37	24.40	7.76	10.18	15.26	15.28
Slovak Republic	SVK	28.87	49.18	47.27	47.29	10.17	15.77	28.83	28.84
Slovenia	SVN	23.74	39.08	43.17	43.19	14.03	21.75	21.03	21.04
Cyprus	CYP	9.47	13.05	22.44	22.44	18.04	25.64	21.24	21.24
Malta	MLT	27.37	46.21	73.62	73.62	29.64	48.58	45.41	45.41

Source: own calculation based on GTAP (2003)

A degree of openness of zero percent of the gross domestic product indicates a closed economy which finds itself in a status of complete autarky. The higher the empirical value is, the more significant the other member countries of an integration area and the trading partners in the rest of the world, with respect to their trade relationships for the country of interest. Table 13 reveals that all empirical realizations of the degree of openness indicate a lower importance of the intra- and extra-regional trading partners of the countries when they are calculated by value-added based measures of trade openness instead of indicators of the established openness concept. Both methods describe the same economic situation a country faces but the

new approach clearly reveals that exports create less income in the producer country than suggested by the standard trade shares. Export sectors and their supplying sectors demand imported intermediate commodities to produce exports that increase the wealth abroad and rather than in the domestic economy.

For example, the trade activities of Poland, as a representative of the Central and Eastern European countries, with its 24 neighbors within the European Union and all of its trading partners in the rest of the world are summarized by the degree of openness towards intra-regional trade and extra-regional trade, respectively. Table 13 demonstrates that the results of the alternative measures of openness to intra-regional (extra-regional) trade range between 12.3 and 24.2 (7.8 and 15.3) percent of the gross domestic product in the year 1997. For Poland, both methods of measuring openness reveal a relatively low level of trade openness, especially towards foreign trading partners outside the European Union. For example, the country exports 17.4 percent of all final goods and services to the EU member countries (IER). According to the IEDR measure, these exports lead to domestic income which amounts to 12.3 percent of the total earnings in Poland. Within the same year, the expense for imports from the European Union represents a share of 24.40 percent of the national income (IIR). 24.37 percent of the income that the domestic factors of production receive, is transferred to the other members of the EU since imports include exported intermediate commodities towards the European Union. This creates income in Poland (IIIR). The openness indices towards extra-regional trade are interpreted as those presented for the bilateral trade within the European Union.

6.2.2 Methodology

Several methods are applied to analyze whether indicating openness with the value-added based openness indices as opposed to traditional indices leads to the same *systematic effects* on the degree of openness towards bilateral trade as were discussed for international trade. The comparative analysis of the measures of openness based on the traditional and actual openness concept begins with the presentation of the countries' *rank order of openness* due to the alternative openness methods. This will disclose whether the value-added based openness indices display a similar rank order as when the traditional indicators are used. This would indicate that the innovative measures describe the same aspects of bilateral trade as the established proxies of openness. Since the main drawback of most approaches that try to adjust the traditional trade shares is their very poor correlation with the established indices, a superiority

of the new concept of actual openness over many alternative methods would be indicated (see Section 3.1).

Subsequently, the value-added based openness proxies are characterized by a *visual analysis* to give an impression of the differences between the two alternative openness concepts. This includes the discussion of the degrees of actual and traditional openness and the structure of traditional openness. In addition, the relative intra-regional trade orientation of each member of the European Union is illustrated. The visual analysis is complemented by a *frequency distribution analysis* that highlights key characteristics of the outcomes of the traditional and actual openness indices by means of standard statistical measures. Next, a *correlation analysis* accentuates the countries' rank order of openness using the Spearman measure. The elasticity of the degree of actual openness due to a change in the level of traditional openness is described with a *regression analysis* based on the ordinary least squares method.

6.2.3 Outcomes and interpretation

The comparison of the value-added based indices of openness towards intra-regional trade with the traditional measures of openness begins with a presentation of the relative positions of the 25 member states of the European Union according to their degrees of openness towards intra-regional and extra-regional trade. Table 14 records the *rank order* of the eight indicators in Table 13 for the year 1997. These rank orders begin with one for the country with the lowest degree of openness, continue with two, three, …, and end with the total number of countries for the most integrated economy.

Table 14: Rank order of actual and traditional openness of the EU-25, 1997

Intra-regional trade						Extra-regional trade					
Export side			Import side			Export side			Import side		
Code	IEDR	IER	Code	IIIR	IIR	Code	EEDR	EER	Code	EIER	EIR
GRC	1	1	ITA	1	1	GRC	1	1	FRA	1	1
CYP	2	2	FRA	2	2	PRT	2	2	ITA	2	2
GBR	4	3	GBR	3	3	ESP	4	3	ESP	3	3
ITA	3	4	DEU	4	4	POL	3	4	GRC	5	4
FRA	6	5	GRC	5	5	FRA	5	5	DEU	4	5
DEU	7	6	ESP	6	6	DEU	6	6	DNK	6	6
ESP	8	7	FIN	7	7	ITA	7	7	FIN	7	7
POL	5	8	DNK	8	8	GBR	9	8	SWE	8	8
PRT	9	9	SWE	9	9	DNK	11	9	GBR	9	9
DNK	12	10	CYP	10	10	AUT	12	10	PRT	10	10
FIN	11	11	POL	11	11	SVK	8	11	POL	11	11
SWE	10	12	AUT	12	12	CZE	10	12	AUT	12	12
AUT	13	13	PRT	13	13	FIN	14	13	SVN	13	13
LTU	14	14	NLD	14	14	HUN	13	14	CYP	14	14
SVN	16	15	IRL	15	15	SWE	17	15	CZE	15	15
HUN	15	16	HUN	16	16	NLD	15	16	HUN	16	16
CZE	17	17	CZE	17	17	SVN	16	17	NLD	17	17
NLD	21	18	LTU	18	18	BEL	18	18	SVK	18	18
LVA	18	19	SVN	19	19	CYP	21	19	BEL	19	19
MLT	22	20	BEL	20	20	LUX	19	20	IRL	20	20
SVK	23	21	SVK	21	21	IRL	20	21	LUX	21	21
BEL	19	22	LUX	22	22	LTU	22	22	LTU	22	22
IRL	24	23	LVA	23	23	LVA	23	23	LVA	23	23
LUX	20	24	MLT	24	24	EST	24	24	MLT	24	24
EST	25	25	EST	25	25	MLT	25	25	EST	25	25

Source: own calculation based on GTAP (2003)

On the export side, 68.0 (60.0) percent of the countries change their positions in response to a shift of the applied measure for calculating the degree of openness towards intra-regional (extra-regional) trade and this happens on the import side of intra-regional (extra-regional) trade in none (two) of the 25 cases (which means 8.0 percent). Changes take place by up to four rank positions. This means, for example for Luxembourg, that the openness of the economy towards intra-regional trade decreased relative to the other countries under investigation. With respect to the rank order for the export (import) side, the actual openness concept leads to relatively similar (nearly identical) outcomes as with the traditional openness approach.

There is almost no variation in the ranking of the import side because the intra-regional and extra-regional import ratio (IIR and EIR) index almost correctly indicates the amount of income that domestic residents have to spend to purchase imports. The value-added based measures of openness (IIIR and EIER) improve their traditional counterparts by taking the

redistribution of income generated by exports into account but the value of exported intermediates which are assembled in imports is usually so small that it can be neglected.

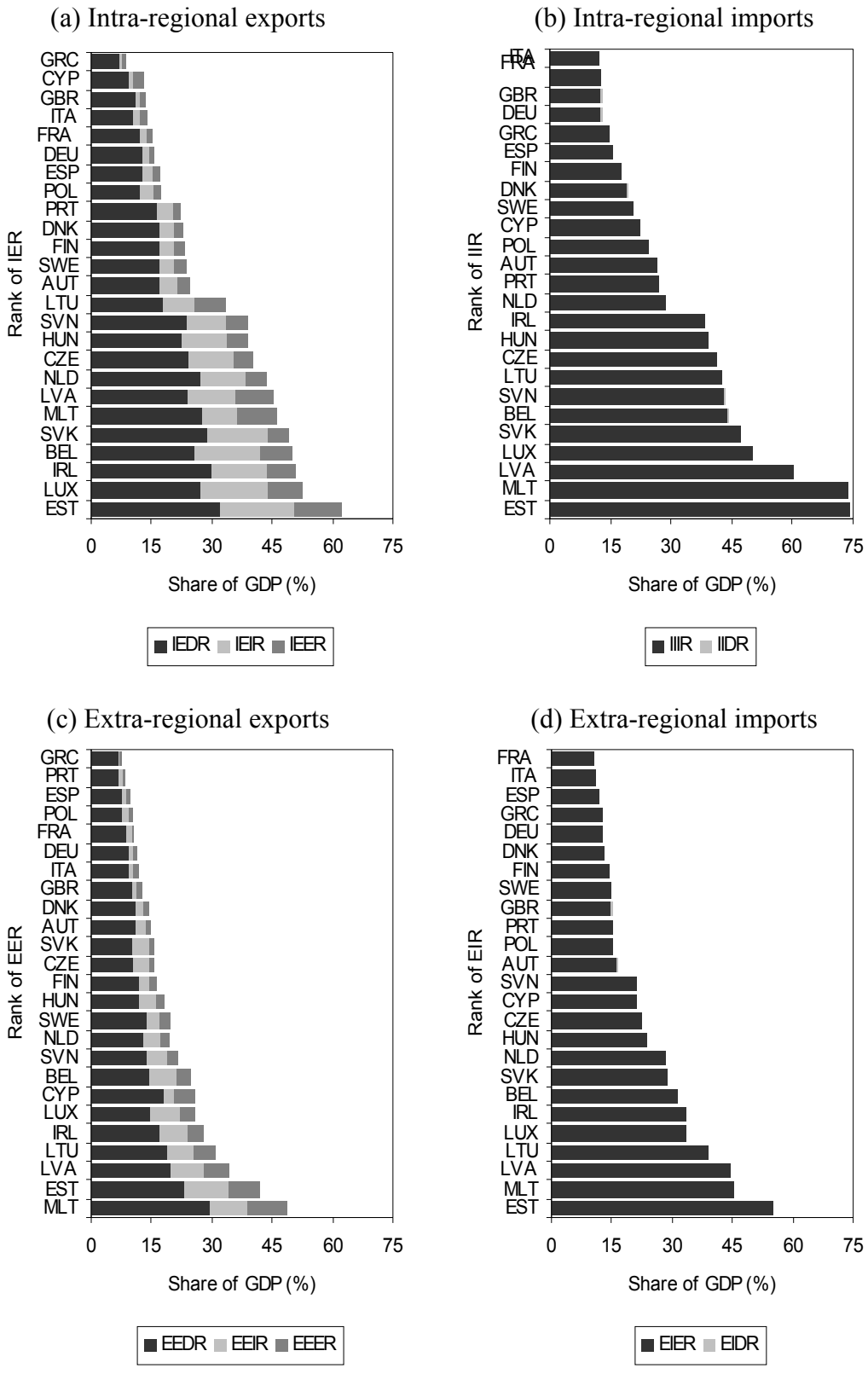
The positions of many countries in the ranking are altered on the export side, but mostly only one or two positions. This is the case because the traditional intra-regional and extra-regional export ratio (IER and EER) increasingly overestimates the effect of trade on the domestic economy the more commodities a country exports in relation to all produced commodities. In more open economies, the focus of firms to re-export imports determines a larger fraction of imports than in less open countries. Firms which redistribute final commodities or process the finishing of imported intermediate commodities employ less domestic factors of production and thus contribute less to national income than other firms which produce the exports mainly with national intermediate commodities in all processing stages.

The measures of actual openness (IEDR and EEDR) are able to model the fact that open countries have more re-exporting firms than closed countries, since this kind of production structure is less able to create income in the domestic economy. This result distinctly indicates that the measures of actual openness explain the same aspects of openness to bilateral trade as the indices of traditional openness do but with more accuracy, which are considerable improvements over many alternative concepts of openness measurement (see Section 3.1 and Harrison, 1996).

Coming back to our previous example of Poland, the country creates less income at home with its exports in relation to the other countries as the traditional openness concept suggests for intra-regional and extra-regional trade (rank changes from 8 to 5 and 4 to 3, respectively). On the import side nearly no changes occur due to a different applied measure of openness. This is because imports of a country include a very low fraction of intermediate products exported by that country. Table 14 indicates that Poland can be regarded as a relatively closed economy, characterized by ranks between 3 and 11.

In the following, we search for *systematic disparities* between the empirical outcomes when different openness concepts are applied. As a starting point, we *visualize* the empirical results gained in the preceding overview. Figure 8 gives a brief visual impression of the empirical realizations of the degrees of openness from Table 13, dependent on the method used. The horizontal axes arrange the 25 members of the European Union in an order increasing by their position within the rank order of the traditional openness measures. The vertical axes display the empirical outcomes of the traditional and actual openness concept, respectively.

Figure 8: Actual and traditional openness of the EU-25, 1997



Source: own calculation based on GTAP (2003)

Figure 8a illustrates for *intra-regional export*, first, that traditional openness to intra-regional trade (IER) consists of actual openness (IEDR) and second, the significance of imported in-

termediate inputs from the integration area (IEIR) and from the trading partners in the rest of the world (IEER). The IEDR measure is lower than the IER measure in all cases. Consequently, the actual openness concept, as a rule, leads to lower measured degrees of openness as compared to the often applied and still popular traditional approach. Let us now once again draw attention to the fact that the IEDR indicator introduced in this paper cannot exceed 100 percent. Following this concept, it is simply not possible to use all an economy's factors of production to exclusively manufacture export products since production factors earn income for the production of tradeables and non-tradeables.

However, in the case of the corresponding IER measure it cannot be excluded that the index indicates a degree of openness that is larger than 100 percent. For example, a country can export more goods and services than it produces for final demand when it serves as an international hub for the exchange of goods between other economies. Secondly, Figure 8a clearly reveals the tendency of the IEDR measure to increase with the IER. This means that the more products the industries of an economy sell to their regional trading partners, the more domestic factors of production the exporting industries and their supplying industries need for production.

Thirdly, Figure 8a points out that the spread between the indicators IEDR and IER increases with the rank order. This spread reflects the imported intermediate products that a country demands to produce exports as a share of the gross domestic product (IEIR and IEER). An increasing gap between the measure of total and actual openness reveals that a more open economy towards regional trade demands domestic factors of production at a relatively lower magnitude. For example, the more companies sell products on international markets, the more firms are confronted with the pressure to reduce costs and the more of them gain experience through exporting final products which let them include relatively more cost-efficient intermediate commodities from abroad than domestic production factors do.

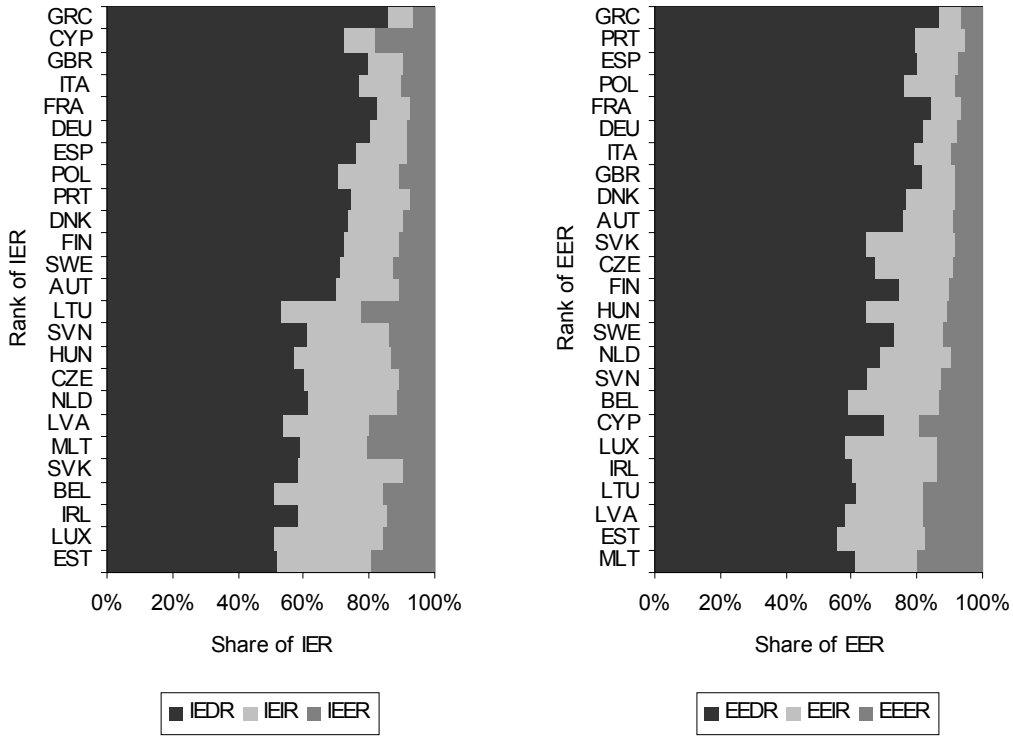
Fourth, the curve of the IEDR index is less steep than the IER measure and, thus, the economies reveal smaller differences with respect to their degree of openness when the value-added based openness concept is applied. This implies that the importance of intra-regional trade is more similar for the countries within an integration area than the conventional approach suggests. Fifth, the jitter of the IEDR measure as well as the emergence of local maxima reflects that some positions of countries within the rank order change due to a shift in the indication of openness. The increasing importance of export-induced imported intermediates products disturbs the rank order.

Figure 8b completes the overview of Table 13 because Figure 8c and Figure 8d, which illustrate the degrees of openness towards extra-regional trade, are interpreted analogously to Figure 8a and 8b, respectively. Figure 8b presents the values of the openness measures to intra-regional trade on the *import side* of the EU members. The horizontal axis of the diagram puts the economies in increasing order of their IIR values. From its vertical axis, the empirical realizations of the IIIR and IIR index can be read off. In addition, the IIDR measure of openness represents the importance of intra-regional import-induced exported intermediate commodities. The diagram discloses that the results of the actual openness concept for the import side correspond, in principle, to those of the traditional openness concept.

Next, the *structure of traditional openness* towards intra-regional and extra-regional trade (IER and EER) is displayed in Figure 9, in addition to Figure 8a and 8c. The horizontal axes of the diagrams put the members of the European Union in increasing order of their IER and EER values, respectively. The vertical axes show the outcomes of the alternative value-added based openness measures expressed as shares of the traditional openness indices.

Figure 9: Structure of traditional openness on the export side of the EU-25, 1997

(a) Intra-regional exports (b) Extra-regional exports



Source: own calculation based on GTAP (2003)

Figure 9 discloses a clear tendency of a decreasing share of production factors embodied in intra-regional and extra-regional *exports* (IEDR and EEDR) the more commodities a country

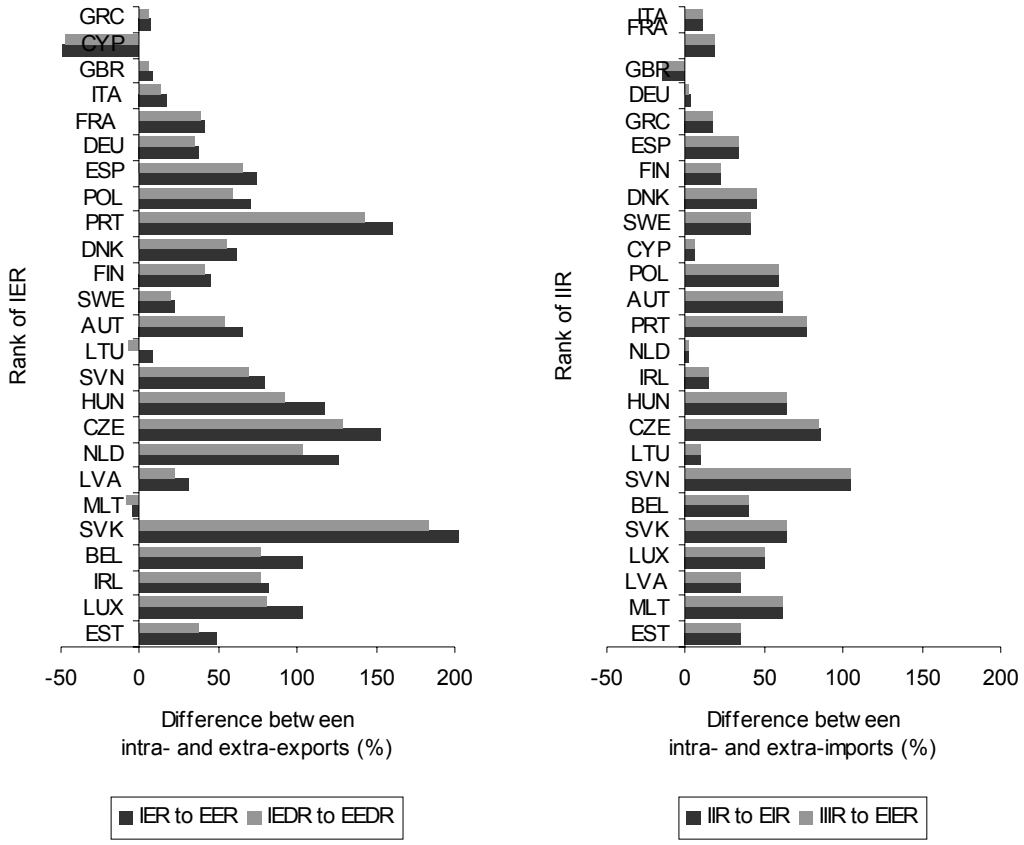
exports in relation to all produced commodities (IER and EER). Consequently, the more open and economy is, the more likely it is that a country's domestic economy production structure consists of an increased share of firms that are focused on the re-export of imported intermediate and final commodities.

Furthermore, the production process of exports tends to entail relatively more intermediate commodities from other member countries of the European Union (IEIR and EEIR) than from trading partners in the rest of the world (IEER and EEER). This result might be explained with the geographic variables of the gravity model of international trade and the reduction of impeding border effects on regional trade as discussed in Section 2.1.2. The most striking outcome of Figure 9 is that the traditional openness concept is not capable of clearly separating intra- and extra-regional trade. Intra-regional (extra-regional) exports consist partly of imported intermediate commodities from extra-regional (intra-regional) trading partners. Consequently, the well-established IER and EER measure overestimate intra-regional and extra-regional openness and since the member states of the European Union trade more with each other, the traditional concept overstates the regional integration of the EU due to trade. The value-added based IEDR and EEDR measures of the new openness concept do not show this drawback. The *import side* of the countries is not illustrated since the degrees of openness towards intra-regional and extra-regional trade alter only slightly when the value-added based measures are applied instead of the established indices.

Figure 10 displays the strong *intra-regional orientation* of the participating members of the European Union more accurately than the previous figure. As before, the horizontal axes of the diagrams order the countries according to their degree of openness to trade based on the traditional concepts (IER and IIR). The relationship between intra-regional trade and extra-regional trade, expressed in percentage, is displayed on the vertical axes.

Figure 10: Relative intra-regional trade orientation of the EU-25, 1997

(a) Export side (b) Import side



Source: own calculation based on GTAP (2003)

Cyprus and the United Kingdom are the most evident outsiders of the intra-regional trade orientation of the EU members. On the export side, the concept of actual openness reveals that the traditional concept understates the significance of extra-regional trading partners. In addition, Figure 10 indicates only a very weak association, if any, between the degree of openness towards intra-regional trade and the degree of intra-regional orientation.

We now proceed to an econometric evaluation of the results via a brief regression analysis. For this purpose, we analyze the indicators of the traditional and actual openness concept with a *frequency distribution analysis* in Table 15. The standard statistical measures also include the Jarque-Bera test of a normality distribution (Jarque and Bera, 1987). As usual, a small probability value leads to a rejection of the null hypothesis that the underlying distribution of the observations is a normal distribution. Given the whole picture, Table 15 confirms the previous outcomes.

Table 15: Frequency distribution analysis of openness of the EU-25, 1997

Sample 1 25 Observations 25	Intra-regional trade				Extra-regional trade			
	Export side		Import side		Export side		Import side	
	IEDR	IER	IIIR	IIR	EEDR	EER	EIER	EIR
Mean	19.344	31.318	32.826	32.897	13.255	19.904	23.600	23.647
Median	17.122	24.382	26.860	26.886	11.667	16.047	21.035	21.041
Maximum	32.160	62.349	74.239	74.248	29.637	48.576	55.100	55.106
Minimum	7.1351	8.2999	12.024	12.145	6.7163	7.7500	10.650	10.750
Range	25.025	54.049	62.215	62.103	22.921	40.826	44.451	44.356
Standard deviation	7.2946	15.741	18.477	18.445	5.4759	10.505	12.425	12.409
Variation coefficient	0.3770	0.5026	0.5629	0.5607	0.4131	0.5278	0.5265	0.5248
Skewness	0.0996	0.2584	0.7927	0.7938	1.2623	1.1522	0.9644	0.9641
Kurtosis	1.7377	1.7212	2.7690	2.7682	4.4564	3.7462	2.9602	2.9569
Jarque-Bera	1.7012	1.9817	2.6740	2.6815	8.8488	6.1111	3.8770	3.8749
Probability	0.4272	0.3713	0.2626	0.2616	0.0120	0.0471	0.1440	0.1440

Source: own calculation based on GTAP (2003)

The results of the *correlation analysis*, as presented in Table 16, validate the first impression gained from Table 14 (rank orders of economies by their degrees of openness based on the traditional and actual openness concept). It characterizes the different rank orders of the 25 participating member countries of the European Union. The analysis incorporates the rank order correlation measure developed by Spearman.

Table 16: Rank order correlation analysis of openness of the EU-25, 1997

Sample 1 25 Observations 25	IER	IIR	EER	EIR
IEDR	0.973846	/	/	/
IIIR	/	1.000000	/	/
EEDR	/	/	0.985385	/
EIER	/	/	/	0.999231

Source: own calculation based on GTAP (2003)

The empirical realizations of the Spearman measure demonstrate that the positions of economies within the rank order scarcely change when the new openness measures are applied instead of the conventional indices. Exports include a larger share of imported intermediates the more an economy trades with other countries since, for example, experiences in exploiting cost-efficient input sources abroad increase. Positions on the import side alter even less than those on the export side or not at all, since the share of exported intermediate commodities in imports is of very low magnitude for the members of the EU.

What additional insights between the relationship of bilateral trade and induced income can a *regression analysis* offer (Greene, 2002)? It would appear that the following specifications of the regression equations are useful in our context:

(146) $\log \text{IEDR}_t = \hat{c}_1 + \hat{c}_2 \log \text{IER}_t + \hat{u}_t, \quad t = 1,2,\ldots,25,$

(147) $\log \text{IIIR}_t = \hat{c}_1 + \hat{c}_2 \log \text{IIR}_t + \hat{u}_t, \quad t = 1,2,\ldots,25,$

(148) $\log \text{EEDR}_t = \hat{c}_1 + \hat{c}_2 \log \text{EER}_t + \hat{u}_t, \quad t = 1,2,\ldots,25,$ and

(149) $\log \text{EIER}_t = \hat{c}_1 + \hat{c}_2 \log \text{EIR}_t + \hat{u}_t, \quad t = 1,2,\ldots,25$

where the index t represents the economy with the number t in the sample. The estimator $\hat{c}_2$ in equation (146) measures the induced percentage change of IEDR_t when IER_t increases by one percent. The other equations have to be interpreted in an analogous fashion. We apply the ordinary least squares (OLS) method after making sure that the usual assumptions of functionality, of no autocorrelation, normality and homoscedasticity of the residuals are valid for the chosen specifications. Table 17 displays the final estimation results.

Table 17: Regression analysis of openness of the EU-25, 1997

Sample 1 25 Observations 25	IER	IIR	EER	EIR
IEDR	0.728012***	/	/	/
IIIR	/	1.005978***	/	/
EEDR	/	/	0.757536***	/
EIER	/	/	/	1.004008***

Source: own calculation based on GTAP (2003)
Note: *** 1 percent significance level

The upper left-hand value of the table supports the result of Figure 9a that the importance of domestic production factors in relation to imported intermediate products to produce exports declines with the level of an economy's participation within the international division of labor. An increase of exports to the integration area in relation to all products for final demand (IER) of 1.0 percent increases the wealth at home for the same amount as the traditional concept suggests. But these exports only lead to an increase of 0.73 percent of the income that domestic production factors earn (IEDR). The value added of exports at home is lower because a part of the induced wealth is transferred abroad through the payment of imported intermediate products. As a consequence, the innovative value-added based openness method is able to quantify the magnitude of the different sources of production inputs by taking production linkages in the exporting sectors and their supplying sectors into account.

For the import side, the regression analysis estimates an increase of the IIIR of 1.0 percent when the IIR raises 1.0 percent. This outcome clearly goes in line with that of Figure 8b, namely that the share of exported intermediate commodities which are manufactured in the

imports is at a similarly low level for the countries and hence independent of the degree of openness to bilateral trade. The measures of openness towards extra-regional trade show similar outcomes as those discussed. Table 18 reproduces Table 17 in detail for the IEDR measure to present all relevant estimation results for a representative dependent variable.

Table 18: Estimation results of the IEDR measure

Dependent Variable	LOG(IEDR)	Sample		1 25
Method	Least Squares	Included observations		25
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.479692	0.078472	6.112917	0.0000
LOG(IER)	**0.728012**	0.023420	31.08534	0.0000
R-squared	0.976751	Mean dependent var		2.886176
Adjusted R-squared	0.975740	S.D. dependent var		0.411983
S.E. of regression	0.064168	Akaike info criterion		-2.577993
Sum squared resid	0.094704	Schwarz criterion		-2.480483
Log likelihood	34.22491	F-statistic		966.2983
Durbin-Watson stat	1.706187	Prob(F-statistic)		0.000000

Source: own calculation based on GTAP (2003)

6.3 Computable general equilibrium analysis with the Global Trade Analysis Project (GTAP) model

The Global Trade Analysis Project (*GTAP*) *model* builds the theoretical framework for forecasting the potential degrees of openness to trade of the Central and Eastern European countries for the year 2008. This is done in two steps. First, a scenario of the economic conditions of the world economy for that year are simulated and then the degrees of openness towards bilateral trade are calculated on the basis of the simulated data and the traditional and value-added based indices of openness. We feel legitimized to combine our input-output model with the computable general equilibrium (CGE) model since both instruments explain economic interdependences that are described by input-output tables. The CGE model expands the input-output model by forecasting changes of variables at a new level of equilibrium in the system due to behavioral equations of market participants.

The GTAP model is a *multi-regional multi-sector computable general equilibrium model*. Hertel (1997) characterizes the GTAP model as an applied model because of its focus on recommendations for economic policy instead of providing new insights in economic key mechanisms as theoretical models tend to. In contrast to partial equilibrium models, the GTAP model (as a general equilibrium model) is able to take into account that resources shift

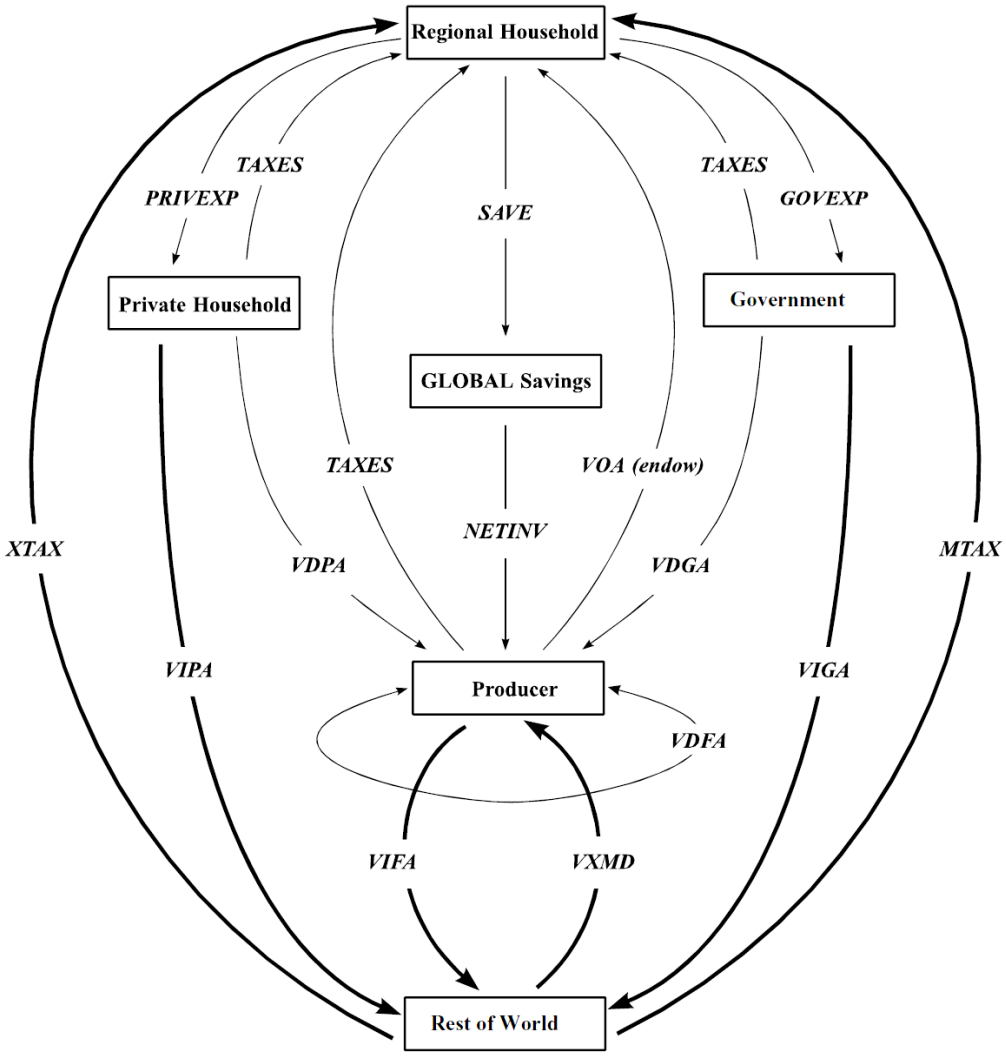
among alternative uses and that feedback effects among income and expenditure exist, since it is built on a sound theoretical structure.

Furthermore, the multi-regional orientation of the model allows the patterns of specialization and trade among regions and the behavior of international trading partners to be endogenously explained, which is not possible with single-regional models. The GTAP model consists of accounting equations and expresses market interactions in value terms. Value flows correspond to real flows, crossing markets in the opposite direction. The model describes the world economy by dividing the world into regions, which consist of a single country or several member countries. Every economy is described in the same way in a national input-output table and the economies are linked together based on trade flows. Consequently, the GTAP model is a global model.

The economic interdependences within an economy and the interrelation of economies are described through interactions of agents on markets where supply equals demand. In the national economy, the regional household's income is linked with spending of private households, government expenditure, and savings. Additionally, firms are connected with income and expenditure. Taxes and subsidies are related to the agents. The association between a region and the foreign countries is described by exports and imports. Finally, a global banking sector ties global savings to investments. The GTAP model explains these economic relationships by means of a system of equations which consists of two different kinds of equation. *Equilibrium relationships* ensure that receipts and expenditures of agents are balanced and that behavioral relationships specify the agents' behavior of optimization (see Brockmeier, 2001, Itakura and Hertel, 2000 and Hertel and Tsigas, 1997). Figure 11 illustrates the model structure by highlighting the most significant equilibrium relationships of an economy.[51]

[51] For a detailed description of the equilibrium and behavioral relationships, which are described in an equation system of more than 100 equations, refer to Hertel and Tsigas (1997) and Huff et al. (1997).

Figure 11: Value flows in the multi-regional multi-sector GTAP model



Source: Brockmeier (2001), p. 16.

An economy's regional household collects all regional income and exhausts the income over final demand by expenditures of private households (*PRIVEXP*), government expenditures (*GOVEXP*), and global savings (*SAVE*). Policy interventions from the government lead to net tax revenues (*TAXES*). These transfers flow from private households, producers, and the government to the regional household.[52] Trading partners in the rest of the world receive payments for selling their commodities to private households (*VIPA*), the government (*VIGA*), and producers (*VIFA*).[53] The revenues of trading partners are exhausted on commodities ex-

[52] Transfers are value flows which include tax revenues and subsidy expenditures. Thus, transfers are taxes minus subsidies. They are not accompanied by flows of goods crossing the market in the opposite direction.

[53] The Armington assumption models the behavior of the trading sector which distinguishes imports by their origin and explains intra-industry trade. Intra-industry trade is trade within the same product categories. The

ported from the single region to the rest of the world (*VXMD*), import taxes (*MTAX*), and export taxes (*XTAX*).

(150) $VIPA + VIGA + VIFA = VXMD + MTAX + XTAX$

Producers pay the value of output (*VOA*) for the use of endowment commodities to the regional household.[54] In addition, the regional income consists of the sum over all kind of net taxes (*TAXES*, *MTAX*, and *XTAX*). Consequently, the regional household links agents in such a way that expenditures cannot exceed regional income.

(151) $VOA + \sum TAXES + MTAX + XTAX = PRIVEXP + GOVEXP + SAVE$

Private households demand domestic commodities (*VDPA*) and imported commodities (*VIPA*).[55] Furthermore, private household pay net taxes (*TAXES*). The government expenditures consist of domestic commodities (*VDGA*), imported commodities (*VIGA*), and net taxes (*TAXES*).[56] Savings are completely used for investment activities of producers (*NETINV*).[57]

(152) $PRIVEXP = VDPA + VIPA + TAXES$

(153) $GOVEXP = VDGA + VIGA + TAXES$

(154) $SAVE = NETINV$

Producers receive payments for selling consumption goods and services to private households (*VDPA*) and to the government (*VDGA*) as well as intermediate inputs to other producers (*VDFA*). Moreover, firms supply the savings sector with investment goods (*NETINV*) and they export commodities to the rest of the world (*VXMD*). The earned revenues of the companies are spent on domestic factors of production (*VOA*), domestic intermediate inputs (*VDFA*), imported intermediate inputs (*VIFA*), and net taxes (*TAXES*).[58]

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elasticity of substitution between domestic goods and imports is assumed to be equal across private households, government, and producers.

[54] Endowment commodities are non-tradable commodities which include, for example, labor, capital, and land.

[55] The CDE (constant difference of elasticity) implicit expenditure function models the constrained optimizing behavior of private consumption.

[56] A Cobb Douglas sub-utility function models the behavior of government consumption. The government pays consumption taxes on commodities.

[57] Current investment is not installed during the investigated period. Therefore, it does not influence the sectors' productivity. Nevertheless, the demand of investment goods affects the production pattern in the period.

[58] This relationship incorporates the assumption of zero profit for producers. Moreover, the production technology is assumed to reveal constant returns to scale and every economic sector produces a single output. These assumptions are also made in the static open Leontief system (see sections 3.2 and 3.3). Technology is weakly

(155) $VDPA + VDGA + VDFA + NETINV + VXMD = VOA + VDFA + VIFA + TAXES$

The theory of the GTAP model computes the simulation results based on the external shock of the model, the description of economic relationships in the GTAP data base, and the GTAP behavioral parameters of the agents (Dimaranan and McDougall, 2002, Gehlhar et al., 1997 and Huff et al., 1997). The GTAP (2003) data base consists of 78 national input-output tables which describe the inter-industry linkages of 57 industries. In addition, the regions are linked among each other based on matrices of bilateral trade, transport, and protection, where the data are value flows which are measured in US dollar terms and effective rates of protection. Endowment commodities of each industry include unskilled labor, skilled labor, capital, land, and natural resources. Table A-1 presents a complete list of the 78 regions and Table A-2 lists the 57 commodities and their specification which are described by the GTAP (2003) data base. In cases where regions consist of more than one nation, the table includes the member countries of the region.

Behavioral parameters consist of the agents' elasticity specifications for each region. These are substitution elasticities in consumption and production, demand elasticities of consumers, transformation elasticities (which determine the degree of mobility of domestic production factors across sectors), and allocation flexibilities of regional investment. Therefore, an empirical analysis with the GTAP model enhances a theoretical one because it allows the significance of the induced economic consequences to be forecasted.

6.4 Scenario of the CEECs' trade integration in the European Union for 2008

6.4.1 The simulation design

The simulation of a scenario of the economic situation of the Central and Eastern European countries, the other member countries of the European Union, and the rest of the world for the year 2008 is performed with the GEMPACK modeling software. Within this scenario, the prospective degrees of openness towards intra- and extra-regional trade are forecasted for the Central and Eastern European countries with the measures of traditional and actual openness.

How does the *GEMPACK modeling software* integrate data and problem specifications to perform economic simulations (see Harrison and Pearson, 2000 and Pearson, 1997, pp. 164 ff.)? The input for the GEMPACK modeling software consists of data files and a command

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separable between intermediate inputs and domestic factors of production. In addition, the behavior of producers is modeled by the constant elasticity of substitution (CES) function.

file. Data files are derived from the GTAP data base and the GTAP behavioral parameters. The regions, commodities, and factors of production are aggregated at a level that fits to the problem. The command file specifies the shocks and closure of the simulation. A shock represents a change in economic development, trade policy, technology, population, factor endowment, and so forth. The model closure indicates the split between exogenous and endogenous variables of the GTAP model.

Several programs support the construction of input for the GEMPACK modeling software. The GTAPAgg aggregating software allows the individual aggregation of data in the GTAP data base. In addition, the RunGTAP specifying software makes it possible to specify shocks, the closure, and the solution method as well as to access the GEMPACK modeling software for solving the specification (see Pearson, Horridge and Pratt, 2001).[59] The solution method gives a linearized representation of non-linear problems using the Johansen, Euler, and Gragg method to compute the endogenous outcomes (see Hertel and Tsigas, 1997, pp. 30 ff.). Based on these files and the theory of the GTAP model, the GEMPACK modeling software calculates the non-linear simulation outcomes, which are the solution file and updated data files. These files describe the economic situation after the simulation, where the solution file includes percentage changes in endogenous variables.

Our *implementation* of the scenario for the model experiment begins with the *aggregation* of the 78 regions, the 57 commodities, and the five factors of production in the GTAP data base. This aggregation of data is necessary to compare the post-simulated degrees of openness towards bilateral trade with the pre-simulated results of traditional and actual openness. Table 19 illustrates the aggregation of data.

[59] The RunGTAP specification software gives a simplified but limited access to the GEMPACK modeling software. This is suitable if the GTAP model does not need to be expanded, for example, to perform dynamic simulations.

Table 19: Aggregation of regions, commodities and production factors for the simulation

Regions	Commodities	Production factors
Czech Republic	Food	Un-skilled Labor
Estonia	Other primary products	Skilled Labor
Hungary	Manufactures	Capital
Latvia	Services	Land
Lithuania		Natural Resources
Poland		
Slovak Republic		
Slovenia		
Rest of EU-25		
Rest of the world		

The scenario consists of the eight Central and Eastern European countries that joined the European Union in May 1, 2004 and the 'Rest of EU-25' region which includes the remaining 17 member countries of the European Union at its last enlargement stage. All other economies are represented by the 'Rest of the World' region. Consequently, the trade integration of each Central and Eastern European country of interest with all residual countries of the European Union is focused on for the cost-benefit analysis of monetary integration in Section 6.5. The economies outside the integration area are taken into account to reveal additional insights for the standard cost-benefit framework. In addition, the aggregations of the commodities and the factors of production are identical to those of the pre-simulated data used to compare the forecasted degrees of openness for the year 2008 with the counterparts of 1997.

Next, the exogenous *shocks* are implemented in the model experiment. They consist of the economic growth of the CEECs, the other participating countries of the EU, and the economies, which form the rest of the world. As a proxy for economic development, the percentage change in the gross domestic product of the regions is chosen. Alternative measures of economic growth are the change of labor use, capital stock, or total factor productivity. For the production of output, the economic development requires the input of resources from the domestic economy of the country, which are intermediate commodities and production factors, as well as from abroad by means of imported intermediate products. The increase of domestic output induces more income and consequently increases the demand for domestic and imported goods and services. In addition, economic growth abroad might raise the foreign residents' demand for exports (see Section 2.1.3 and McDougall and Tyres, 1997). Therefore, economic development might have an impact on the degree of openness towards trade of the Central and Eastern European economies.

The growth of the gross domestic product, measured in annual percentage change of US dollars, is the indicator of economic growth in this study due to the lack of available data for the alternative indices. Table 20 reproduces the estimation of the economic growth of the CEECs, the remaining members of the European Union, and the countries outside this integration area between 1998 and 2008.

Table 20: Estimation of economic growth of the regions for the simulation, 1998-2008

GDP (annual percentage change of US$)	1998	1999	2000	2001	2002	2003e	2004e	2005e	2006e	2007e	2008e	'98-'08e
Czech Republic	7.5	-3.4	-6.5	10.4	22.4	8.8	8.8	8.8	8.8	8.8	8.8	117.8
Estonia	13.3	-0.7	-1.1	7.5	17.8	6.8	6.8	6.8	6.8	6.8	6.8	109.3
Hungary	2.9	2.1	-3.0	11.4	26.8	6.7	6.7	6.7	6.7	6.7	6.7	112.6
Latvia	7.9	9.5	7.4	5.5	11.3	5.7	5.7	5.7	5.7	5.7	5.7	108.5
Lithuania	12.1	-0.8	5.8	6.2	15.0	11.6	11.6	11.6	11.6	11.6	11.6	178.4
Poland	6.4	-2.2	1.7	11.8	7.2	8.8	8.8	8.8	8.8	8.8	8.8	110.1
Slovak Republic	4.4	-8.1	-2.3	3.6	15.8	7.1	7.1	7.1	7.1	7.1	7.1	69.9
Slovenia	7.6	2.5	-9.7	3.8	16.7	6.3	6.3	6.3	6.3	6.3	6.3	74.1
Rest of EU-25	2.8	2.6	3.3	1.6	0.9	2.2	2.2	2.2	2.2	2.2	2.2	27.5
Rest of the world	2.9	3.1	3.8	0.9	2.4	2.6	2.6	2.6	2.6	2.6	2.6	33.0

Source: own calculation based on World Bank (2004)
e: estimated

The period starts with 1998 because the base year of the GTAP (2003) data base is the year 1997. The year 2008 has been chosen as the potential date where the Central and Eastern European countries might be allowed to adopt the euro so long as these economies meet a number of criteria. The CEECs have been member countries of the European Union, the Exchange Rate Mechanism (ERM) II, and the Economic and Monetary Union (EMU) since May 1, 2004. To be included in the euro zone, the CEECs have to enduringly fulfill the Maastricht criteria for several years and they are not allowed to devaluate their currency for two years as member states of the ERM II (see, for example, Backé et al., 2004 and Belke and Hebler, 2002, pp. 209 ff.). The annual change in the the regions' gross domestic product is based on the latest available data, which is the year 2002 (World Bank, 2004). The economic development of the years between 2003 and 2008, which represents the year of the proposed accession of the CEECs to the euro zone, are based on the average growth rates up until the year 2002. The figures in the last column specify the shocks in the model experiment.

Finally, the *closure* is specified for the simulation of the economic effects of the shocks presented. The split between model exogenous and endogenous variables is necessary to build a solvable equation system of the GTAP model. Exogenous variables are given and do not

change by the interplay of the model equations as the endogenous variables do. The following changes of variables are exogenous in the specification: population, slack of saving, profit, income, endowment, capital goods, and capital trade, world price index of primary factors, augmenting technological change, output technological change, factor input technological change, input-neutral shift in the utility function, private and government consumption distribution parameters, saving distribution parameter, tax, and the output of produced commodities. The latter variable is exogenous because it constitutes the place where the economic development of the countries comes into the model as shocks. Finally, the Johansen approach is used for solving the GTAP model. Table A-13 illustrates the implementation of the model experiment with the RunGTAP software.

6.4.2 Results of the simulation and interpretation

The simulation outcomes of the CEECs' accession scenario to the euro zone are presented in Table 21. It displays the *simulated degrees of openness* based on the same traditional and actual openness indices as Table 13 for each Central and Eastern European country that became a member of the Economic and Monetary Union. The results of the six additional value-added based indices are listed in Table A-14.

Table 21: Simulated actual and traditional openness of the CEEC-8, 2008

Simulation	Intra-regional trade				Extra-regional trade			
Percent of GDP	Export side		Import side		Export side		Import side	
Country name	IEDR	IER	IIIR	IIR	EEDR	EER	EIER	EIR
Czech Republic	24.33	40.94	42.99	43.05	10.23	15.60	23.82	23.85
Estonia	32.40	64.61	80.22	80.23	21.73	40.52	58.07	58.08
Hungary	21.77	39.79	41.67	41.72	11.12	18.05	25.66	25.68
Latvia	23.73	45.69	63.96	63.97	17.83	32.09	44.10	44.11
Lithuania	16.88	34.14	45.11	45.12	17.25	30.04	43.24	43.25
Poland	11.64	16.65	25.29	25.33	7.12	9.55	15.91	15.93
Slovak Republic	31.21	54.27	51.65	51.68	9.58	15.16	31.41	31.42
Slovenia	24.06	39.89	44.47	44.49	13.72	21.63	21.77	21.78

Source: simulation results based on GTAP (2003)

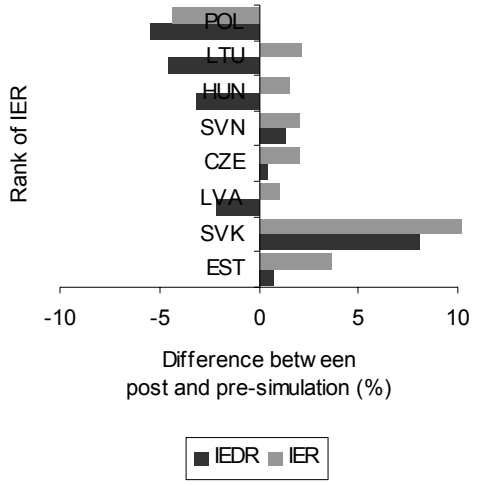
Given the whole picture, the most striking result of Table 21 is that a further integration of trade between the Central and Eastern European countries (CEECs) and the existing members of the European Union and the trading partners in the rest of the world takes place on a similar level in the scenario of 2008 as it does in the year 1997. This result reflects the strong trade integration of the CEECs with the European Union, which the new members had already

achieved before their accession in 2004 via their transformation and re-orientation towards the European Union following the collapse of communism in 1989.

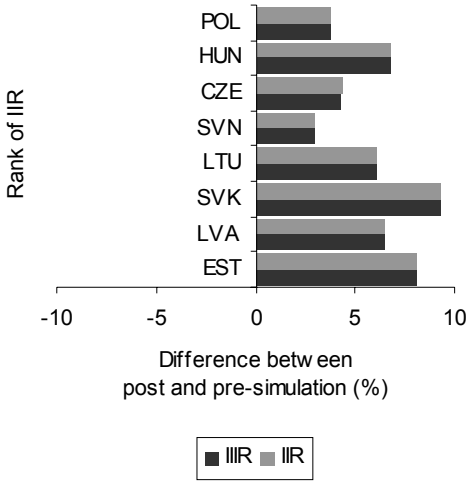
Figure 12 accentuates the estimated *changes* in the degrees of openness towards intra-regional and extra-regional trade of the CEECs for the traditional and actual openness concept. The horizontal axes of the diagrams reflect the rank order of the CEECs by means of their degree of openness to trade based on the traditional openness concepts. On the vertical axes, the differences between the post- and pre-simulated degrees of openness are displayed in percentage.

Figure 12: Estimated changes in the regional trade integration of the CEEC-8, 2008

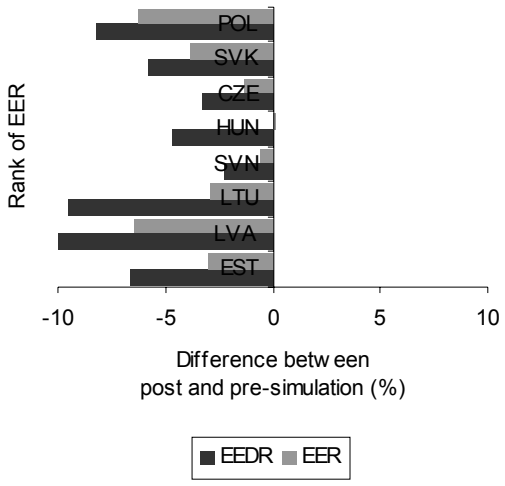
(a) Intra-regional exports



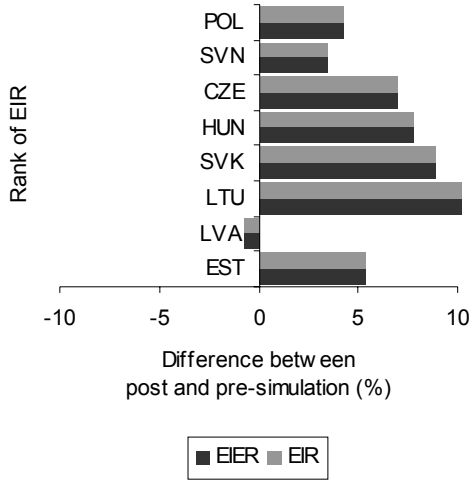
(b) Intra-regional imports



(c) Extra-regional exports



(d) Extra-regional imports



Source: simulation results based on GTAP (2003)

For all openness measures, the deviations of the simulated outcomes from the degrees of openness in the year 1997 are less than 10 percent. The significance of intra-regional and ex-

tra-regional imports increase according to the traditional and actual openness concept (except for Latvia). The traditional IER measure indicates that exports to the European Union might play a slightly more important role for the CEECs in 2008 (except Poland). In all cases, the new IEDR index forecasts a less positive or even a stronger negative change. This could be interpreted as an indicator of the CEECs acting as intermediate input product finishers for the other European Union memebers. This would also explain the likely increase in the importance of imports for the Central and Eastern European economies. In addition, the accentuated change in the European Union members' production processes also explains the likely decline in the significance of extra-regional exports.

The actual openness concept clearly improves the accuracy of the traditional concept in indicating the role of bilateral trade.[60] But are these new insights significant for the CEECs when they are in the position to decide whether they should access the euro zone or not?

6.5 Should the CEECs adopt the euro in the year 2008?

6.5.1 Methodology

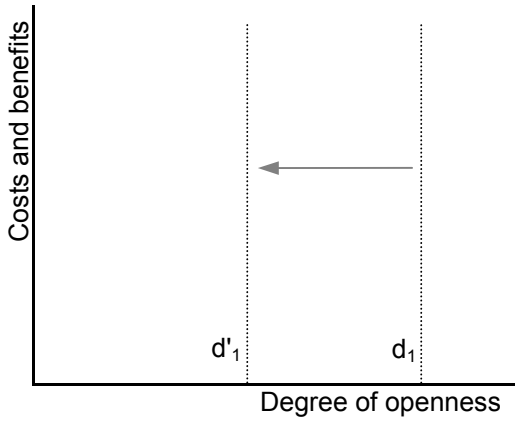
The evaluation of the potential accession of the Central and Eastern European countries to the euro zone in the year 2008 is performed within the standard *cost-benefit analysis of monetary integration*. As pointed out in Section 2.3.3, the degree of openness towards intra-regional trade is – independent from the measurement concept of openness – of high relevance within the cost-benefit framework. Consequently, the theory of optimum currency areas explains the likely association between the degree of openness and the choice of a sound exchange rate regime within an integration area. If the candidate's degree of trade openness towards the member states of a single currency area outperforms the break-even degree of openness then the potential participating country would benefit from abolishing the national currency.

The characterization of actual openness reveals that the traditional measures of openness to trade overestimates the influence of trading partners on the domestic economy of a country. This considerable difference between the outcome of the traditional and actual concept can, at least theoretically, have an impact on the results of the cost-benefit analysis of monetary integration. Figure 13 illustrates the impact of a change in the calculation of the degree of open-

[60] Wang (2004b) reveals similar results based on a scenario with less annual growth rates of gross domestic product in the other member countries of the European Union without the CEECs and in the rest of the world.

ness to intra-regional trade from the traditional to actual openness for an economy that decides to peg its currency to a fixed exchange rate area.[61]

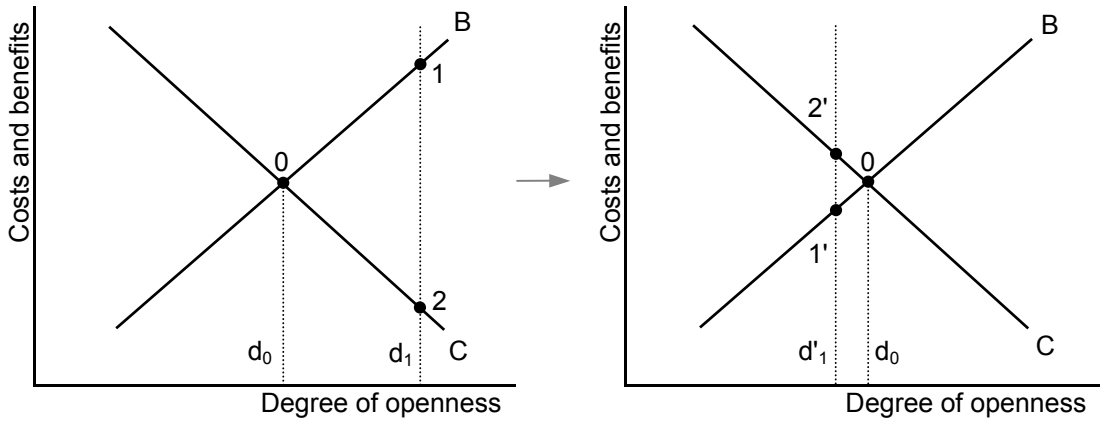
Figure 13: Stylized impact of actual openness on the degree of openness



In a very simplified stylized fashion, the diagram demonstrates the repositioning of the currently measured degree of openness from d_1 to the lower level d'_1 when a value-added based index of openness is applied (instead of an established openness proxy) to indicate the significance of the member economies within an integration area for the possible participant country.

If we add the costs and benefits curves in a diagram for the traditional openness and in a separate diagram for the actual openness, then it becomes apparent that a reassessment of a candidate country's decision to adopt the currency of a single currency area might be necessary. Figure 14 illustrates this straightforward outcome.

Figure 14: Stylized impact of actual openness on the assessment of monetary integration



(a) Traditional openness concept (b) Actual openness concept

[61] The following diagrams use the same cost-benefit framework as in Figure 1. For a description of their construction refer to Section 2.3.3.

It is assumed that the cost and benefit functions of monetary integration are linear, that they reflect the view of the EC Commission (1990), and that the costs respond to asymmetric shocks and not the opposite Krugman (1993, 1991) view. In addition, the assumption is made that a change in the concept of measuring openness does not influence the cost and benefit functions because the traditional and the actual openness indices describe the same economic conditions of the potential participating country.

The diagram picks up the country's break-even degree of openness, represented by d_0, of Figure 1. Figure 14a displays a scenario in which the degree of openness d_1 is derived from the traditional openness concept. The measured degree of openness towards intra-regional trade is higher than the break-even degree of openness d_0. Since the benefits of joining the fixed exchange rate area in point 1 outweigh the costs in point 2, the result of this cost-benefit analysis of monetary integration is a recommendation for the economy to peg its currency to the fixed exchange rate area. On the other hand, Figure 14b draws another conclusion for the same potential candidate that faces an unaltered economic environment. A change in the indication of trade openness towards the actual openness concept leads, in this example, to an *opposite recommendation* than with the established measures of openness. In the scenario of Figure 14b, the degree of openness d'_1 is lower than the break-even degree of openness d_0. The benefits accruing from entering the currency area in point 1' are less than the costs in point 2'. Consequently, the economy should not join the fixed exchange rate area.

Thus, on the whole, outcomes of the common cost-benefit analysis of monetary integration based on value-added based measures of trade openness might deviate from those analysis results given on the basis of the traditional openness concept. This seems to be quite an important policy conclusion from our derivation of value-added based indices.

In addition to openness indices towards intra-regional trade, *measures of extra-regional trade openness* are included in the analysis of the potential accession of the CEECs to the euro zone in the year 2008. A comparison of the similarity of intra- and extra-regional trade patterns and levels of the potential aspirant country and the member nations of the euro zone might be a valid simplified method to assess whether or not the currency adoption of the potential entrant might result in positive net benefits for the domestic economy.

Contrary to this, the common cost-benefit analysis of monetary integration postulates to empirically calculate the net benefits (see Section 2.3.3). The critical levels are necessary to exactly assess the influence of the value-added based openness measures on the outcomes of the

cost-benefit analysis for an economy. Only a sound assessment of the break-even degree of openness based on the precise identification of the costs curve and the benefits curve is able to reveal whether, in the concrete economic situation of a country, the benefits of joining the fixed exchange rate area surpass the costs. Since this contribution emphasizes the calculated degree of openness and not the break-even degree of openness, the *simplified method* is chosen in the following comparative analysis. Gros and Steinherr (1997) empirically estimate the effect of openness on the costs of fixing the national currency.

6.5.2 Results of the analysis of monetary integration and interpretation

Table 22 presents the simulated degrees of openness towards intra-regional and extra-regional trade for the eight Central and Eastern European countries of interest ('CEEC-8') calculated with the traditional and actual openness concept by means of standard statistical measures. In addition, the table lists the outcomes for the 12 participating members of the euro zone, denoted as 'Euro-12', for the base year 1997.

Table 22: Simulated regional trade integration of CEEC-8 compared to Euro-12

	Intra-regional trade						Extra-regional trade					
	Export side			Import side			Export side			Import side		
Percent of GDP	IEDR	IER	IEDR to IER (%)	IIIR	IIR	IIIR to IIR (%)	EEDR	EER	EEDR to EER (%)	EIER	EIR	EIER to EIR (%)
CEEC-8 (post-simulation)												
Mean	23.3	42.0	56.7	49.4	49.4	99.9	13.6	22.8	61.9	33.0	33.0	99.9
Maximum	32.4	64.6	69.9	80.2	80.2	100.0	21.7	40.5	74.6	58.1	58.1	100.0
Minimum	11.6	16.7	49.4	25.3	25.3	99.8	7.1	9.5	53.6	15.9	15.9	99.9
Standard deviation	6.4	13.2	6.3	15.4	15.4	0.1	4.6	9.8	6.2	13.3	13.3	0.0
Euro-12 (pre-simulation)												
Mean	18.0	28.1	70.2	25.0	25.1	99.4	11.0	15.7	74.0	19.2	19.3	99.5
Maximum	30.0	52.5	86.0	50.3	50.3	100.0	16.9	28.0	86.7	33.4	33.4	100.0
Minimum	7.1	8.3	51.4	12.0	12.1	97.9	6.7	7.7	58.1	10.6	10.8	98.4
Standard deviation	7.2	15.7	11.2	12.6	12.6	0.6	3.2	6.8	9.6	9.0	9.0	0.5

Source: own calculation and simulation results based on GTAP (2003)

The traditional openness measures on the export and import side state that the CEEC-8 are significantly more regionally integrated due to trade than the Euro-12. Similarly, the actual openness indices on the export side reveal that the CEEC-8 are more open towards the integration area than the Euro-12 but at a lower and more similar level. Table 23 highlights the intra-regional trade orientation of both country groups, expressed by means of intra-regional trade as a share of extra-regional trade in percentage, for the traditional and actual openness

indices on both the export and import side. The summary outcomes are presented with statistical measures. The table reveals the same outcomes as the previous table in a more concise way.

Table 23: Relative intra-regional trade orientation of CEEC-8 compared to Euro-12

	Export side		Import side	
Intra-trade as share of extra-trade in percent	IER to EER	IEDR to EEDR	IIR to EIR	IIIR to EIER
CEEC-8 (post-simulation)				
Mean	101.9	84.8	57.3	57.3
Maximum	258.0	225.7	104.3	104.2
Minimum	13.6	-2.1	4.3	4.3
Standard deviation	72.9	66.0	27.7	27.7
Euro-12 (pre-simulation)				
Mean	72.1	61.4	29.3	29.1
Maximum	160.2	142.9	76.9	76.8
Minimum	7.1	6.2	1.6	1.4
Standard deviation	43.7	36.8	22.8	22.9

Source: own calculation and simulation results based on GTAP (2003)

Should the Central and Eastern European countries adopt the euro in the year 2008 if they meet the Maastricht criteria and the non-devaluation condition in the ERM II for two years? In a situation where the degree of openness towards intra-EU trade is higher than the break-even degree of openness, the CEECs should abolish their national currencies. The result that traditional measures of openness overstate the influence of trade integration on the domestic economy potentially affects the outcome of the cost-benefit analysis of monetary integration. Furthermore, traditional openness suggests that CEECs are significantly more integrated in the European Union than the member countries of the euro zone, whereas according to actual openness, the regional integration of the CEECs and the members of the euro zone is relatively similar. The Central and Eastern European economies are, however, still further integrated.

If the degree of openness becomes even lower than the minimum break-even degree of openness, the recommendation for a Central and Eastern European country to peg its currency to the euro zone might have to be revised. All Central and Eastern European economies are more open towards the member states of the European Union than the member countries of the euro zone, independent from the the degree of openness calculation. This means that if the twelve participating countries in the euro zone gain net benefits due to the abolishment of their national currency then the *CEECs might also benefit* from adopting the euro in the year 2008.

7. Conclusions and outlook

The concept of trade openness is broadly applied as a potential predictor in numerous empirical studies, despite the fact that no commonly accepted approach of measuring openness has been developed. The most widely applied ('traditional') openness indices are not able to accurately calculate the degree of trade openness. For example, the export ratio, which relates the value of exports to the gross domestic product, can exceed 100 percent because trade is stated in gross terms, while the gross domestic product is expressed in value-added terms. This implies a negative value of domestic non-tradeables. Many openness concepts try to *adjust* the traditional measures of openness with an aim to increase the quality of indication, but most of these attempts show a poor correlation with the traditional concept. This might indicate that the alternative approaches capture different aspects of trade openness.

This study presents the development of innovative value-added based ('actual') measures of openness towards international and bilateral trade, respectively. They are based on a multi-regional input-output analysis of income effects due to trade. In clear contrast to the mainstream, the actual openness concept corrects the traditional concept by expressing trade in value-added terms instead of gross terms. All surveyed alternative openness approaches disregard the fact that the general interpretation of the traditional concept is misleading. Traditional openness measures do not take the international redistribution of income generated by trade into account. This means, for example, that the export ratio overstates the potency of a country to build a surplus in output at home because imported intermediate commodities that are employed in the process of production of exported commodities generate income abroad. The import ratio, which expresses imports as a share of the gross domestic product, overstates the dependency on imports since residents have to spend a lower portion of their income to purchase imports from abroad. Imports are partly produced with intermediate commodities delivered by the country that creates income for its production factors.

The innovative actual openness concept is able to reflect the different structures of production among countries since the value-added created by trade is forecasted on the foundation of a sound theory of production. This makes it possible to quantify the effects of the interdependences of industries within an economy. Open economies consist of more firms that import intermediate of final commodities for the purpose of their re-export than closed economies. These firms, which redistribute final commodities or process the finishing of imported intermediate commodities, employ less domestic factors of production and thus contribute less to national income than other firms which produce exports primarily with national intermediate

commodities in all processing stages. This means that the more open economies are, the smaller the proportion of domestic production factors in the production process of exports is and the additional income earned from the selling of exports is again transferred abroad by means of imported intermediate commodities employed in exports. None of the approaches of openness measurement reviewed include this aspect of international trade.

The expression of trade in value-added terms, based on the theory of production, is an outstanding feature of the new actual openness concept, which is superior to the accuracy of traditional measures of indicating trade openness. In addition to this, the strong and statistically significant positive correlation between degrees of openness calculated by the actual openness concept and those calculated by the traditional concept indicate that both approaches represent the same aspects of trade openness. Most of the alternative methods lack this feature.

There are only a limited number of degrees of trade openness *data bases* based on concepts of openness measurement that differ to the traditional approach. They only include data for a few countries, which mainly consist of industrialized economies, and/or only for a small number of years. Consequently, the outcome of empirical tests of potential associations between the degree of openness and other variables might be, in some cases, hampered. In clear contrast to this, the new data base of the degrees of openness to international trade based on the actual openness concept consists of roughly 20,000 entries. The data base represents the degrees of trade openness of 66 countries, which range from developing to highly industrialized economies, for a period of 14 years (1989 to 2002). This feature of the study is a strong contribution to economic research since it makes the improved adequacy in the indication of trade openness available to many different empirical analyses.

The *empirical re-evaluation* of the association between the degree of openness and the choice of exchange rate regimes in this contribution is based on regression analysis which contains up to 525 observations of 54 countries between the years 1989 and 2000. The test results indicate a positive and statistically significant correlation between trade openness and the likelihood of choosing a fixed exchange rate regime. This is clearly in line with the findings of the mainstream in the empirical research. In addition, in all cases the actual openness concept outperforms the traditional openness concept in predicting the exchange rate regime selection.

Subsequently, the analysis of the relationship between the degree of trade openness and the selection of exchange rate regimes is extended to adhere to the ongoing debate in economic research as to when the Central and Eastern European countries (CEECs), which became

member countries of the Economic and Monetary Union in May 1, 2004, are able to adopt the euro as their national currency. The results of a computable general equilibrium analysis suggest that if the Central and Eastern European countries meet the Maastricht criteria and the non-devaluation condition in the Exchange Rate Mechanism II for two years, they could gain net benefits from the abolishment of their national currencies in the year 2008.

The *recommendations* for further work include the update of the data base of the degrees of openness for the year 2003 as well as the addition of other integration areas besides just the European Union with its 25 member countries. Furthermore, the empirical analysis might be improved by including alternative determinants of the choice of exchange rate regimes to the degree of openness in the test specification. The usage of estimation methods other than the ordinary least squares method, such as the logit or probit method, might also reveal additional insights. For the cost-benefit analysis of monetary integration, the evaluation of the association between the degree of openness and the choice of exchange rate arrangements may be improved by calculating the minimum degree of openness that is necessary for a potential entrant to a single currency union to benefit from the abolishment of the national currency.

Appendix

Table A-1: List of regions within the GTAP 5.4 Data Base

Region	Included regions
Australia	Heard Islands, McDonald Islands, Norfolk Island
New Zealand	
China	
Hong Kong	
Japan	
Korea	
Taiwan	
Indonesia	East Timor
Malaysia	
Philippines	
Singapore	
Thailand	
Vietnam	
Bangladesh	
India	
Sri Lanka	
Rest of South Asia	Bhutan, Maldives, Nepal, Pakistan
Canada	
United States of America	American Samoa, Guam, Northern Mariana Islands, Puerto Rico, United States Virgin Islands
Mexico	
Central America and the Caribbean	Antigua, Barbuda, Aruba, Bahamas, Barbados, Belize, British Virgin Islands, Cayman Islands, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Montserrat, Netherlands Antilles, Nicaragua, Panama, Saint Christopher, Saint Nevis, Saint Lucia, Saint Vincent, Grenadines, Trinidad, Tobago, Turks and Caicos Islands
Colombia	
Peru	
Venezuela	
Rest of Andean Pact	Bolivia, Ecuador
Argentina	
Brazil	
Chile	
Uruguay	
Rest of South America	Guyana, Paraguay, Surinam
Austria	
Belgium	
Denmark	
Finland	
France	
Germany	
United Kingdom	Channel Islands, Isle of Man
Greece	
Ireland	
Italy	
Luxembourg	
Netherlands	
Portugal	
Spain	
Sweden	
Switzerland	
Rest of EFTA	Iceland, Liechtenstein, Norway, Svalbard and Jan Mayen Islands

Table A-1: List of regions within the GTAP 5.4 Data Base, continued

Region	Included regions
Albania	
Bulgaria	
Croatia	
Czech Republic	
Hungary	
Malta	
Poland	
Romania	
Slovakia	
Slovenia	
Estonia	
Latvia	
Lithuania	
Russian Federation	
Former Soviet Union	Armenia, Azerbaijan, Belarus, Georgia, Kazakstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan
Cyprus	
Turkey	
Rest of Middle East	Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, Yemen, Yemen Democratic
Morocco	Western Sahara
Rest of North Africa	Algeria, Egypt, Libya, Tunisia
Botswana	
Rest of SACU	Lesotho, Namibia, South Africa, Swaziland
Malawi	
Mozambique	
Tanzania	
Zambia	
Zimbabwe	
Rest of Southern Africa	Angola, Mauritius
Uganda	
Rest of Sub-Saharan Africa	Benin, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Cote d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Mali, Mauritania, Mayotte, Niger, Nigeria, Rwanda, Sao Tome, Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo, Zaire
Rest of World	Afghanistan, Albania, Andorra, Bermuda, Bosnia, Herzegovina, British Indian Ocean Territories, Brunei, Burma, Cambodia, Christmas Island, Cocos (Keeling) Islands, Cook Islands, Croatia, Falkland Islands, Faroe Islands, Fiji, French Polynesia, Gibraltar, Greenland, Johnston Island, Kiribati, Laos, Macao, Macedonia, Malta, Marshall Islands, FS Micronesia, Mongolia, Nauru, New Caledonia, Niue, North Korea, Pacific Islands, Palau, Papua New Guinea, Pitcairn Islands, Saint Helena, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, Wake Island, Wallis, Futura Islands, Western Samoa, Yugoslavia, French Guiana, Guadeloupe, Vatican Holy See, Martinique, Monaco, Reunion, Saint Pierre and Miquelon San Marino

Source: GTAP (2003) and McDougall und Dimaranan (2002), pp. 8-3 ff.

Table A-2: List of commodities within the GTAP 5.4 Data Base

Commodities	Specification
Paddy Rice	rice, husked and unhusked
Wheat	wheat and meslin
Other Grains	maize (corn), barley, rye, oats, other cereals
Vegetables and Fruit	vegetables, fruit vegetables, fruit and nuts
Oil Seeds	oil seeds and oleaginous fruit; copra
Cane and Beet	sugar cane and sugar beet
Plant Fibres	cotton, flax, hemp, sisal and other raw vegetable materials used in textiles
Other Crops	live plants; cut flowers and flower buds; flower seeds and fruit seeds; vegetable seeds, beverage and spice crops, unmanufactured tobacco, cereal straw and husks, unprepared, whether or not chopped, ground, pressed or in the form of pellets; swedes, mangolds, fodder roots, hay, lucerne (alfalfa), clover, sainfoin, forage kale, lupines, vetches and similar forage products, whether or not in the form of pellets, plants and parts of plants used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal or similar purposes, sugar beet seed and seeds of forage plants, other raw vegetable materials
Cattle	cattle, sheep, goats, horses, asses, mules, and hinnies; and semen thereof
Other Animal Products	swine, poultry and other live animals; eggs, in shell (fresh or cooked), natural honey, snails (fresh or preserved) except sea snails; frogs' legs, edible products of animal origin n.e.c., hides, skins and furskins, raw , insect waxes and spermaceti, whether or not refined or colored
Raw Milk	
Wool	wool, silk, and other raw animal materials used in textile
Forestry	forestry, logging and related service activities
Fishing	hunting, trapping and game propagation including related service activities, fishing, fish farms; service activities incidental to fishing
Coal	mining and agglomeration of hard coal, lignite and peat
Oil	extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)
Gas	extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)
Other Mining	mining of metal ores, uranium, gems. other mining and quarrying
Cattle Meat	fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules, and hinnies. raw fats or grease from any animal or bird
Other Meat	pig meat and offal. preserves and preparations of meat, meat offal or blood, flours, meals and pellets of meat or inedible meat offal; greaves
Vegetable Oils	crude and refined oils of soya-bean, maize (corn),olive, sesame, ground-nut, olive, sunflower-seed, safflower, cotton-seed rape, colza, mustard, coconut palm, palm kernel, castor, tung jojoba, babassu and linseed, perhaps partly or wholly hydrogenated,inter-esterified, re-esterified or elaidinised; also margarine and similar preparations, animal or vegetable waxes, fats and oils and their fractions, cotton linters, oil-cake and other solid residues resulting from the extraction of vegetable fats or oils; flours and meals of oil seeds or oleaginous fruits, except those of mustard; degras and other residues resulting from the treatment of fatty substances or animal or vegetable waxes
Milk	dairy products
Processed Rice	rice, semi- or wholly milled
Sugar	
Other Food	prepared and preserved fish or vegetables, fruit juices and vegetable juices, prepared and preserved fruit and nuts, all cereal flours, groats, meal and pellets of wheat, cereal groats, meal and pellets n.e.c., other cereal grain products (including corn flakes), other vegetable flours and meals, mixes and doughs for the preparation of bakers' wares, starches and starch products; sugars and sugar syrups n.e.c., preparations used in animal feeding, bakery products, cocoa, chocolate and sugar confectionery, macaroni, noodles, couscous and similar farinaceous products, food products n.e.c.

Table A-2: List of commodities within the GTAP 5.4 Data Base, continued

Commodities	Specification
Beverages and Tobacco	
Textiles	textiles and man-made fibres
Wearing Apparel	clothing, dressing and dyeing of fur
Leather	tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear
Lumber	wood and products of wood and cork, except furniture; articles of straw and plaiting materials
Paper and Paper Products	includes publishing, printing and reproduction of recorded media
Petroleum and Coke	coke oven products, refined petroleum products, processing of nuclear fuel
Chemical Rubber Products	basic chemicals, other chemical products, rubber and plastics products
Non-Metallic Minerals	cement, plaster, lime, gravel, concrete
Iron and Steel	basic production and casting
Non-Ferrous Metals	production and casting of copper, aluminium, zinc, lead, gold, and silver
Fabricated Metal Products	Sheet metal products, but not machinery and equipment
Motor Vehicles	cars, lorries, trailers and semi-trailers
Other Transport Equipment	
Electronic Equipment	office, accounting and computing machinery, radio, television and communication equipment and apparatus
Other Machinery and Equipment	electrical machinery and apparatus n.e.c., medical, precision and optical instruments, watches and clocks
Other Manufacturing	includes recycling
Electricity	production, collection and distribution
Gas Distribution	distribution of gaseous fuels through mains; steam and hot water supply
Water	collection, purification and distribution
Construction	building houses factories offices and roads
Trade	all retail sales; wholesale trade and commission trade; hotels and restaurants; repairs of motor vehicles and personal and household goods
Other Transport	road, rail; pipelines, auxiliary transport activities; travel agencies
Water Transport	
Air Transport	
Communications	post and telecommunications
Other Financial Intermediation	includes auxiliary activities but not insurance and pension funding (see next)
Insurance	includes pension funding, except compulsory social security
Other Business Services	real estate, renting and business activities
Recreation and Other Services	recreational, cultural and sporting activities, other service activities; private households with employed persons (servants)
Other Services (Government)	public administration and defense; compulsory social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
Dwellings	ownership of dwellings (imputed rents of houses occupied by owners)

Source: McDougall und Dimaranan (2002), pp. 8-9 ff.

Table A-3: Aggregation of commodities for the calculation of the degrees of openness

Commodity	Included commodities
Food	Paddy rice, Wheat, Cereal grains nec, Vegetables, fruit, nuts, Oil seeds, Sugar cane, sugar beet, Crops nec, Bovine cattle, sheep and goats, horses, Animal products nec, Raw milk, Fishing, Bovine meat products, Meat products nec, Vegetable oils and fats, Dairy products, Processed rice, Sugar, Food products nec, and Beverages and tobacco products
Other primary products	Plant-based fibers, Wool, silk-worm cocoons, Forestry, Coal, Oil, Gas, and Minerals nec
Manufactures	Textiles, Wearing apparel, Leather products, Wood products, Paper products, publishing, Petroleum, coal products, Chemical, rubber, plastic products, Mineral products nec, Ferrous metals, Metals nec, Metal products, Motor vehicles and parts, Transport equipment nec, Electronic equipment, Machinery and equipment nec, and Manufactures nec
Services	Electricity, Gas manufacture, distribution, Water, Construction, Trade, Transport nec, Water transport, Air transport, Communication, Financial services nec, Insurance, Business services nec, Recreational and other services, Public Administration, Defense, Education, Health, and Dwellings

Table A-4: Openness based on the ER_i measure of 56 countries, 1989-2002, % of current GDP

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	Food	6.88	4.94	3.80	3.25	3.06	3.17	4.05	4.54	4.42	4.52	4.11	4.09	4.45	11.42
	Other primary products	0.91	1.06	0.63	0.61	0.64	0.84	1.20	1.47	1.33	0.96	1.19	1.83	1.88	4.90
	Manufactures	4.71	2.77	1.89	1.47	1.83	2.09	2.89	2.73	3.26	3.35	2.92	3.33	3.57	8.58
	Services	2.73	1.60	1.14	1.25	1.24	1.25	1.42	1.54	1.49	1.52	1.55	1.62	1.58	2.82
	Total	15.23	10.37	7.47	6.58	6.77	7.35	9.56	10.28	10.50	10.35	9.77	10.88	11.48	27.71
Australia	Food	2.90	2.95	2.81	3.06	3.47	3.55	3.26	3.73	3.79	3.53	3.45	3.60	3.86	3.69
	Other primary products	4.00	4.14	4.53	4.62	4.30	3.92	4.01	3.98	4.31	4.23	3.62	4.80	5.07	4.58
	Manufactures	5.29	5.74	5.91	6.01	6.29	6.32	6.98	6.83	6.99	7.28	6.75	8.05	8.26	7.60
	Services	2.80	3.17	3.35	3.49	3.82	4.00	4.21	4.36	4.35	4.25	4.21	4.69	4.42	4.25
	Total	15.00	16.00	16.60	17.18	17.88	17.79	18.46	18.91	19.45	19.29	18.03	21.13	21.61	20.13
Austria	Food	0.92	0.85	0.79	0.79	0.77	0.85	1.01	1.13	1.46	1.53	1.76	1.93	2.16	2.29
	Other primary products	1.43	1.38	1.12	1.02	0.94	1.08	1.04	1.03	1.16	1.09	1.30	1.51	1.72	1.91
	Manufactures	22.49	23.31	22.43	21.60	20.21	20.65	22.49	22.98	26.44	27.75	28.48	32.43	33.67	34.37
	Services	14.02	14.10	14.87	14.15	14.17	13.80	13.48	14.43	14.19	13.83	14.75	16.48	17.50	16.96
	Total	38.86	39.64	39.22	37.56	36.09	36.38	38.02	39.58	43.26	44.19	46.30	52.35	55.05	55.52
Bangladesh	Food	0.86	0.79	0.69	0.73	0.91	1.18	1.03	1.00	0.96	0.84	..	..	0.91	..
	Other primary products	0.39	0.45	0.41	0.37	0.31	0.21	0.30	0.24	0.35	0.22	..	..	0.18	..
	Manufactures	3.60	4.30	4.36	5.52	6.47	7.29	8.50	8.63	10.13	10.59	..	..	11.95	..
	Services	0.99	0.98	1.11	1.24	1.31	1.24	1.24	0.55	0.63	0.57	0.58	0.60	0.52	0.64
	Total	5.84	6.53	6.57	7.86	9.00	9.92	11.07	10.41	12.07	12.23	12.46	14.19	13.56	13.45
Belgium	Food	..	..	..	..	..	..	..	..	7.38	..	7.70	8.06	8.31	..
	Other primary products	..	..	..	..	..	..	..	..	3.11	..	3.25	5.25	4.82	..
	Manufactures	..	..	..	..	..	..	..	..	60.88	..	63.57	72.79	73.97	..
	Services	12.94	13.49	14.10	13.93	14.46	16.16	12.14	12.26	13.91	14.62	17.57	21.24	21.34	..
	Total	76.35	73.34	72.47	68.48	73.78	78.67	76.43	77.84	85.28	87.12	92.09	107.34	108.44	..
Brazil	Food	2.11	1.89	1.95	2.35	2.24	2.34	1.92	1.89	2.08	1.96	2.66	2.21	3.27	..
	Other primary products	0.46	0.38	0.37	0.45	0.42	0.42	0.41	0.29	0.28	0.29	0.49	0.60	0.91	..
	Manufactures	5.09	4.48	5.42	6.37	6.15	5.20	4.27	3.98	4.20	4.24	5.88	6.47	7.40	..
	Services	0.68	0.80	0.80	1.02	0.89	0.88	0.85	0.57	0.68	0.90	1.29	1.51	1.74	1.95
	Total	8.35	7.55	8.55	10.19	9.70	8.85	7.46	6.73	7.24	7.39	10.33	10.79	13.32	..
Canada	Food	1.86	2.03	2.05	2.34	2.24	2.44	2.65	2.86	2.97	2.95	2.72	2.66	2.96	2.82
	Other primary products	4.52	4.47	4.30	4.63	5.28	5.87	6.39	6.51	6.41	5.62	5.96	8.09	7.87	6.87
	Manufactures	15.91	15.79	15.22	16.53	18.63	21.38	23.97	24.04	24.71	26.68	27.94	28.45	26.61	25.59
	Services	3.07	3.20	3.33	3.51	3.82	4.17	4.37	4.73	4.89	5.44	5.42	5.45	5.34	5.08
	Total	25.36	25.50	24.90	27.00	29.96	33.86	37.38	38.16	38.99	40.70	42.04	44.65	42.78	40.36
Chile	Food	6.65	6.63	7.12	6.91	5.91	6.20	6.02	6.43	6.12	6.49	6.70	6.42	7.55	..
	Other primary products	2.47	2.53	2.25	2.31	2.21	2.62	3.15	2.24	2.24	2.13	2.43	2.97	3.36	..
	Manufactures	20.21	18.44	16.43	14.66	12.57	13.97	15.36	14.22	15.42	13.69	14.42	16.03	16.93	..
	Services	5.37	5.90	5.95	5.44	5.49	5.42	4.98	5.09	5.05	5.28	5.17	5.28	6.06	6.05
	Total	34.70	33.51	31.75	29.32	26.17	28.20	29.52	27.99	28.82	27.59	28.72	30.71	33.91	34.57
China	Food	2.15	2.26	2.36	2.31	2.31	2.25	1.76	1.52	1.45	1.29	1.18	1.26	1.23	1.28
	Other primary products	2.04	2.11	1.80	1.58	1.38	1.22	1.12	1.01	1.06	0.76	0.71	0.98	0.92	0.87
	Manufactures	11.15	13.15	14.93	16.41	17.55	18.84	18.39	15.96	17.86	17.40	17.78	20.82	20.80	23.60
	Services	1.30	1.62	1.82	2.18	2.55	3.02	2.63	2.52	2.73	2.53	2.64	2.79	2.84	3.11
	Total	16.64	19.13	20.91	22.48	23.79	25.33	23.90	21.02	23.10	21.97	22.31	25.84	25.79	28.86
Colombia	Food	5.44	5.56	5.69	4.66	3.82	3.92	3.42	2.97	3.46	3.49	3.29	2.98	2.71	2.77
	Other primary products	5.41	6.98	5.95	4.89	4.15	2.86	3.62	4.57	3.93	3.91	6.12	7.21	6.21	6.28
	Manufactures	3.61	4.28	5.89	4.52	4.79	3.52	3.87	3.37	3.39	3.63	4.26	5.43	6.00	5.78
	Services	3.16	3.85	3.73	3.92	4.41	1.86	1.77	2.19	1.97	1.91	2.22	2.38	2.56	2.21
	Total	17.63	20.66	21.27	17.98	17.17	12.17	12.69	13.10	12.75	12.94	15.89	18.00	17.49	17.04
Croatia	Food	..	..	..	5.73	4.36	3.26	2.65	2.59	2.48	2.39	2.04	2.07	2.26	2.43
	Other primary products	..	..	..	6.44	5.42	3.87	3.23	3.16	3.29	2.10	2.68	3.61	3.28	2.99
	Manufactures	..	..	..	32.99	26.08	22.08	18.73	16.94	14.77	16.50	16.71	17.60	17.51	16.43
	Services	..	..	..	..	20.36	18.24	11.80	16.05	19.61	18.26	18.49	21.44	24.04	24.74
	Total	..	..	..	..	56.23	47.45	36.41	38.75	40.16	39.25	39.92	44.72	47.09	46.58

Table A-4: Openness based on the ER_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Czech Republic	Food	..	..	..	..	3.47	2.78	2.48	2.08	2.21	2.05	1.98	2.33	2.22	1.87
	Other primary products	..	..	..	..	3.93	4.09	3.30	2.94	2.77	2.39	2.56	3.05	2.92	3.09
	Manufactures	..	..	..	..	34.78	31.83	35.15	33.30	37.28	41.02	43.07	51.01	53.68	50.28
	Services	..	..	..	..	13.61	12.46	12.76	13.93	13.26	13.20	12.59	13.12	12.38	10.10
	Total	..	..	..	..	55.79	51.16	53.69	52.26	55.53	58.66	60.20	69.51	71.20	65.34
Denmark	Food	7.98	7.89	8.10	7.78	7.76	7.82	7.49	7.12	7.23	6.81	6.37	6.68	6.82	6.67
	Other primary products	2.06	1.95	2.11	1.99	1.76	1.67	1.71	2.29	2.11	1.69	1.95	3.23	2.81	3.03
	Manufactures	17.39	17.83	17.98	18.51	17.71	18.38	19.05	18.69	19.83	19.92	20.59	22.09	22.37	23.26
	Services	8.75	9.52	10.59	9.52	9.00	8.96	8.43	8.91	8.28	8.82	11.55	15.03	15.72	15.73
	Total	36.19	37.19	38.78	37.80	36.23	36.82	36.67	37.00	37.45	37.23	40.47	47.02	47.73	48.69
Estonia	Food	..	..	..	..	..	..	6.16	7.36	10.29	9.36	6.24	5.95	7.32	7.85
	Other primary products	..	..	..	..	..	..	5.86	6.67	9.55	7.92	9.27	10.27	8.75	8.93
	Manufactures	..	..	..	..	..	..	26.23	33.70	43.45	42.59	41.09	58.33	56.69	49.91
	Services	..	..	..	4.73	8.23	12.78	18.04	25.24	28.39	28.31	28.69	29.00	29.68	30.43
	Total	..	..	..	..	..	45.74	56.28	72.98	91.68	88.17	85.29	103.56	102.44	97.12
Finland	Food	0.41	0.47	0.46	0.54	0.84	1.00	0.74	0.91	0.96	0.79	0.62	0.63	0.67	0.67
	Other primary products	2.50	2.15	2.19	2.54	2.95	3.43	3.24	3.28	3.29	2.86	2.97	3.75	3.27	3.29
	Manufactures	17.25	16.83	16.05	18.99	23.46	25.28	27.35	28.04	29.64	30.30	29.28	33.75	31.80	30.11
	Services	3.43	3.33	3.26	4.19	5.02	5.42	5.67	5.54	5.37	5.14	5.03	5.06	4.77	4.87
	Total	23.59	22.78	21.96	26.27	32.27	35.12	36.99	37.76	39.27	39.09	37.91	43.19	40.52	38.93
France	Food	2.97	2.83	2.73	2.73	2.78	2.75	2.82	2.78	2.96	2.84	2.82	2.81	2.67	2.66
	Other primary products	0.79	0.75	0.74	0.68	0.72	0.75	0.76	0.78	0.82	0.74	0.75	1.01	0.91	0.82
	Manufactures	14.45	14.26	14.31	14.12	13.90	15.08	15.80	16.13	17.69	18.53	19.01	21.31	21.08	19.72
	Services	5.96	6.16	6.44	6.69	6.65	5.53	5.35	5.31	5.68	5.80	5.66	6.15	6.11	6.00
	Total	24.18	24.01	24.23	24.23	24.05	24.11	24.73	25.00	27.16	27.91	28.24	31.28	30.77	29.20
Germany	Food	1.33	1.21	1.23	1.17	1.10	1.12	1.09	1.20	1.23	1.30	1.28	1.31	1.47	1.38
	Other primary products	0.65	0.62	0.56	0.52	0.46	0.48	0.46	0.54	0.56	0.54	0.55	0.75	0.76	0.74
	Manufactures	24.72	23.11	20.97	19.60	17.87	18.81	19.72	20.28	22.51	23.52	24.04	27.53	28.75	28.77
	Services	2.94	3.05	3.01	2.90	2.89	2.83	3.08	3.32	3.72	3.77	3.92	4.44	4.71	5.02
	Total	29.64	27.98	25.77	24.18	22.31	23.24	24.35	25.35	28.03	29.14	29.79	34.02	35.69	35.92
Greece	Food	3.40	2.85	3.00	3.30	2.74	2.83	2.86	2.85	2.57	2.45	2.62	2.31	2.11	..
	Other primary products	0.97	0.95	1.14	0.72	1.03	1.37	1.06	1.29	1.14	0.87	1.20	1.91	1.28	..
	Manufactures	6.74	5.84	5.46	5.51	5.26	5.19	5.52	5.27	5.60	5.48	5.43	6.05	5.32	..
	Services	7.02	7.74	7.91	8.66	8.72	9.13	8.11	7.45	7.60	..	13.75	17.15	16.56	15.13
	Total	18.12	17.39	17.51	18.18	17.75	18.51	17.55	16.85	16.91	..	22.99	27.42	25.26	22.96
Hungary	Food	7.22	7.06	7.59	6.84	4.98	5.50	6.18	7.01	6.00	5.59	4.53	4.49	4.69	3.87
	Other primary products	1.81	1.84	1.94	1.77	1.54	1.71	1.55	1.97	1.64	1.55	1.45	1.62	1.49	1.26
	Manufactures	24.13	21.35	20.99	20.11	16.56	18.56	21.15	25.78	34.13	41.74	46.06	54.19	52.55	46.96
	Services	4.32	8.11	7.03	8.62	7.18	7.35	11.19	12.86	12.55	12.07	11.59	12.83	14.25	11.74
	Total	37.47	38.36	37.54	37.34	30.26	33.13	40.07	47.63	54.33	60.96	63.63	73.13	72.99	63.83
India	Food	0.90	0.90	1.13	1.32	1.35	1.22	1.63	1.62	1.55	1.42	1.19	1.23	1.22	1.19
	Other primary products	0.26	0.40	0.29	0.36	0.34	0.25	0.26	0.36	0.27	0.17	0.14	0.53	0.57	0.82
	Manufactures	4.25	4.38	5.21	6.35	6.20	6.28	6.72	6.61	6.72	6.48	6.69	7.52	7.28	7.65
	Services	1.40	1.45	1.84	2.00	1.84	1.87	1.90	1.86	2.18	2.68	3.14	4.05	4.27	4.82
	Total	6.81	7.13	8.47	10.03	9.72	9.62	10.52	10.45	10.72	10.75	11.16	13.32	13.34	14.49
Indonesia	Food	2.63	2.51	2.56	2.50	2.52	2.89	2.56	2.45	3.22	6.91	4.21	3.65	3.47	3.80
	Other primary products	10.83	11.01	9.93	9.29	7.58	7.08	7.19	6.94	8.25	14.29	9.52	11.83	11.31	9.51
	Manufactures	8.42	8.95	10.22	12.65	13.19	12.70	12.71	12.51	13.28	29.93	21.06	25.32	24.04	19.71
	Services	1.85	2.18	2.20	2.44	2.46	2.65	2.64	2.84	3.15	4.55	3.18	3.32	3.69	3.77
	Total	23.73	24.64	24.90	26.88	25.75	25.31	25.10	24.74	27.90	55.68	37.96	44.12	42.50	36.79
Ireland	Food	13.79	11.69	11.92	13.30	13.59	14.30	13.99	10.86	8.37	7.93	7.40	7.03	6.05	5.45
	Other primary products	1.33	1.20	1.12	1.17	1.19	1.20	1.12	0.96	0.89	0.71	0.63	0.69	0.62	0.62
	Manufactures	39.87	37.22	37.63	38.28	42.89	46.57	52.07	54.20	57.35	65.71	67.04	73.47	73.48	66.56
	Services	6.40	6.96	7.31	7.18	7.10	7.58	7.21	7.60	7.56	19.08	16.24	17.41	22.56	23.14
	Total	61.39	57.06	57.97	59.93	64.77	69.65	74.39	73.62	74.17	93.44	91.30	98.61	102.71	95.76

Table A-4: Openness based on the ER_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Italy	Food	1.03	0.98	1.01	1.03	1.18	1.27	1.41	1.35	1.32	1.33	1.35	1.39	1.42	1.44
	Other primary products	0.48	0.47	0.43	0.42	0.48	0.42	0.41	0.39	0.43	0.36	0.39	0.62	0.58	0.53
	Manufactures	14.66	13.97	13.11	13.01	15.35	16.94	19.50	18.70	18.81	18.86	18.24	20.45	20.14	19.22
	Services	3.54	4.41	3.95	4.69	5.20	5.19	5.58	5.26	5.69	5.57	4.91	5.22	5.24	5.02
	Total	19.71	19.83	18.51	19.14	22.22	23.82	26.90	25.70	26.26	26.12	24.89	27.68	27.38	26.21
Japan	Food	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.08	0.06
	Other primary products	0.09	0.10	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.09	0.08	0.09	0.10	0.10
	Manufactures	9.08	9.28	8.90	8.80	8.14	8.11	8.23	8.61	9.60	9.70	9.19	9.92	9.56	10.28
	Services	1.36	1.36	1.25	1.25	1.18	1.18	1.21	1.41	1.58	1.57	1.34	1.43	1.54	1.63
	Total	10.59	10.79	10.29	10.19	9.45	9.43	9.58	10.17	11.34	11.41	10.67	11.49	11.27	12.07
Korea	Food	1.05	0.85	0.77	0.70	0.62	0.60	0.59	0.59	0.64	0.88	0.71	0.58	0.60	0.52
	Other primary products	0.64	0.59	0.79	0.83	0.82	0.74	0.85	1.07	1.52	1.99	1.81	2.39	2.24	1.67
	Manufactures	26.59	24.29	22.80	22.81	22.34	22.51	24.12	23.33	26.38	38.77	32.94	34.29	32.69	31.79
	Services	3.82	3.63	3.28	3.34	3.62	4.02	4.52	4.34	5.33	7.82	6.35	6.44	6.66	5.69
	Total	32.10	29.36	27.64	27.67	27.39	27.87	30.07	29.33	33.87	49.45	41.82	43.70	42.19	39.67
Latvia	Food	..	..	..	..	..	2.33	3.92	4.41	4.14	3.03	1.60	1.48	2.31	2.75
	Other primary products	..	..	..	..	..	3.55	6.72	6.12	7.46	8.54	8.49	8.37	6.97	6.90
	Manufactures	..	..	..	..	..	12.25	16.07	17.72	18.01	18.18	15.73	16.28	17.21	17.48
	Services	..	..	..	4.56	9.95	11.92	14.64	21.81	18.27	18.08	15.31	16.63	15.50	14.63
	Total	..	..	..	..	..	30.05	41.35	50.05	47.89	47.83	41.13	42.77	41.99	41.76
Lithuania	Food	..	..	..	..	..	7.97	7.60	7.10	6.34	4.78	3.50	3.93	4.70	..
	Other primary products	..	..	..	..	..	7.16	8.08	8.80	8.79	7.93	5.78	8.81	10.51	..
	Manufactures	..	..	..	..	..	19.70	26.37	26.67	25.14	21.82	18.85	21.02	22.98	..
	Services	..	..	..	..	3.25	5.52	7.48	9.96	10.64	10.23	10.13	9.30	9.59	10.51
	Total	..	..	..	..	..	40.35	49.53	52.53	50.91	44.75	38.26	43.06	47.78	50.81
Malawi	Food	15.31	20.61	19.93	..	..	24.88	25.62	17.19	18.41	22.72	22.25	19.86	23.01	..
	Other primary products	0.53	0.42	0.62	..	..	0.82	0.61	0.88	0.92	0.39	0.59	0.71	0.69	..
	Manufactures	0.95	1.14	0.73	..	..	3.24	2.12	1.71	1.87	1.71	2.18	1.63	2.77	..
	Services	1.92	1.95	1.75	1.58	1.45	2.21	1.69	1.50	1.53	1.81	2.72	2.01	2.49	2.60
	Total	18.71	24.12	23.03	23.59	16.90	31.15	30.04	21.28	22.73	26.63	27.74	24.21	28.97	27.74
Malaysia	Food	9.01	7.84	7.49	7.27	6.69	7.85	8.01	6.83	6.87	10.22	8.60	6.09	6.12	7.43
	Other primary products	22.12	21.60	18.76	16.03	13.49	11.55	11.10	10.42	9.92	9.44	10.45	13.44	11.94	11.84
	Manufactures	33.47	37.57	43.57	45.68	50.23	59.54	64.08	60.39	61.77	81.90	87.71	89.53	81.90	79.04
	Services	7.16	8.56	8.71	8.25	9.40	12.35	12.83	14.87	15.57	15.79	14.91	15.33	16.24	15.60
	Total	71.77	75.57	78.52	77.23	79.81	91.30	96.02	92.51	94.14	117.35	121.67	124.39	116.20	113.91
Malta	Food	1.15	1.05	1.08	1.20	1.29	1.00	0.96	1.26	1.44	1.23	1.34	1.44	1.79	..
	Other primary products	0.08	0.08	0.06	0.07	0.08	0.03	0.03	0.04	0.05	0.02	0.07	0.04	0.04	..
	Manufactures	42.66	47.73	48.12	54.86	53.91	56.61	57.85	50.59	47.61	50.90	52.90	66.86	52.27	..
	Services	32.66	31.18	31.28	31.42	36.26	35.80	31.73	31.50	32.64	33.06	32.92	30.53	30.09	27.65
	Total	76.55	80.04	80.54	87.56	91.54	93.44	90.57	83.40	81.74	85.20	87.23	98.88	84.19	81.66
Mexico	Food	1.94	1.80	1.71	0.89	0.94	1.02	2.14	1.86	1.69	1.72	1.52	1.41	1.32	1.27
	Other primary products	5.66	6.07	4.31	2.41	1.97	1.90	3.23	3.80	3.03	1.87	2.20	2.92	2.18	2.39
	Manufactures	8.18	7.62	7.56	9.41	9.96	11.54	22.40	23.23	22.72	24.19	24.58	24.28	22.07	21.61
	Services	2.87	2.75	2.51	2.24	2.06	2.40	3.35	3.16	2.74	2.73	2.41	2.34	2.02	1.96
	Total	18.66	18.24	16.09	14.95	14.93	16.87	31.13	32.05	30.18	30.52	30.72	30.96	27.60	27.23
Morocco	Food	3.79	4.32	4.40	3.78	3.98	5.20	6.55	6.17	6.50	4.24	4.37	4.78	4.39	4.71
	Other primary products	0.98	1.07	0.75	0.81	0.76	1.01	1.17	0.78	0.97	0.60	0.93	1.26	1.18	0.99
	Manufactures	9.71	11.14	10.23	9.37	10.15	12.11	13.13	11.83	13.57	15.12	15.59	16.23	15.30	16.27
	Services	6.70	7.24	5.35	6.92	6.94	6.19	6.12	6.63	6.58	7.15	7.94	8.55	11.08	11.36
	Total	21.18	23.78	20.73	20.88	21.83	24.51	26.98	25.41	27.62	27.11	28.83	30.83	31.94	33.33
Mozambique	Food	..	..	..	..	..	4.83	4.82	5.27	4.69	..	3.43	..	4.50	..
	Other primary products	..	..	..	..	..	1.42	1.31	0.80	0.94	..	2.39	..	2.69	..
	Manufactures	..	..	..	..	..	0.95	1.13	1.58	0.91	..	0.78	..	12.29	..
	Services	4.12	4.18	6.01	8.90	9.08	8.77	10.47	8.91	8.21	7.38	7.40	8.52	6.90	..
	Total	8.66	9.30	12.63	16.40	15.75	15.98	17.74	16.55	14.75	13.32	14.00	18.07	26.39	..

Table A-4: Openness based on the ER_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Netherlands	Food	9.64	9.32	9.37	9.23	9.60	10.19	10.10	10.05	8.86	9.30	9.45	9.49	9.91	10.99
	Other primary products	6.32	6.47	6.49	5.63	5.79	5.67	5.58	6.25	5.70	5.36	5.60	8.21	6.74	2.70
	Manufactures	29.51	29.05	28.48	27.01	27.64	30.33	33.26	34.45	40.63	39.73	39.96	45.36	44.11	44.70
	Services	10.15	9.68	10.59	11.18	11.40	11.62	10.75	11.22	12.66	12.35	12.06	13.10	13.18	13.07
	Total	55.61	54.52	54.92	53.05	54.44	57.81	59.69	61.97	67.84	66.74	67.07	76.15	73.95	71.45
New Zealand	Food	9.61	10.30	11.14	12.10	11.50	10.66	10.05	10.21	10.17	10.53	10.43	12.63	13.91	12.49
	Other primary products	5.01	4.92	4.78	4.76	5.02	5.01	4.58	4.21	3.92	3.52	3.42	4.43	4.16	3.87
	Manufactures	6.17	6.31	6.94	7.35	7.31	7.89	7.73	7.20	7.47	8.30	8.46	9.13	9.10	8.22
	Services	5.48	5.55	5.97	6.38	6.36	6.95	7.23	6.86	6.35	6.83	7.73	8.63	8.61	8.60
	Total	26.26	27.08	28.84	30.60	30.20	30.52	29.60	28.48	27.90	29.18	30.04	34.82	35.78	33.18
Peru	Food	4.47	2.60	3.70	2.38	3.08	3.56	3.27	3.35	4.03	2.64	3.59	3.99	4.04	4.03
	Other primary products	1.99	1.64	1.35	0.95	0.90	0.68	0.84	1.06	1.07	0.79	0.97	1.33	1.29	1.47
	Manufactures	10.50	8.04	8.94	6.31	6.09	5.88	6.29	6.16	6.47	6.71	7.28	7.83	7.81	8.11
	Services	3.66	2.72	3.11	2.09	2.13	2.12	1.94	2.36	2.47	2.94	2.89	2.79	2.59	2.53
	Total	20.62	15.00	17.10	11.73	12.20	12.25	12.34	12.94	14.04	13.07	14.73	15.94	15.73	16.14
Philippines	Food	3.62	3.47	3.62	3.18	3.19	2.97	3.11	2.48	2.53	3.13	2.20	2.55	2.55	2.41
	Other primary products	0.90	0.75	0.82	0.72	0.71	0.60	0.67	0.76	0.72	0.50	0.61	1.01	0.63	0.72
	Manufactures	13.68	14.10	14.94	14.50	16.51	17.18	19.83	21.39	27.00	41.48	45.26	49.70	42.59	43.44
	Services	6.28	6.54	7.29	8.63	8.50	10.53	12.57	15.57	18.34	11.46	6.28	5.27	4.35	3.89
	Total	24.48	24.86	26.66	27.03	28.91	31.29	36.18	40.19	48.58	56.57	54.34	58.53	50.13	50.45
Poland	Food	..	3.25	2.79	2.41	1.84	1.97	2.16	2.02	2.15	1.89	1.62	1.60	1.62	1.63
	Other primary products	..	3.53	3.03	2.55	2.02	2.08	2.24	1.68	1.43	1.32	1.24	1.37	1.44	1.38
	Manufactures	..	17.47	12.23	12.23	12.53	12.96	16.28	14.97	13.76	14.59	14.81	17.15	17.42	18.68
	Services	..	5.43	4.82	5.65	4.88	6.59	9.58	7.42	5.98	6.82	5.37	6.60	5.53	5.29
	Total	..	29.67	22.87	22.84	21.28	23.59	30.27	26.10	23.31	24.61	23.05	26.71	26.01	26.98
Portugal	Food	1.75	1.64	1.58	1.41	1.27	1.41	1.53	1.61	1.64	1.56	1.47	1.58	1.57	1.57
	Other primary products	2.53	2.16	1.53	1.40	1.26	1.62	1.62	1.21	1.24	1.00	1.05	1.32	0.97	0.95
	Manufactures	18.99	19.14	17.01	16.03	15.32	16.85	18.11	19.13	19.69	19.51	18.82	20.12	19.78	18.53
	Services	6.74	7.07	6.38	5.56	7.88	7.40	7.61	7.10	7.45	7.78	7.47	7.90	7.93	7.99
	Total	30.01	30.01	26.50	24.39	25.74	27.29	28.87	29.05	30.01	29.85	28.81	30.92	30.25	29.05
Russian Federation	Food	..	..	..	..	..	..	..	0.47	0.39	0.50	0.47	0.58	0.54	0.73
	Other primary products	..	..	..	..	..	..	..	12.46	12.59	13.21	21.15	25.39	21.48	20.13
	Manufactures	..	..	..	..	..	..	..	9.68	8.83	13.93	17.00	14.67	11.26	9.98
	Services	..	..	..	..	..	2.13	2.67	3.39	3.48	4.57	4.63	3.68	3.61	3.88
	Total	..	..	..	..	..	19.23	23.17	26.01	25.29	32.20	43.25	44.33	36.89	34.72
Singapore	Food	8.73	7.58	7.80	7.33	6.51	6.32	5.74	5.12	4.81	4.65	3.96	3.37	3.39	3.42
	Other primary products	28.45	29.70	26.53	19.45	17.69	14.78	11.50	12.29	10.47	11.15	11.93	15.25	11.84	12.10
	Manufactures	112.63	106.44	103.38	102.64	104.12	117.53	124.78	120.02	117.02	117.97	123.27	130.17	127.21	128.22
	Services	32.07	34.63	31.98	32.81	32.08	32.80	35.02	33.42	31.22	26.88	31.83	31.27	33.63	34.03
	Total	181.89	178.35	169.68	162.23	160.40	171.43	177.04	170.86	163.53	160.65	170.99	180.07	176.07	177.76
Slovak Republic	Food	..	..	..	..	..	2.54	2.78	2.26	2.07	2.01	2.00	1.93	2.20	2.18
	Other primary products	..	..	..	..	..	3.63	3.55	3.90	3.42	2.82	3.65	5.54	5.33	4.79
	Manufactures	..	..	..	..	..	37.93	38.48	36.90	40.24	43.81	44.83	52.81	54.06	53.83
	Services	..	..	..	..	14.68	14.63	12.43	10.05	10.20	10.32	9.35	11.25	..	..
	Total	..	..	..	..	56.00	58.74	57.24	53.11	55.93	58.96	59.84	71.52	..	..
Slovenia	Food	..	..	..	3.48	2.30	2.30	1.73	1.83	1.80	1.77	1.66	1.78	1.79	1.58
	Other primary products	..	..	..	2.36	3.21	1.33	1.33	1.03	1.29	1.16	0.94	1.07	1.16	1.02
	Manufactures	..	..	..	47.50	42.47	43.84	41.33	41.16	42.89	43.27	40.25	45.31	46.23	40.53
	Services	..	..	..	9.74	10.97	12.58	10.78	11.28	11.15	10.31	9.32	10.37	10.42	10.43
	Total	..	..	..	63.08	58.95	60.06	55.17	55.30	57.12	56.52	52.16	58.53	59.59	53.55
Spain	Food	1.79	1.62	1.72	1.65	2.09	2.44	2.61	2.75	2.91	2.95	2.56	2.82	2.98	2.74
	Other primary products	0.87	0.76	0.66	0.47	0.51	0.52	0.55	0.65	0.70	0.63	0.59	1.02	0.83	0.96
	Manufactures	8.63	8.52	8.59	8.60	10.34	12.25	13.58	14.15	14.38	15.46	14.11	16.66	16.31	14.51
	Services	6.19	5.41	5.25	5.59	6.03	6.64	6.81	7.21	7.80	8.33	8.81	9.48	9.93	9.51
	Total	17.48	16.31	16.22	16.31	18.97	21.85	23.55	24.76	25.79	27.38	26.08	29.99	30.04	27.73

Table A-4: Openness based on the ER_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sri Lanka	Food	7.97	8.50	6.80	5.82	6.21	5.93	..	..	6.58	..	6.27	..	6.50	6.02
	Other primary products	2.08	1.61	1.21	1.08	0.98	1.04	..	..	0.62	..	0.59	..	0.49	0.48
	Manufactures	12.13	13.67	14.10	18.44	20.47	20.42	..	..	23.55	..	22.45	..	23.30	21.86
	Services	4.64	5.29	5.82	6.20	5.99	6.22	6.14	5.33	5.63	5.65	6.00	5.61	8.36	7.55
	Total	26.82	29.07	27.93	31.55	33.65	33.61	35.31	34.83	36.38	36.10	35.32	38.92	38.65	35.91
Sweden	Food	0.51	0.53	0.47	0.44	0.51	0.70	0.80	0.86	1.03	0.96	0.96	1.01	1.14	1.16
	Other primary products	2.80	2.50	2.17	2.14	2.54	2.89	3.03	2.52	2.79	2.40	1.24	1.60	3.03	2.74
	Manufactures	22.59	21.10	19.66	19.42	22.88	28.21	29.65	29.03	30.84	32.02	32.79	35.42	31.87	29.85
	Services	5.58	5.66	5.82	6.24	6.39	6.48	6.37	6.38	7.33	7.39	8.12	8.73	10.39	9.78
	Total	31.48	29.79	28.12	28.23	32.33	38.28	39.84	38.79	41.99	42.77	43.11	46.76	46.42	43.53
Switzerland	Food	0.79	0.77	0.77	0.80	0.80	0.83	0.79	0.80	0.83	0.80	0.82	0.86	0.84	0.83
	Other primary products	0.27	0.25	0.25	0.24	0.22	0.24	0.24	0.21	0.26	0.25	0.26	0.36	0.30	0.27
	Manufactures	27.66	26.91	25.41	25.95	25.68	25.87	25.53	26.29	28.68	29.06	29.97	32.82	32.09	31.77
	Services	8.53	7.97	8.21	8.34	8.79	8.38	8.14	8.55	9.57	9.84	10.55	11.53	10.52	10.43
	Total	37.26	35.90	34.64	35.32	35.48	35.31	34.69	35.85	39.35	39.95	41.60	45.56	43.75	43.30
Tanzania	Food	..	..	..	..	..	..	..	..	6.43	4.56	4.41	4.84	5.09	..
	Other primary products	..	..	..	..	..	..	..	..	2.32	0.92	0.85	0.99	1.11	..
	Manufactures	..	..	..	..	..	..	..	..	1.06	1.54	1.02	1.47	2.11	..
	Services	2.65	3.08	2.86	3.69	7.30	9.11	10.77	9.27	6.12	6.37	6.67	6.33	6.62	6.49
	Total	10.90	10.85	9.76	12.74	17.87	20.62	23.75	21.34	15.92	13.40	12.96	13.64	14.92	15.82
Thailand	Food	9.59	7.87	7.92	7.69	6.57	6.65	6.54	6.14	7.79	8.72	8.41	8.47	9.04	..
	Other primary products	2.01	1.62	1.61	1.61	1.51	1.69	2.06	2.16	2.65	2.34	2.36	3.70	3.30	..
	Manufactures	16.23	17.58	19.38	19.86	21.52	23.01	24.99	22.36	30.45	35.99	37.02	45.10	44.43	..
	Services	7.36	7.37	7.26	8.22	8.72	7.89	8.76	9.19	11.11	11.31	11.87	11.44	11.25	11.98
	Total	35.18	34.44	36.17	37.38	38.32	39.23	42.35	39.85	52.00	58.35	59.65	68.70	68.01	66.27
Turkey	Food	2.49	1.93	2.34	2.10	1.92	3.06	2.50	2.56	2.75	2.37	2.23	1.81	2.72	1.93
	Other primary products	0.60	0.46	0.44	0.28	0.26	0.40	0.35	0.37	0.28	0.32	0.38	0.31	0.54	0.52
	Manufactures	7.75	6.24	6.24	6.87	6.35	10.49	9.91	9.88	10.87	10.84	11.87	11.83	17.93	16.39
	Services	5.88	5.23	5.41	5.83	5.85	8.25	8.56	7.35	10.41	11.87	9.08	10.14	10.77	8.00
	Total	16.71	13.86	14.43	15.08	14.38	22.20	21.32	20.16	24.32	25.40	23.56	24.09	31.96	26.84
Uganda	Food	..	..	..	..	..	9.54	7.21	7.54	6.57	6.64	6.78	5.26	5.52	5.56
	Other primary products	..	..	..	..	..	0.42	0.37	0.90	0.73	0.50	1.56	1.72	1.68	1.31
	Manufactures	..	..	..	..	..	0.27	0.40	1.27	1.55	0.53	0.36	0.83	0.83	0.74
	Services	..	..	0.63	1.21	2.91	1.60	1.81	2.40	2.63	2.69	3.15	3.48	3.75	3.96
	Total	..	..	6.65	6.18	8.46	11.84	9.80	12.10	11.48	10.36	11.85	11.29	11.79	11.58
United Kingdom	Food	1.32	1.34	1.37	1.47	1.47	1.51	1.58	1.52	1.41	1.25	1.16	1.10	1.01	1.00
	Other primary products	1.45	1.65	1.41	1.33	1.52	1.52	1.50	1.64	1.45	0.96	1.16	1.83	1.69	1.55
	Manufactures	15.30	15.70	15.11	14.92	15.80	16.63	17.89	18.62	18.22	17.03	16.33	17.01	16.47	15.33
	Services	5.34	5.44	5.19	5.73	6.21	6.47	6.74	7.19	7.22	7.37	7.68	8.04	7.72	7.85
	Total	23.40	24.13	23.08	23.45	25.00	26.13	27.71	28.97	28.31	26.62	26.33	27.98	26.89	25.73
United States	Food	0.87	0.80	0.78	0.82	0.78	0.78	0.88	0.90	0.78	0.68	0.62	0.61	0.60	0.57
	Other primary products	0.54	0.55	0.51	0.47	0.41	0.41	0.47	0.43	0.39	0.32	0.28	0.34	0.32	0.30
	Manufactures	5.29	5.51	5.83	5.87	5.87	6.15	6.62	6.73	7.17	6.82	6.63	7.01	6.35	5.82
	Services	2.10	2.31	2.50	2.54	2.52	2.59	2.70	2.79	2.81	2.73	2.81	2.82	2.67	2.63
	Total	8.79	9.16	9.61	9.69	9.59	9.92	10.67	10.85	11.15	10.55	10.34	10.78	9.94	9.31
Uruguay	Food	6.91	7.21	5.86	5.09	4.77	4.81	5.11	5.55	6.09	6.40	5.42	5.20	4.92	7.54
	Other primary products	4.05	3.83	2.65	2.58	1.91	1.80	1.84	1.94	1.73	1.21	1.05	1.21	1.42	2.09
	Manufactures	7.52	7.16	5.86	5.42	5.01	5.06	4.55	4.36	4.71	4.93	4.10	4.71	4.70	5.70
	Services	4.91	4.95	5.27	6.33	7.22	8.06	7.14	6.86	6.48	5.93	5.80	6.05	5.89	6.20
	Total	23.39	23.15	19.64	19.42	18.90	19.73	18.64	18.70	19.02	18.47	16.38	17.17	16.93	21.54
Venezuela	Food	0.59	0.69	0.62	0.60	0.68	0.77	0.67	0.82	0.68	0.69	0.52	0.39	0.38	0.46
	Other primary products	23.53	29.00	23.04	18.72	19.28	21.35	18.36	26.55	19.26	12.91	15.97	22.64	18.31	23.32
	Manufactures	6.41	6.32	4.78	4.05	4.52	5.45	4.88	5.37	4.41	4.34	3.07	3.19	3.25	4.74
	Services	2.06	2.30	2.15	1.99	2.05	2.48	1.98	2.06	1.34	1.35	1.17	0.87	1.01	1.02
	Total	32.60	38.32	30.59	25.36	26.53	30.05	25.88	34.80	25.69	19.29	20.72	27.10	22.94	29.53

Table A-4: Openness based on the ER_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Zambia	Food	..	..	..	..	0.99	..	0.80	..	1.68	2.29	2.72	2.13	2.61	2.52
	Other primary products	..	..	..	..	0.67	..	1.14	..	1.86	2.52	3.74	1.07	1.05	1.23
	Manufactures	..	..	..	..	23.58	..	28.02	..	19.86	27.00	27.38	17.36	23.41	22.49
	Services	1.95	2.87	2.04	..	..	..	..	..	2.86	3.15	3.42	3.52	..	..
	Total	35.74	42.71	34.02	..	..	..	..	..	26.26	34.96	37.26	24.08	..	..

Source: World Bank (2004)

Table A-5: Openness based on the IR_i measure of 56 countries, 1989-2002, % of current GDP

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	Food	0.20	0.12	0.24	0.39	0.39	0.43	0.43	0.43	0.56	0.52	0.44	0.44	0.43	0.41
	Other primary products	0.70	0.35	0.37	0.31	0.31	0.38	0.48	0.48	0.47	0.43	0.38	0.46	0.42	0.65
	Manufactures	4.58	2.42	3.76	5.81	6.40	7.54	6.89	7.83	9.39	9.55	8.17	8.01	6.70	7.75
	Services	3.30	2.04	1.99	2.30	2.60	2.67	2.70	2.78	2.93	2.98	2.97	3.09	3.00	4.27
	Total	8.78	4.92	6.35	8.82	9.70	11.02	10.49	11.52	13.34	13.49	11.97	11.99	10.56	13.08
Australia	Food	0.72	0.69	0.70	0.72	0.76	0.79	0.82	0.77	0.78	0.85	0.84	0.85	0.86	0.88
	Other primary products	1.12	1.06	1.04	1.11	1.24	1.04	1.12	1.23	1.19	1.03	1.24	1.82	1.70	1.55
	Manufactures	12.93	11.79	11.41	12.18	13.02	13.67	14.50	13.77	13.85	15.49	14.97	15.73	14.77	15.33
	Services	4.21	4.32	4.14	4.29	4.28	4.38	4.48	4.39	4.42	4.55	4.41	4.63	4.50	4.32
	Total	18.98	17.86	17.29	18.30	19.30	19.88	20.93	20.16	20.24	21.93	21.46	23.04	21.83	22.08
Austria	Food	1.66	1.58	1.56	1.46	1.43	1.52	1.62	1.81	2.08	2.11	2.15	2.21	2.44	2.50
	Other primary products	2.79	2.87	2.70	2.29	2.06	2.05	2.17	2.35	2.25	1.97	2.28	3.32	3.48	3.47
	Manufactures	25.92	25.91	25.83	24.71	22.95	24.14	24.36	25.44	27.61	28.84	29.60	32.83	33.65	32.25
	Services	8.96	8.72	9.00	9.36	10.29	10.34	11.74	12.62	13.80	12.93	13.98	15.68	16.65	16.86
	Total	39.32	39.09	39.10	37.82	36.74	38.04	39.89	42.22	45.73	45.85	48.02	54.05	56.22	55.08
Bangladesh	Food	3.27	2.28	1.91	2.15	1.92	..	2.97	2.78	2.75	2.42	..	..	2.93	..
	Other primary products	2.16	2.63	1.73	1.89	1.91	..	1.90	1.87	2.34	2.04	..	..	2.12	..
	Manufactures	8.08	7.10	7.37	7.72	8.20	..	12.26	11.63	11.21	11.35	..	..	12.84	..
	Services	2.20	1.84	1.79	2.03	2.36	2.54	3.14	2.61	2.79	2.63	2.87	3.23	3.04	2.92
	Total	15.70	13.85	12.81	13.79	14.39	16.16	20.27	18.89	19.09	18.44	19.60	20.97	20.92	19.55
Belgium	Food	..	..	..	..	..	..	..	..	6.59	..	6.99	7.18	7.25	..
	Other primary products	..	..	..	..	..	..	..	..	4.97	..	5.28	8.87	8.52	..
	Manufactures	..	..	..	..	..	..	..	..	54.51	..	57.86	66.56	67.42	..
	Services	13.19	13.14	13.90	13.48	13.62	15.18	11.74	11.63	12.81	13.58	15.46	18.09	18.68	..
	Total	75.65	74.00	73.26	68.92	68.31	71.74	71.34	73.88	78.88	80.91	85.60	100.70	101.87	..
Brazil	Food	0.44	0.46	0.63	0.57	0.62	0.72	0.82	0.79	0.73	0.74	0.77	0.67	0.68	0.75
	Other primary products	1.29	1.43	1.50	1.62	1.59	1.20	1.13	1.19	1.15	0.88	1.30	1.69	1.84	1.84
	Manufactures	2.71	2.95	3.51	3.72	4.12	4.67	5.69	5.36	6.17	6.07	7.66	7.51	9.12	8.39
	Services	1.13	1.45	1.56	1.69	2.09	1.80	1.87	1.57	1.78	1.99	2.52	2.63	3.14	3.01
	Total	5.57	6.29	7.21	7.61	8.41	8.39	9.51	8.92	9.83	9.69	12.26	12.50	14.79	13.99
Canada	Food	1.30	1.35	1.40	1.49	1.62	1.73	1.70	1.75	1.83	1.94	1.84	1.77	1.91	1.94
	Other primary products	1.45	1.75	1.39	1.37	1.42	1.44	1.58	1.73	1.92	1.65	1.61	2.32	2.32	2.03
	Manufactures	19.18	18.32	18.44	19.77	22.01	24.71	25.61	25.48	28.28	30.35	30.41	30.57	28.46	27.81
	Services	4.33	4.79	4.99	5.28	5.75	5.78	5.67	5.86	5.98	6.21	6.17	6.13	6.18	5.87
	Total	26.26	26.21	26.22	27.90	30.81	33.66	34.56	34.81	38.00	40.15	40.03	40.80	38.86	37.64
Chile	Food	0.95	1.13	1.39	1.56	1.52	1.63	1.66	1.88	1.78	2.01	1.90	1.82	1.98	2.13
	Other primary products	3.94	4.62	4.22	3.37	3.01	2.72	2.63	3.23	2.98	2.73	3.23	4.78	4.87	4.72
	Manufactures	21.04	19.78	18.08	19.42	20.43	18.82	20.09	20.84	21.41	22.50	16.78	17.90	19.94	19.80
	Services	6.93	6.53	5.74	5.78	5.91	5.64	5.40	5.08	5.18	5.83	6.12	6.08	7.34	7.44
	Total	32.85	32.05	29.44	30.13	30.87	28.81	29.78	31.04	31.35	33.07	28.02	30.58	34.13	34.09
China	Food	1.58	1.31	1.04	0.95	0.69	0.94	1.33	1.01	0.80	0.71	0.68	0.84	0.81	0.78
	Other primary products	1.73	1.28	1.61	1.82	2.12	1.71	1.73	1.73	1.99	1.35	1.64	2.91	2.46	2.48
	Manufactures	13.95	12.45	14.29	16.51	21.27	18.73	15.78	14.29	13.02	12.74	14.43	17.09	17.78	20.03
	Services	1.04	1.16	1.05	2.20	2.69	2.91	3.51	2.74	3.08	2.80	3.13	3.32	3.36	3.64
	Total	18.31	16.19	17.99	21.48	26.77	24.29	22.36	19.77	18.89	17.59	19.87	24.16	24.42	26.94
Colombia	Food	0.90	1.01	0.82	1.28	1.44	1.37	1.49	1.82	1.65	1.78	1.65	1.70	1.84	1.92
	Other primary products	1.13	1.38	1.18	1.24	1.21	0.78	0.85	0.69	0.76	0.62	0.61	0.70	0.60	0.61
	Manufactures	10.62	11.49	9.90	10.73	14.97	12.42	12.69	11.59	12.04	12.37	10.35	11.43	13.09	13.17
	Services	3.82	4.17	4.24	3.98	4.03	3.16	3.05	3.43	3.37	3.39	3.63	3.92	4.30	4.02
	Total	16.46	18.05	16.15	17.23	21.65	17.72	18.07	17.53	17.81	18.17	16.24	17.74	19.83	19.71
Croatia	Food	..	..	..	5.90	4.13	4.01	4.99	4.63	4.86	3.92	3.41	3.43	4.03	4.25
	Other primary products	..	..	..	6.28	5.47	4.68	5.66	5.30	5.18	3.50	5.03	6.69	6.59	6.59
	Manufactures	..	..	..	32.00	33.23	27.17	29.27	29.28	34.80	31.33	30.45	31.34	34.55	36.84
	Services	..	..	..	..	10.00	8.16	7.07	8.35	11.04	8.55	10.27	9.41	9.48	10.70
	Total	..	..	..	..	52.83	44.02	46.99	47.56	55.88	47.30	49.14	50.86	54.64	58.39

Table A-5: Openness based on the IR_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Czech Republic	Food	..	..	..	..	3.36	3.68	3.27	3.35	3.36	2.97	2.93	3.08	3.01	2.48
	Other primary products	..	..	..	..	5.82	5.44	5.14	5.27	5.58	4.17	4.40	7.31	7.00	9.10
	Manufactures	..	..	..	..	33.28	32.99	39.83	39.37	42.20	42.53	43.92	52.22	54.27	47.11
	Services	..	..	..	..	10.76	11.39	9.34	10.70	10.02	9.99	10.49	10.42	9.67	9.16
	Total	..	..	..	..	53.23	53.50	57.58	58.70	61.15	59.66	61.73	73.03	73.95	67.86
Denmark	Food	3.30	3.05	3.31	3.34	3.29	3.27	3.29	3.33	3.48	3.46	3.30	3.32	3.37	3.42
	Other primary products	2.90	2.63	2.21	1.99	1.91	1.90	1.73	1.74	1.89	1.63	1.59	2.45	1.97	2.03
	Manufactures	19.76	19.29	19.99	18.95	17.35	18.99	20.44	19.69	21.20	22.12	21.44	22.67	22.70	23.11
	Services	7.86	7.57	7.76	7.27	7.49	7.90	7.71	7.98	8.11	9.16	10.63	13.41	13.93	14.51
	Total	33.82	32.54	33.26	31.54	30.04	32.08	33.18	32.74	34.67	36.36	36.96	41.85	41.97	43.08
Estonia	Food	..	..	..	..	..	..	7.34	11.27	15.46	14.57	10.16	9.68	10.02	10.37
	Other primary products	..	..	..	..	..	..	7.32	8.85	10.03	7.16	7.76	10.33	9.25	9.11
	Manufactures	..	..	..	..	..	..	38.34	53.78	70.53	66.44	60.82	78.29	75.40	70.57
	Services	..	..	..	2.91	4.67	8.33	8.73	12.05	14.07	15.57	15.96	16.90	17.67	21.51
	Total	..	..	..	..	..	50.10	61.73	85.95	110.08	103.74	94.70	115.20	112.33	111.56
Finland	Food	1.11	0.97	1.06	1.23	1.41	1.64	1.38	1.68	1.77	1.69	1.60	1.52	1.52	1.53
	Other primary products	2.65	2.79	2.79	3.18	3.29	3.37	2.88	3.30	3.21	2.62	2.84	4.15	3.95	3.75
	Manufactures	17.36	15.98	13.80	15.10	16.18	18.29	18.55	19.65	20.83	21.26	20.57	22.78	21.50	20.27
	Services	5.23	5.43	6.08	6.83	7.50	7.09	7.29	6.75	6.57	5.92	5.84	6.88	6.61	6.18
	Total	26.35	25.17	23.74	26.33	28.38	30.39	30.10	31.37	32.38	31.50	30.84	35.33	33.59	31.73
France	Food	2.00	1.88	1.97	1.88	1.90	2.03	2.00	1.97	2.03	2.05	2.00	2.04	2.07	2.00
	Other primary products	2.34	2.35	2.29	1.95	1.87	1.83	1.74	1.98	2.09	1.66	1.85	3.07	2.82	2.50
	Manufactures	15.30	15.01	14.75	13.99	13.23	14.34	14.87	15.03	16.15	17.51	18.03	20.86	20.23	18.49
	Services	4.58	4.90	5.09	5.27	5.32	4.16	4.15	4.22	4.45	4.57	4.40	4.59	4.72	4.76
	Total	24.22	24.15	24.10	23.10	22.33	22.37	22.76	23.20	24.72	25.79	26.29	30.56	29.84	27.75
Germany	Food	2.32	2.19	2.22	2.12	1.79	1.93	1.93	2.00	2.09	2.09	2.02	1.96	2.06	1.99
	Other primary products	2.48	2.45	2.45	2.09	1.95	1.81	1.78	2.01	2.21	1.82	1.87	3.09	2.88	2.63
	Manufactures	16.68	16.44	17.35	16.04	13.80	14.47	15.16	15.25	16.83	18.05	18.64	21.58	21.38	20.28
	Services	4.71	4.99	5.04	5.10	5.16	5.31	5.41	5.62	6.16	6.30	6.80	7.50	7.80	7.51
	Total	26.19	26.08	27.07	25.34	22.69	23.52	24.29	24.88	27.29	28.26	29.33	34.13	34.13	32.41
Greece	Food	3.87	3.61	3.36	3.41	3.35	3.45	3.54	3.41	3.30	3.39	3.35	3.29	2.87	..
	Other primary products	2.48	2.64	3.02	2.83	2.97	2.64	2.16	2.47	2.22	2.30	1.84	4.36	4.04	..
	Manufactures	17.48	17.30	17.54	17.01	17.22	15.38	16.33	16.79	16.64	18.98	20.22	21.20	17.16	..
	Services	3.24	3.28	3.27	3.45	3.41	3.41	3.40	3.08	3.46	..	7.36	9.74	9.56	7.75
	Total	27.06	26.83	27.19	26.69	26.95	24.88	25.43	25.76	25.63	..	32.77	38.59	33.63	31.32
Hungary	Food	2.18	2.37	1.96	1.67	1.99	2.40	1.97	2.12	2.22	2.35	1.90	2.09	2.08	1.86
	Other primary products	5.01	5.59	6.35	5.46	5.62	5.31	5.19	6.57	5.29	4.44	4.32	4.49	4.51	5.05
	Manufactures	23.21	23.21	25.79	22.67	24.78	27.47	27.55	31.38	38.86	47.83	52.07	62.30	58.31	50.20
	Services	5.49	6.84	5.62	6.79	6.56	6.94	7.99	8.68	8.73	9.52	9.70	10.43	11.44	10.77
	Total	35.90	38.00	39.73	36.59	38.94	42.11	42.69	48.76	55.09	64.15	67.98	79.31	76.34	67.87
India	Food	0.26	0.26	0.22	0.39	0.28	0.54	0.45	0.49	0.60	1.00	0.78	0.55	0.64	0.65
	Other primary products	1.73	2.48	2.75	3.45	2.76	2.52	2.93	3.42	3.02	2.65	3.71	4.62	3.93	4.10
	Manufactures	5.03	4.71	4.67	5.82	5.29	5.25	6.39	5.92	6.49	6.74	6.07	6.10	5.99	6.35
	Services	1.97	1.87	2.17	2.71	2.32	2.49	2.84	2.85	3.00	3.43	3.82	3.57	3.35	3.63
	Total	8.99	9.32	9.82	12.37	10.64	10.80	12.61	12.69	13.11	13.82	14.37	14.83	13.91	14.72
Indonesia	Food	1.23	0.96	1.11	1.25	1.16	1.41	1.78	2.04	1.71	3.02	2.70	2.19	2.11	2.00
	Other primary products	2.13	2.59	2.79	2.64	2.32	2.41	2.76	2.68	2.81	4.79	3.92	5.61	5.46	4.91
	Manufactures	12.80	15.49	16.31	15.73	14.43	14.27	15.55	14.15	14.81	20.79	10.53	14.20	13.77	11.19
	Services	5.21	5.16	4.98	5.66	6.08	6.28	6.53	6.51	7.51	12.26	8.07	9.72	10.74	9.72
	Total	21.38	24.21	25.19	25.29	23.99	24.37	26.62	25.38	26.84	40.86	25.21	31.73	32.07	27.82
Ireland	Food	5.22	4.77	5.09	5.02	4.61	5.00	4.53	4.25	3.96	3.86	3.80	3.57	3.53	3.31
	Other primary products	3.51	3.72	3.36	2.87	2.81	2.71	2.43	2.49	2.32	1.91	2.04	2.85	2.45	1.87
	Manufactures	37.49	35.27	35.10	34.05	34.75	39.03	41.59	40.14	40.83	44.19	43.50	47.08	43.00	37.56
	Services	11.45	10.87	11.79	13.14	13.36	15.34	16.98	18.32	19.00	34.11	28.04	30.11	34.17	33.26
	Total	57.67	54.63	55.34	55.08	55.53	62.07	65.53	65.20	66.11	84.07	77.39	83.61	83.16	76.00

Table A-5: Openness based on the IR_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Italy	Food	2.35	2.07	2.14	2.01	2.06	2.15	2.23	2.05	2.05	2.01	1.96	2.00	1.98	1.95
	Other primary products	2.87	2.74	2.37	2.11	2.24	2.37	2.54	2.32	2.37	1.88	2.03	3.22	2.91	2.70
	Manufactures	12.32	11.70	11.25	11.15	10.60	11.95	14.00	12.50	13.58	14.33	14.73	17.05	16.51	15.87
	Services	3.66	4.23	3.81	4.71	4.90	4.69	4.98	4.62	5.05	5.26	4.76	5.09	5.15	5.19
	Total	21.20	20.74	19.57	19.98	19.80	21.17	23.75	21.49	23.05	23.47	23.47	27.36	26.55	25.71
Japan	Food	1.15	1.14	1.08	1.07	0.98	1.05	1.04	1.17	1.17	1.14	1.07	1.04	1.12	1.14
	Other primary products	2.07	2.42	2.03	1.80	1.53	1.37	1.39	1.68	1.84	1.37	1.38	1.90	1.96	1.89
	Manufactures	3.85	4.14	3.70	3.26	3.02	3.29	3.92	4.58	4.85	4.59	4.48	5.04	5.34	5.41
	Services	2.59	2.76	2.47	2.43	2.18	2.18	2.31	2.75	2.83	2.82	2.54	2.43	2.58	2.68
	Total	9.67	10.46	9.27	8.56	7.71	7.90	8.65	10.18	10.69	9.92	9.46	10.41	11.01	11.12
Korea	Food	1.72	1.56	1.62	1.60	1.42	1.47	1.53	1.77	1.79	1.88	1.70	1.69	1.91	1.92
	Other primary products	5.96	6.62	6.23	6.37	5.97	5.30	5.49	6.17	7.29	7.25	6.88	9.40	9.17	7.77
	Manufactures	20.18	19.45	19.76	18.02	16.85	18.57	20.57	20.90	21.35	20.29	20.97	23.57	22.32	22.20
	Services	3.77	3.96	4.03	4.23	4.25	4.52	5.19	5.61	6.09	7.60	6.60	7.15	7.67	7.36
	Total	31.63	31.59	31.64	30.22	28.49	29.86	32.78	34.45	36.52	37.03	36.15	41.82	41.07	39.25
Latvia	Food	..	..	..	..	..	2.46	3.89	5.85	6.48	6.72	5.49	5.48	5.75	6.20
	Other primary products	..	..	..	..	..	6.94	8.49	10.54	7.43	6.23	5.64	6.31	5.76	5.47
	Manufactures	..	..	..	..	..	13.30	24.73	28.79	34.34	39.48	33.15	32.79	34.85	36.51
	Services	..	..	..	1.89	3.37	3.86	4.59	13.69	11.30	11.79	9.43	9.92	9.06	8.30
	Total	..	..	..	..	..	26.57	41.70	58.88	59.55	64.22	53.71	54.51	55.42	56.49
Lithuania	Food	..	..	..	..	..	3.96	7.55	7.59	6.41	5.81	4.99	4.81	4.99	..
	Other primary products	..	..	..	..	..	13.94	13.47	12.38	11.71	9.30	8.30	12.32	12.56	..
	Manufactures	..	..	..	..	..	22.41	35.62	37.81	40.82	38.86	32.10	31.25	35.41	..
	Services	..	..	..	..	2.90	4.56	7.09	8.10	8.87	7.59	7.01	5.80	5.58	6.36
	Total	..	..	..	..	..	44.88	63.73	65.87	67.81	61.56	52.39	54.18	58.53	62.47
Malawi	Food	3.40	2.67	2.63	..	..	7.02	4.63	2.92	3.60	5.95	4.46	3.24	3.53	..
	Other primary products	3.75	3.53	3.61	..	..	3.45	3.90	3.15	4.10	3.15	4.82	5.26	5.60	..
	Manufactures	24.48	24.38	25.67	..	..	31.58	24.72	19.59	23.13	20.56	27.91	22.67	21.18	..
	Services	14.53	14.25	16.16	18.84	12.56	12.52	10.57	7.65	8.64	9.33	10.22	9.78	9.78	11.68
	Total	46.16	44.82	48.06	59.68	38.93	54.58	43.82	33.30	39.47	38.99	47.40	40.95	40.08	47.12
Malaysia	Food	5.41	4.84	4.94	4.50	4.25	4.35	4.38	4.28	4.42	4.71	4.60	4.06	4.58	4.60
	Other primary products	3.82	4.48	4.11	3.65	3.42	3.17	3.24	3.32	3.52	3.84	3.79	5.74	5.66	5.11
	Manufactures	48.68	57.24	65.44	59.30	60.65	72.50	79.85	70.13	70.93	72.23	73.73	81.27	73.70	74.48
	Services	11.84	12.24	13.13	12.26	14.01	15.98	16.66	17.25	18.07	18.01	18.45	18.44	18.74	17.07
	Total	69.76	78.80	87.62	79.71	82.32	96.00	104.13	94.99	96.94	98.79	100.57	109.51	102.68	101.26
Malta	Food	9.55	8.84	9.12	8.83	8.80	8.15	9.07	9.20	9.23	8.59	8.33	8.07	8.28	..
	Other primary products	5.79	5.28	5.16	4.87	4.95	4.91	4.28	5.20	4.65	3.55	4.63	7.37	6.84	..
	Manufactures	61.63	70.63	71.02	71.23	74.46	76.88	75.69	69.60	62.47	63.94	65.21	79.80	60.23	..
	Services	21.69	21.58	20.14	20.56	23.90	24.52	19.90	19.92	18.83	19.55	19.61	19.83	19.68	18.45
	Total	98.66	106.34	105.45	105.50	112.11	114.47	108.94	103.92	95.18	95.63	97.79	115.07	95.03	91.32
Mexico	Food	2.71	2.42	2.14	1.61	1.39	1.83	1.79	2.20	1.80	1.88	1.68	1.49	1.53	1.67
	Other primary products	1.43	1.22	1.30	0.93	0.81	0.89	1.26	1.14	1.35	1.29	1.14	1.36	1.20	1.13
	Manufactures	12.19	12.92	13.20	15.36	14.77	17.02	23.47	24.85	25.54	27.95	27.57	28.01	25.27	24.35
	Services	3.43	3.84	3.40	3.19	2.93	2.95	3.15	3.01	2.94	2.99	2.93	2.88	2.67	2.67
	Total	19.76	20.40	20.03	21.09	19.89	22.70	29.68	31.20	31.63	34.11	33.32	33.73	30.67	29.82
Morocco	Food	3.11	2.62	2.56	3.65	4.30	3.95	5.92	5.00	4.74	4.08	3.73	4.74	4.62	4.51
	Other primary products	5.25	6.16	5.02	5.42	4.93	5.86	6.11	5.53	6.28	3.69	4.44	7.18	6.71	6.06
	Manufactures	15.66	18.02	17.10	16.77	15.89	17.44	18.29	15.95	17.50	20.98	19.98	22.57	20.82	21.57
	Services	3.35	3.64	3.63	4.04	3.92	3.99	4.09	3.55	3.80	4.13	4.37	4.56	4.97	5.26
	Total	27.38	30.44	28.31	29.88	29.03	31.23	34.41	30.02	32.32	32.89	32.51	39.05	37.11	37.40
Mozambique	Food	..	..	..	..	..	8.57	6.91	5.96	5.19	..	..	..	5.27	..
	Other primary products	..	..	..	..	..	7.30	4.08	3.53	3.09	..	..	..	6.46	..
	Manufactures	..	..	..	..	..	30.96	19.47	17.23	13.48	..	..	..	17.66	..
	Services	8.47	8.36	9.69	13.27	13.68	14.83	15.15	11.23	9.69	10.22	9.84	11.51	16.83	..
	Total	43.39	44.01	46.42	59.40	61.88	61.65	45.61	37.95	31.44	30.62	38.45	41.93	46.22	..

Table A-5: Openness based on the IR_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Netherlands	Food	5.87	5.43	5.53	5.68	5.67	6.54	6.25	6.35	5.59	5.68	5.79	5.78	5.75	6.29
	Other primary products	5.60	5.43	4.76	4.29	4.52	4.52	4.43	5.09	5.41	4.31	4.88	7.79	7.29	5.79
	Manufactures	32.31	31.93	31.41	30.40	28.54	31.97	33.92	34.94	39.68	39.82	41.07	45.43	41.94	40.56
	Services	10.48	9.85	10.98	11.30	11.44	11.56	10.51	10.71	11.75	11.77	12.08	13.50	13.73	13.52
	Total	54.26	52.65	52.67	51.67	50.17	54.60	55.11	57.09	62.43	61.58	63.83	72.50	68.71	66.16
New Zealand	Food	1.53	1.48	1.56	1.65	1.70	1.73	1.71	1.68	1.71	2.13	1.99	2.11	2.20	2.21
	Other primary products	1.50	1.94	1.74	1.78	1.68	1.57	1.52	1.63	1.67	1.69	1.80	3.11	2.86	2.64
	Manufactures	17.52	18.36	16.62	19.32	18.51	19.69	19.80	18.75	18.63	19.26	21.73	22.15	21.32	20.93
	Services	7.21	7.45	7.96	8.68	7.86	7.78	7.56	7.21	7.32	8.18	8.05	8.80	8.33	7.99
	Total	27.76	29.23	27.89	31.44	29.74	30.77	30.58	29.27	29.33	31.26	33.58	36.18	34.70	33.77
Peru	Food	2.09	2.36	2.37	2.40	2.39	2.21	1.91	2.37	2.07	2.36	2.10	1.62	1.81	1.79
	Other primary products	1.24	1.43	1.52	1.28	1.21	1.05	1.51	1.63	1.73	1.43	1.70	2.42	2.06	2.09
	Manufactures	6.44	6.22	7.91	7.29	8.55	9.27	10.71	10.25	10.73	10.67	10.54	9.84	9.68	9.43
	Services	5.10	4.07	4.87	3.69	3.73	3.23	3.32	3.57	3.77	4.05	4.17	4.06	4.11	4.19
	Total	14.87	14.07	16.68	14.66	15.87	15.76	17.45	17.81	18.30	18.51	18.51	17.94	17.65	17.50
Philippines	Food	2.68	3.03	2.43	2.47	2.69	2.86	3.19	3.35	3.57	4.26	3.54	3.48	3.74	3.40
	Other primary products	4.23	5.07	4.99	4.77	4.75	4.11	4.33	4.67	4.76	4.07	4.08	6.16	5.62	4.63
	Manufactures	19.35	21.22	20.98	22.01	27.14	28.30	30.67	33.15	38.55	40.00	35.19	35.59	34.60	37.13
	Services	3.61	3.88	3.92	4.36	5.65	7.24	9.32	11.33	17.12	15.50	9.83	8.54	7.28	5.53
	Total	29.87	33.20	32.32	33.62	40.23	42.51	47.50	52.49	64.00	63.83	52.64	53.76	51.23	50.68
Poland	Food	..	1.51	3.15	2.56	2.67	2.38	2.52	2.88	2.42	2.31	2.02	1.88	1.80	1.76
	Other primary products	..	4.93	5.19	4.32	3.52	3.02	3.28	3.37	2.72	2.51	2.73	3.98	3.49	3.24
	Manufactures	..	13.23	15.71	15.05	17.30	17.04	20.49	22.14	23.27	24.90	24.85	25.17	23.25	24.16
	Services	..	4.83	3.91	4.80	4.22	3.71	6.33	4.77	3.77	4.09	4.41	5.62	5.02	4.81
	Total	..	24.50	27.97	26.73	27.71	26.15	32.63	33.17	32.18	33.82	34.02	36.65	33.55	33.96
Portugal	Food	4.21	4.09	4.14	3.71	3.85	4.29	4.16	4.21	4.15	4.29	4.30	4.25	4.38	3.97
	Other primary products	5.12	5.20	4.02	3.38	3.32	3.60	3.60	3.46	3.65	3.02	3.28	4.88	4.38	3.80
	Manufactures	25.39	26.11	24.05	23.21	20.89	22.06	22.64	23.74	25.20	26.88	27.27	28.61	27.21	23.89
	Services	4.74	5.28	5.13	4.60	6.10	5.80	5.91	5.67	5.91	5.89	5.71	6.00	5.61	5.41
	Total	39.46	40.68	37.35	34.90	34.15	35.74	36.31	37.08	38.92	40.07	40.55	43.74	41.58	37.07
Russian Federation	Food	..	..	..	..	..	..	..	4.58	4.80	5.61	5.74	4.02	3.95	4.02
	Other primary products	..	..	..	..	..	..	..	0.92	1.09	1.07	1.03	1.30	0.78	0.69
	Manufactures	..	..	..	..	..	..	..	12.07	12.29	14.73	13.41	11.95	12.62	12.76
	Services	..	..	..	..	..	3.91	5.11	4.76	4.95	6.07	6.82	6.25	6.61	6.80
	Total	..	..	..	..	..	16.69	20.52	22.34	23.13	27.48	27.00	23.52	23.96	24.27
Singapore	Food	11.44	10.16	9.85	9.46	8.77	7.81	6.97	6.42	6.11	5.50	5.46	4.76	5.01	4.87
	Other primary products	27.13	29.42	24.18	20.74	17.65	14.54	13.65	14.72	14.35	10.82	13.08	18.37	17.83	18.27
	Manufactures	128.01	126.22	120.25	116.95	121.32	125.15	129.82	122.88	119.25	107.72	115.78	122.43	112.60	110.24
	Services	22.79	23.40	21.12	19.22	19.42	19.76	24.67	24.19	23.29	23.35	28.80	28.90	31.17	31.28
	Total	189.37	189.20	175.40	166.37	167.16	167.27	175.11	168.22	163.00	147.39	163.12	174.46	166.61	164.66
Slovak Republic	Food	..	..	..	..	..	3.83	4.08	4.49	3.85	3.85	3.61	3.64	4.14	3.77
	Other primary products	..	..	..	..	..	9.46	7.16	8.81	9.80	7.58	8.11	12.60	12.25	10.50
	Manufactures	..	..	..	..	..	30.29	34.56	40.84	41.85	48.13	43.21	48.59	55.95	55.39
	Services	..	..	..	..	12.64	10.22	9.40	9.75	9.77	10.32	8.96	9.02	..	..
	Total	..	..	..	..	60.54	53.79	55.21	63.88	65.28	69.87	63.90	73.85	..	..
Slovenia	Food	..	..	..	4.62	4.51	4.55	4.06	3.93	3.85	3.53	3.15	3.33	3.32	3.06
	Other primary products	..	..	..	7.70	7.64	6.03	5.81	5.74	6.15	4.56	4.73	7.13	6.12	5.10
	Manufactures	..	..	..	36.71	39.38	40.17	40.76	40.23	41.42	43.49	41.69	45.26	44.25	41.47
	Services	..	..	..	8.22	7.97	7.99	7.63	7.84	7.63	7.71	7.52	7.83	7.66	7.83
	Total	..	..	..	57.25	59.50	58.74	58.26	57.74	59.05	59.28	57.10	63.55	61.35	57.47
Spain	Food	1.93	1.86	2.01	2.02	2.10	2.40	2.66	2.45	2.44	2.67	2.35	2.56	2.68	2.46
	Other primary products	2.83	2.57	2.31	2.10	2.06	2.14	2.21	2.37	2.37	2.03	2.06	3.95	3.50	3.01
	Manufactures	13.38	12.77	12.69	12.53	11.36	13.09	14.64	15.02	15.84	18.60	18.00	21.30	20.46	18.27
	Services	2.89	2.98	2.99	3.37	3.53	3.55	3.59	3.85	4.26	4.59	5.00	5.51	5.79	5.76
	Total	21.03	20.18	20.00	20.01	19.05	21.18	23.11	23.69	24.91	27.89	27.40	33.32	32.43	29.49

Table A-5: Openness based on the IR_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sri Lanka	Food	6.54	6.39	5.95	5.86	5.41	6.47	..	..	5.96	..	5.84	..	5.40	5.25
	Other primary products	3.97	4.84	4.48	3.93	3.81	3.34	..	..	2.70	..	2.65	..	4.05	5.61
	Manufactures	20.83	22.26	23.57	26.27	29.57	30.89	..	..	30.17	..	29.57	..	28.07	25.96
	Services	7.81	7.72	8.17	8.24	8.16	8.70	8.98	8.42	8.42	8.42	8.88	9.75	7.35	5.83
	Total	39.15	41.21	42.17	44.31	46.95	49.41	49.73	47.56	47.25	45.84	46.94	53.79	44.87	42.65
Sweden	Food	1.49	1.41	1.42	1.46	1.70	2.12	1.83	1.88	2.02	2.07	2.16	2.10	2.20	2.21
	Other primary products	2.47	2.52	2.14	2.14	2.47	2.55	2.18	2.35	2.45	2.10	2.07	3.34	3.28	3.06
	Manufactures	20.68	18.86	16.64	16.01	18.02	22.16	23.05	21.32	22.99	24.37	24.04	26.39	24.64	22.28
	Services	7.19	7.13	6.95	7.45	6.91	7.06	7.12	7.14	8.12	9.01	9.27	10.22	10.91	9.86
	Total	31.83	29.92	27.15	27.06	29.10	33.88	34.18	32.68	35.58	37.55	37.55	42.05	41.04	37.41
Switzerland	Food	2.06	1.92	1.90	1.82	1.76	1.81	1.68	1.77	1.86	1.91	1.90	1.92	1.86	1.86
	Other primary products	2.08	2.08	1.91	1.71	1.50	1.40	1.29	1.42	1.82	1.40	1.38	2.11	2.00	1.73
	Manufactures	28.32	26.51	24.77	23.45	22.43	22.81	23.13	23.61	26.02	27.25	27.61	30.88	30.17	27.71
	Services	5.08	4.86	4.73	4.85	4.82	4.82	4.85	5.27	5.47	5.72	6.11	6.47	6.64	6.36
	Total	37.54	35.37	33.31	31.83	30.50	30.84	30.95	32.06	35.17	36.28	37.00	41.39	40.67	37.65
Tanzania	Food	..	..	..	..	..	..	3.21	3.33	2.94	3.45	2.93	2.44	2.78	..
	Other primary products	..	..	..	..	..	..	0.56	2.36	2.76	1.93	1.84	3.52	2.77	..
	Manufactures	..	..	..	..	..	..	28.19	15.70	11.74	11.92	13.29	10.77	12.75	..
	Services	6.15	6.76	6.05	7.41	14.16	9.73	13.87	13.59	9.23	10.56	8.37	6.83	6.71	6.90
	Total	28.55	30.95	36.92	40.23	49.39	42.99	45.84	34.99	26.67	27.86	26.43	23.57	25.02	24.91
Thailand	Food	2.05	2.00	2.13	2.07	1.78	1.66	1.62	1.69	2.21	2.13	2.09	2.26	2.75	..
	Other primary products	5.23	5.56	5.60	4.91	4.43	4.24	4.67	5.07	5.69	4.31	5.27	7.92	8.18	..
	Manufactures	28.42	31.10	30.55	29.53	30.67	31.81	35.88	33.04	36.91	30.69	33.79	41.11	43.22	..
	Services	6.06	7.22	7.99	9.24	9.84	10.52	11.08	10.62	12.18	10.27	11.05	12.68	12.64	13.08
	Total	41.77	45.88	46.27	45.76	46.72	48.23	53.25	50.42	56.99	47.39	52.21	63.97	66.79	64.06
Turkey	Food	1.18	1.23	0.85	0.86	0.92	0.89	1.48	1.58	1.44	1.19	1.11	1.12	1.10	1.08
	Other primary products	3.69	3.71	3.05	3.08	3.02	3.92	3.94	4.53	3.98	2.92	3.70	5.03	5.75	5.29
	Manufactures	9.89	9.86	10.03	10.47	12.34	13.15	15.67	17.97	20.27	18.89	17.33	21.20	21.18	20.68
	Services	2.06	1.85	1.94	2.06	2.00	2.64	2.75	3.52	4.54	4.99	4.84	4.28	4.37	3.42
	Total	16.83	16.66	15.87	16.48	18.28	20.60	23.83	27.61	30.23	27.98	26.98	31.63	32.41	30.48
Uganda	Food	..	..	..	..	..	3.48	2.91	2.83	4.45	3.77	3.15	3.69	3.43	4.14
	Other primary products	..	..	..	..	..	1.49	0.80	2.77	1.11	2.76	3.33	5.14	5.22	5.55
	Manufactures	..	..	..	..	..	16.92	14.70	14.07	15.50	15.20	15.99	17.31	19.36	19.78
	Services	4.51	4.53	7.29	8.68	9.10	10.91	9.78	11.16	10.67	11.14	7.02	7.79	9.22	9.13
	Total	9.67	11.22	13.19	26.35	25.71	32.80	28.20	30.83	31.73	32.87	29.48	33.93	37.23	38.60
United Kingdom	Food	2.36	2.35	2.24	2.34	2.36	2.32	2.38	2.44	2.21	2.12	2.02	1.93	1.96	1.92
	Other primary products	1.99	2.08	1.83	1.67	1.65	1.48	1.42	1.45	1.29	0.97	0.99	1.49	1.43	1.30
	Manufactures	19.19	18.11	16.24	16.69	17.69	18.64	19.73	20.24	19.69	19.45	19.28	20.65	19.99	18.81
	Services	4.49	4.52	4.34	4.75	5.14	5.42	5.49	5.75	5.59	5.89	6.24	6.71	6.51	6.45
	Total	28.03	27.05	24.66	25.45	26.83	27.86	29.01	29.89	28.78	28.43	28.53	30.77	29.89	28.48
United States	Food	0.53	0.54	0.52	0.52	0.50	0.51	0.52	0.54	0.56	0.55	0.55	0.55	0.54	0.55
	Other primary products	1.26	1.41	1.17	1.14	1.12	1.10	1.12	1.26	1.25	0.94	1.10	1.68	1.51	1.39
	Manufactures	7.27	7.04	6.87	7.18	7.54	8.24	8.87	8.80	9.07	9.34	9.86	10.62	9.68	9.62
	Services	1.56	1.70	1.69	1.63	1.64	1.70	1.73	1.77	1.82	1.88	1.97	2.09	2.01	1.98
	Total	10.63	10.69	10.25	10.48	10.80	11.55	12.24	12.37	12.71	12.71	13.48	14.93	13.73	13.54
Uruguay	Food	0.95	1.00	1.10	1.45	1.35	1.86	1.63	1.79	1.79	1.84	1.73	1.93	1.88	2.34
	Other primary products	2.65	3.16	2.86	2.10	1.81	1.93	2.22	2.30	2.05	1.52	2.20	3.03	2.56	3.15
	Manufactures	10.26	10.27	10.68	12.24	13.33	13.25	11.80	12.30	13.29	13.89	11.92	11.83	11.95	10.67
	Services	4.54	3.91	3.46	3.97	5.03	5.01	4.44	3.92	3.86	3.76	3.59	4.07	4.11	5.10
	Total	18.40	18.34	18.11	19.76	21.53	22.06	20.08	20.31	20.99	21.01	19.44	20.86	20.51	21.26
Venezuela	Food	2.16	1.70	2.16	2.31	2.38	2.10	2.33	2.18	1.80	2.01	1.74	1.56	1.66	1.58
	Other primary products	1.18	1.04	1.13	0.86	0.70	0.71	0.88	0.62	0.86	0.56	0.54	0.72	0.70	0.49
	Manufactures	14.56	12.36	17.48	20.04	17.73	12.92	13.08	11.20	13.80	13.92	11.37	11.08	12.04	10.45
	Services	4.29	4.92	6.12	6.76	7.26	7.76	6.01	6.56	4.26	4.01	3.85	3.50	3.61	4.00
	Total	22.20	20.02	26.88	29.97	28.08	23.49	22.29	20.57	20.72	20.49	17.50	16.86	18.02	16.50

Table A-5: Openness based on the IR_i measure of 56 countries, 1989-2002, continued

Country name	Product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Zambia	Food	..	..	..	..	..	..	1.99	..	2.46	4.00	2.65	2.26	2.77	4.81
	Other primary products	..	..	..	..	..	..	3.13	..	2.76	4.47	3.10	6.28	3.87	3.01
	Manufactures	..	..	..	..	..	..	15.05	..	15.72	25.50	20.50	22.12	29.36	26.53
	Services	10.21	11.25	10.42	..	..	..	..	..	7.21	8.71	9.51	10.13	..	..
	Total	32.89	48.35	34.65	..	..	..	..	..	28.15	42.69	35.76	40.79	..	..

Source: World Bank (2004)

Table A-6: Openness based on the EFR measure of 56 countries, 1989-2002, % of current GDP

Country name	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	[a]0.81	[a]0.30	[a]0.32	[a]0.39	[a]0.45	[a]0.57	[a]0.69	0.61	0.79	0.81	0.63	0.69	0.63	1.68
Australia	[a]1.95	[a]1.97	[a]1.96	[a]2.11	[a]2.32	[a]2.36	[a]2.58	2.54	2.56	2.72	2.61	3.19	3.04	2.90
Austria	10.29	10.37	10.30	9.70	9.18	9.49	10.10	10.89	12.15	12.29	13.18	15.82	16.86	16.57
Bangladesh	1.26	1.32	1.16	1.44	1.67	..	2.51	2.35	2.66	2.60	..	..	3.02	..
Belgium	..	..	..	..	..	..	..	..	37.60	..	41.77	51.57	52.29	..
Brazil	[a]0.45	[a]0.47	[a]0.59	[a]0.72	[a]0.75	[a]0.67	[a]0.65	0.54	0.62	0.61	1.03	1.13	1.53	..
Canada	[a]6.27	[a]6.25	[a]6.04	[a]6.68	[a]7.74	[a]9.03	[a]9.80	9.75	10.79	11.61	11.75	12.34	11.50	..
Chile	[a]7.25	[a]7.10	[a]6.34	[a]5.91	[a]5.47	[a]5.40	[a]5.72	5.70	5.84	5.84	5.35	6.31	7.36	..
China	[a]2.76	[a]2.76	[a]3.40	[a]4.18	[a]5.35	[a]5.06	[a]4.36	3.75	3.86	3.50	4.00	5.42	5.43	6.40
Colombia	[a]0.16	[a]0.22	[a]0.22	[a]0.20	[a]0.22	[a]0.12	[a]0.14	1.16	1.22	1.26	1.26	1.49	1.68	1.61
Croatia	..	..	..	..	13.74	10.50	9.48	9.40	10.24	9.04	9.74	11.30	12.13	12.18
Czech Republic	..	..	..	..	17.75	16.43	18.51	18.32	19.95	20.25	21.17	26.86	27.58	24.52
Denmark	[a]9.42	[a]9.26	[a]9.64	[a]9.06	[a]8.55	[a]9.09	[a]9.25	9.14	9.68	10.04	10.64	12.87	13.05	13.46
Estonia	..	..	..	..	..	..	18.54	28.62	39.71	36.79	33.78	43.87	43.04	41.23
Finland	[a]5.80	[a]5.51	[a]5.06	[a]6.18	[a]7.34	[a]8.16	[a]8.19	9.84	10.23	9.88	9.62	11.60	10.79	10.12
France	4.36	4.32	4.32	4.12	4.00	4.09	4.22	4.39	4.94	5.11	5.29	6.69	6.44	5.80
Germany	[a]5.37	[a]5.14	[a]5.03	[a]4.50	[a]3.87	[a]4.06	[a]4.32	4.85	5.61	5.87	6.15	7.85	8.05	7.72
Greece	2.40	2.28	2.32	2.37	2.32	2.17	2.11	2.07	2.07	..	3.14	4.49	3.71	..
Hungary	10.87	11.45	12.12	11.20	10.38	11.62	13.13	16.37	19.76	23.76	25.46	30.97	30.15	25.47
India	[a]0.46	[a]0.53	[a]0.66	[a]0.95	[a]0.81	[a]0.77	[a]0.96	1.31	1.34	1.36	1.51	1.88	1.73	1.93
Indonesia	[a]3.05	[a]3.71	[a]4.10	[a]4.32	[a]4.00	[a]3.99	[a]4.33	4.44	4.95	10.75	5.63	7.90	7.78	6.32
Ireland	23.79	21.79	22.10	22.12	23.19	26.17	27.78	26.96	26.98	34.74	32.75	36.58	..	..
Italy	4.49	4.38	3.94	4.04	4.52	5.07	6.10	5.42	5.84	5.87	5.73	7.18	6.94	6.53
Japan	[a]1.00	[a]1.11	[a]0.94	[a]0.86	[a]0.73	[a]0.74	[a]0.82	1.08	1.25	1.12	1.06	1.31	1.36	..
Korea	[a]9.65	[a]9.17	[a]8.74	[a]8.43	[a]7.93	[a]8.22	[a]9.24	8.87	10.32	13.15	11.69	13.84	13.21	12.18
Latvia	..	..	..	..	..	6.43	11.74	17.27	16.54	17.32	13.40	13.89	14.18	14.53
Lithuania	..	..	..	..	..	13.94	19.25	20.20	20.09	16.95	13.71	15.89	17.64	..
Malawi	3.62	4.39	4.23	..	..	7.38	5.37	3.07	3.79	4.19	5.33	4.13	4.94	..
Malaysia	..	..	[a]32.02	[a]29.54	[a]30.99	[a]38.29	[a]42.24	34.80	35.89	41.90	43.30	47.22	42.83	42.04
Malta	29.96	32.17	32.12	33.38	36.31	..	..	32.46	29.93	..	31.59	..	31.17	..
Mexico	[a]3.03	[a]2.96	[a]2.88	[a]3.30	[a]3.26	[a]4.06	[a]8.04	7.95	7.92	8.73	8.59	8.68	7.52	7.21
Morocco	[a]3.66	[a]4.55	[a]3.75	[a]3.82	[a]3.81	[a]4.63	[a]5.33	4.82	5.64	5.51	5.86	7.44	7.21	7.44
Mozambique	..	..	..	..	..	4.14	3.67	3.00	2.20	..	..	..	4.78	..
Netherlands	21.20	20.44	20.28	19.67	19.50	21.52	21.88	22.99	25.58	24.80	25.73	30.65	28.99	27.67
New Zealand	[a]4.23	[a]4.64	[a]4.70	[a]5.44	[a]5.09	[a]5.31	[a]5.20	4.80	4.81	5.36	5.87	7.07	6.90	6.39
Peru	1.74	1.30	1.73	1.15	1.30	1.34	1.55	1.60	1.75	1.68	1.85	1.95	1.86	1.86
Philippines	[a]7.06	[a]7.93	[a]8.13	[a]8.34	[a]9.97	[a]10.49	[a]12.21	16.18	20.09	20.55	17.28	18.79	17.26	17.33
Poland	..	5.21	4.91	4.76	4.58	4.58	6.55	6.01	5.38	5.80	5.63	6.88	6.33	6.63
Portugal	7.10	7.35	6.15	5.42	5.38	5.89	6.26	6.48	6.95	6.98	6.94	8.11	7.62	..
Russian Federation	..	..	..	..	..	..	..	1.91	1.95	2.86	3.08	2.73	2.34	..
Singapore	117.40	..	107.89	101.82	100.97	103.56	108.74	104.06	99.40	89.95	100.93	109.48	105.61	105.54
Slovak Republic	..	..	..	..	..	18.49	18.25	19.49	20.71	22.47	21.11	26.83	..	..
Slovenia	..	..	..	21.97	21.90	21.85	20.65	20.57	21.39	21.15	19.63	23.17	22.68	20.26
Spain	3.41	3.16	3.11	3.11	3.37	4.13	4.73	5.02	5.37	6.11	5.78	7.89	7.62	6.53
Sri Lanka	[a]8.43	[a]9.63	[a]9.74	[a]10.97	[a]12.02	[a]12.26	..	..	12.11	..	11.92	..	12.56	12.11
Sweden	[a]8.02	[a]7.34	[a]6.47	[a]6.43	[a]7.56	[a]9.47	[a]9.68	10.76	11.96	12.48	12.56	14.73	14.26	12.79
Switzerland	9.00	8.41	7.88	7.66	7.36	7.37	7.32	7.72	8.89	9.05	9.41	11.05	10.63	..
Tanzania	..	..	..	..	..	..	..	..	2.01	1.94	1.67	1.72	1.94	..
Thailand	[a]4.51	[a]4.90	[a]5.12	[a]5.08	[a]5.33	[a]5.56	[a]6.57	12.69	17.23	16.16	18.00	23.75	24.45	..
Turkey	[a]2.53	[a]2.12	[a]2.05	[a]2.25	[a]2.31	[a]3.87	[a]4.13	4.23	5.19	4.96	4.76	5.61	7.35	6.12
Uganda	..	..	..	..	..	1.23	1.05	1.85	1.69	1.64	1.68	2.33	2.58	2.64
United Kingdom	[a]4.84	[a]4.78	[a]4.30	[a]4.42	[a]4.79	[a]5.04	[a]5.42	5.66	5.37	5.02	4.95	5.58	5.31	4.91
United States	[a]0.74	[a]0.78	[a]0.77	[a]0.79	[a]0.81	[a]0.88	[a]0.98	1.20	1.26	1.16	1.22	1.46	1.27	1.17
Uruguay	[a]2.95	[a]3.01	[a]2.63	[a]2.65	[a]2.73	[a]2.89	[a]2.54	2.37	2.51	2.47	2.10	2.44	2.31	2.91
Venezuela	3.72	3.45	4.02	4.13	4.01	3.62	3.27	3.24	2.97	2.86	2.20	2.17	2.30	2.41
Zambia	..	..	..	..	..	..	..	..	4.76	7.96	6.79	7.32	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

Table A-7: Openness based on the IDR measure of 56 countries, 1989-2002, % of current GDP

Country name	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	[a]0.01	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.01	[a]0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03
Australia	[a]0.04	[a]0.03	[a]0.04	[a]0.04	[a]0.04	[a]0.04	[a]0.05	0.05	0.05	0.06	0.05	0.07	0.07	0.06
Austria	0.09	0.10	0.09	0.09	0.08	0.08	0.09	0.10	0.12	0.12	0.13	0.17	0.18	0.18
Bangladesh	0.00	0.00	0.00	0.00	0.00	..	0.00	0.00	0.00	0.00	..	..	0.00	..
Belgium	..	..	..	..	..	..	..	..	0.52	..	0.59	0.82	0.83	..
Brazil	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.02	[a]0.01	[a]0.01	0.01	0.02	0.02	0.03	0.03	0.05	..
Canada	[a]0.14	[a]0.14	[a]0.14	[a]0.16	[a]0.19	[a]0.24	[a]0.28	0.33	0.37	0.40	0.42	0.47	0.42	..
Chile	[a]0.02	[a]0.02	[a]0.02	[a]0.02	[a]0.01	[a]0.02	[a]0.02	0.02	0.02	0.02	0.02	0.02	0.03	..
China	[a]0.08	[a]0.08	[a]0.10	[a]0.12	[a]0.16	[a]0.15	[a]0.13	0.13	0.13	0.12	0.14	0.19	0.20	0.25
Colombia	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Croatia	..	..	..	..	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Czech Republic	..	..	..	..	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.09	0.10	0.08
Denmark	[a]0.06	[a]0.06	[a]0.06	[a]0.06	[a]0.05	[a]0.06	[a]0.06	0.06	0.06	0.07	0.07	0.09	0.09	0.10
Estonia	..	..	..	..	..	..	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Finland	[a]0.03	[a]0.02	[a]0.02	[a]0.03	[a]0.04	[a]0.04	[a]0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.05
France	0.25	0.24	0.24	0.23	0.22	0.23	0.25	0.25	0.30	0.32	0.34	0.44	0.42	0.36
Germany	[a]0.60	[a]0.56	[a]0.54	[a]0.47	[a]0.38	[a]0.41	[a]0.45	0.43	0.53	0.58	0.61	0.81	0.84	0.80
Greece	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	..	0.02	0.03	0.02	..
Hungary	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.08	0.08	0.06
India	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Indonesia	[a]0.04	[a]0.05	[a]0.05	[a]0.05	[a]0.05	[a]0.04	[a]0.05	0.05	0.06	0.16	0.06	0.10	0.09	0.07
Ireland	0.07	0.06	0.06	0.06	0.07	0.09	0.10	0.10	0.10	0.15	0.14	0.16	..	..
Italy	0.15	0.14	0.13	0.13	0.15	0.17	0.22	0.19	0.21	0.22	0.21	0.28	0.26	0.24
Japan	[a]0.16	[a]0.17	[a]0.15	[a]0.13	[a]0.11	[a]0.12	[a]0.13	0.14	0.16	0.15	0.14	0.16	0.17	..
Korea	[a]0.14	[a]0.13	[a]0.12	[a]0.12	[a]0.11	[a]0.12	[a]0.14	0.15	0.18	0.26	0.22	0.27	0.25	0.23
Latvia	..	..	..	..	..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	..	..	..	..	..	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	..
Malawi	0.00	0.00	0.00	..	..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	..
Malaysia	..	..	[a]0.26	[a]0.23	[a]0.23	[a]0.30	[a]0.34	0.35	0.36	0.44	0.48	0.55	0.47	0.46
Malta	0.01	0.01	0.01	0.01	0.01	..	..	0.01	0.01	..	0.01	..	0.01	..
Mexico	[a]0.04	[a]0.04	[a]0.03	[a]0.03	[a]0.03	[a]0.04	[a]0.10	0.16	0.15	0.16	0.16	0.17	0.14	0.13
Morocco	[a]0.00	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Mozambique	..	..	..	..	..	0.00	0.00	0.00	0.00	..	..	..	0.00	..
Netherlands	0.35	0.33	0.33	0.31	0.30	0.35	0.38	0.41	0.49	0.48	0.50	0.66	0.58	0.51
New Zealand	[a]0.01	[a]0.01	[a]0.01	[a]0.02	[a]0.01	[a]0.02	[a]0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Peru	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Philippines	[a]0.01	[a]0.02	[a]0.02	[a]0.02	[a]0.02	[a]0.03	[a]0.03	0.05	0.07	0.09	0.08	0.08	0.07	0.07
Poland	..	0.03	0.03	0.02	0.02	0.03	0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.04
Portugal	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	..
Russian Federation	..	..	..	..	..	..	..	0.11	0.11	0.16	0.22	0.21	0.18	..
Singapore	1.02	..	0.89	0.79	0.79	0.85	0.89	0.83	0.77	0.69	0.80	0.91	0.81	0.81
Slovak Republic	..	..	..	..	..	0.02	0.02	0.02	0.02	0.02	0.02	0.03	..	..
Slovenia	..	..	..	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Spain	0.06	0.05	0.05	0.05	0.06	0.07	0.09	0.09	0.10	0.12	0.11	0.16	0.15	0.13
Sri Lanka	[a]0.00	[a]0.00	[a]0.00	[a]0.01	[a]0.01	[a]0.01	..	..	0.01	..	0.01	..	0.01	0.01
Sweden	[a]0.08	[a]0.07	[a]0.06	[a]0.05	[a]0.07	[a]0.10	[a]0.11	0.10	0.12	0.12	0.12	0.15	0.14	0.12
Switzerland	0.12	0.11	0.10	0.10	0.09	0.09	0.09	0.10	0.12	0.12	0.13	0.16	0.15	..
Tanzania	..	..	..	..	..	..	..	..	0.00	0.00	0.00	0.00	0.00	..
Thailand	[a]0.07	[a]0.07	[a]0.08	[a]0.08	[a]0.08	[a]0.09	[a]0.11	0.10	0.14	0.13	0.15	0.22	0.23	..
Turkey	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.02	[a]0.02	0.03	0.04	0.04	0.03	0.04	0.06	0.05
Uganda	..	..	..	..	..	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
United Kingdom	[a]0.23	[a]0.23	[a]0.20	[a]0.20	[a]0.23	[a]0.25	[a]0.28	0.38	0.35	0.32	0.32	0.37	0.35	0.31
United States	[a]0.25	[a]0.26	[a]0.26	[a]0.27	[a]0.27	[a]0.31	[a]0.35	0.43	0.45	0.43	0.45	0.51	0.43	0.40
Uruguay	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Venezuela	0.03	0.04	0.04	0.04	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02
Zambia	..	..	..	..	..	..	..	..	0.00	0.00	0.00	0.00	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

Table A-8: Openness based on the EDR_g measure of 56 countries, 1989-2002, % of current GDP

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	Unskilled employees	a5.49	a3.79	a2.72	a2.33	a2.38	a2.54	a3.32	3.54	3.58	3.56	3.37	3.69	3.95	9.20
	Skilled employees	a1.38	a0.91	a0.65	a0.59	a0.62	a0.65	a0.82	0.83	0.85	0.85	0.81	0.88	0.92	1.86
	Capital	a6.40	a4.44	a3.15	a2.74	a2.81	a3.01	a3.93	4.39	4.41	4.34	4.16	4.64	4.94	11.73
	Land	a0.93	a0.69	a0.51	a0.43	a0.39	a0.41	a0.54	0.60	0.57	0.57	0.53	0.55	0.60	1.66
	Natural resources	a0.22	a0.24	a0.12	a0.11	a0.11	a0.16	a0.26	0.33	0.30	0.21	0.26	0.42	0.44	1.58
	Total	a14.42	a10.07	a7.15	a6.20	a6.32	a6.78	a8.87	9.68	9.71	9.54	9.14	10.19	10.85	26.03
Australia	Unskilled employees	a4.56	a4.90	a5.03	a5.19	a5.46	a5.51	a5.66	5.23	5.36	5.26	4.96	5.62	5.83	5.44
	Skilled employees	a2.39	a2.57	a2.64	a2.70	a2.86	a2.91	a3.02	2.71	2.74	2.72	2.62	2.89	2.91	2.76
	Capital	a5.18	a5.58	a5.87	a6.03	a6.16	a6.06	a6.24	7.29	7.54	7.40	6.86	8.05	8.33	7.71
	Land	a0.25	a0.26	a0.27	a0.29	a0.31	a0.30	a0.28	0.32	0.34	0.31	0.29	0.33	0.36	0.33
	Natural resources	a0.67	a0.72	a0.83	a0.86	a0.77	a0.66	a0.68	0.81	0.91	0.87	0.69	1.05	1.14	0.98
	Total	a13.05	a14.03	a14.64	a15.07	a15.56	a15.43	a15.88	16.37	16.88	16.57	15.42	17.95	18.57	17.23
Austria	Unskilled employees	9.71	10.06	9.87	9.55	9.14	9.13	9.72	9.95	11.12	11.58	11.92	13.23	13.78	14.15
	Skilled employees	5.01	5.17	5.12	4.94	4.76	4.74	4.97	5.10	5.58	5.76	5.93	6.56	6.82	6.94
	Capital	13.45	13.66	13.60	13.07	12.74	12.71	12.92	13.34	14.06	14.21	14.85	16.26	17.04	17.24
	Land	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04
	Natural resources	0.38	0.37	0.30	0.27	0.24	0.28	0.28	0.28	0.32	0.30	0.37	0.44	0.52	0.58
	Total	28.57	29.27	28.92	27.86	26.91	26.89	27.92	28.69	31.11	31.90	33.12	36.53	38.20	38.95
Bangladesh	Unskilled employees	1.73	1.97	2.08	2.53	2.93	..	3.47	3.30	3.89	4.05	..	..	4.49	..
	Skilled employees	0.54	0.56	0.59	0.70	0.78	..	0.89	0.81	0.93	0.96	..	..	1.03	..
	Capital	1.96	2.28	2.37	2.81	3.19	..	3.73	3.52	4.14	4.23	..	..	4.63	..
	Land	0.22	0.25	0.23	0.24	0.28	..	0.30	0.28	0.28	0.25	..	..	0.25	..
	Natural resources	0.12	0.15	0.14	0.15	0.15	..	0.16	0.15	0.16	0.14	..	..	0.13	..
	Total	4.58	5.20	5.41	6.42	7.33	..	8.55	8.06	9.40	9.62	..	..	10.53	..
Belgium	Unskilled employees	..	..	..	..	..	..	..	..	20.60	..	21.38	23.09	23.48	..
	Skilled employees	..	..	..	..	..	..	..	..	10.64	..	11.30	12.23	12.39	..
	Capital	..	..	..	..	..	..	..	..	15.78	..	16.95	19.39	19.29	..
	Land	..	..	..	..	..	..	..	..	0.11	..	0.11	0.11	0.11	..
	Natural resources	..	..	..	..	..	..	..	..	0.56	..	0.58	0.95	0.88	..
	Total	..	..	..	..	..	..	..	..	47.68	..	50.32	55.77	56.15	..
Brazil	Unskilled employees	a2.66	a2.36	a2.69	a3.19	a3.03	a2.72	a2.25	2.24	2.39	2.44	3.32	3.48	4.13	..
	Skilled employees	a0.72	a0.68	a0.75	a0.88	a0.83	a0.77	a0.67	0.65	0.69	0.74	1.00	1.06	1.23	..
	Capital	a4.27	a3.81	a4.29	a5.11	a4.82	a4.41	a3.67	3.10	3.32	3.38	4.64	4.79	5.89	..
	Land	a0.18	a0.16	a0.17	a0.21	a0.19	a0.20	a0.16	0.16	0.18	0.17	0.23	0.19	0.28	..
	Natural resources	a0.08	a0.06	a0.06	a0.08	a0.07	a0.07	a0.06	0.04	0.04	0.04	0.10	0.14	0.25	..
	Total	a7.90	a7.08	a7.96	a9.47	a8.95	a8.17	a6.81	6.19	6.62	6.78	9.30	9.66	11.79	..
Canada	Unskilled employees	a7.31	a7.38	a7.25	a7.78	a8.43	a9.41	a10.48	11.11	11.04	11.78	12.25	12.34	11.91	..
	Skilled employees	a2.67	a2.69	a2.65	a2.82	a3.04	a3.37	a3.73	3.93	3.92	4.25	4.41	4.33	4.16	..
	Capital	a7.47	a7.55	a7.42	a7.98	a8.68	a9.63	a10.62	10.52	10.47	10.72	11.10	11.90	11.59	..
	Land	a0.08	a0.09	a0.09	a0.10	a0.09	a0.10	a0.11	0.12	0.12	0.12	0.11	0.10	0.12	..
	Natural resources	a1.56	a1.54	a1.46	a1.64	a1.98	a2.31	a2.64	2.73	2.65	2.22	2.42	3.63	3.50	..
	Total	a19.09	a19.25	a18.85	a20.32	a22.23	a24.83	a27.57	28.41	28.20	29.08	30.29	32.31	31.28	..
Chile	Unskilled employees	a7.95	a7.60	a7.36	a6.77	a5.91	a6.51	a6.76	6.76	6.96	6.59	7.10	7.34	7.99	..
	Skilled employees	a2.20	a2.18	a2.11	a1.96	a1.82	a1.92	a1.94	1.99	2.04	1.97	2.04	2.11	2.27	..
	Capital	a16.39	a15.70	a14.95	a13.71	a12.16	a13.44	a14.12	12.57	13.06	12.24	13.17	13.86	14.99	..
	Land	a0.64	a0.65	a0.72	a0.70	a0.59	a0.63	a0.60	0.65	0.61	0.64	0.69	0.65	0.76	..
	Natural resources	a0.27	a0.28	a0.26	a0.27	a0.22	a0.30	a0.38	0.33	0.32	0.30	0.37	0.44	0.52	..
	Total	a27.46	a26.41	a25.41	a23.41	a20.70	a22.80	a23.80	22.29	22.98	21.75	23.37	24.40	26.54	..
China	Unskilled employees	a4.85	a5.65	a6.00	a6.20	a6.18	a6.72	a6.42	7.44	8.28	7.98	7.91	8.80	8.76	9.68
	Skilled employees	a0.91	a1.06	a1.18	a1.29	a1.38	a1.52	a1.45	1.60	1.75	1.73	1.75	1.86	1.89	2.07
	Capital	a5.94	a7.26	a8.08	a8.73	a9.00	a10.24	a10.06	6.88	7.78	7.64	7.60	8.42	8.43	9.46
	Land	a0.76	a0.81	a0.82	a0.79	a0.74	a0.72	a0.63	0.51	0.52	0.46	0.44	0.49	0.47	0.47
	Natural resources	a1.43	a1.59	a1.43	a1.29	a1.14	a1.06	a0.98	0.83	0.91	0.66	0.61	0.85	0.81	0.79
	Total	a13.88	a16.37	a17.52	a18.30	a18.43	a20.27	a19.54	17.26	19.24	18.47	18.31	20.43	20.36	22.46

Table A-8: Openness based on the EDR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Colombia	Unskilled employees	a4.74	a5.31	a5.61	a4.91	a4.80	a3.49	a3.44	3.98	3.97	4.04	4.68	5.16	5.11	4.96
	Skilled employees	a1.12	a1.29	a1.33	a1.28	a1.39	a0.86	a0.86	1.31	1.30	1.31	1.46	1.58	1.62	1.53
	Capital	a8.97	a10.58	a11.11	a9.22	a8.80	a6.26	a6.64	5.05	4.84	4.91	6.19	7.04	6.78	6.61
	Land	a1.07	a1.13	a1.15	a0.94	a0.78	a0.72	a0.66	0.35	0.40	0.41	0.41	0.38	0.34	0.35
	Natural resources	a1.58	a2.13	a1.85	a1.43	a1.18	a0.71	a0.96	1.25	1.02	1.02	1.90	2.35	1.96	1.98
	Total	a17.47	a20.44	a21.05	a17.79	a16.95	a12.04	a12.55	11.94	11.53	11.68	14.63	16.51	15.81	15.43
Croatia	Unskilled employees	..	..	..	..	22.97	19.61	14.44	15.28	15.15	15.37	15.39	17.00	17.52	17.09
	Skilled employees	..	..	..	..	6.86	6.39	4.47	5.30	5.79	5.83	5.80	6.44	6.97	6.98
	Capital	..	..	..	..	10.74	9.64	6.92	7.71	7.94	8.21	8.13	8.89	9.43	9.35
	Land	..	..	..	..	1.11	0.77	0.67	0.64	0.60	0.53	0.51	0.60	0.60	0.58
	Natural resources	..	..	..	..	0.80	0.55	0.44	0.43	0.44	0.28	0.35	0.49	0.44	0.40
	Total	..	..	..	..	42.48	36.95	26.93	29.35	29.92	30.22	30.18	33.42	34.96	34.40
Czech Republic	Unskilled employees	..	..	..	..	12.41	11.13	11.64	11.17	12.04	13.44	13.72	15.04	15.59	14.53
	Skilled employees	..	..	..	..	4.59	4.20	4.39	4.50	4.52	4.73	4.65	4.83	4.83	4.41
	Capital	..	..	..	..	18.84	17.24	17.41	16.75	17.57	18.97	19.31	21.17	21.68	20.32
	Land	..	..	..	..	0.44	0.38	0.34	0.31	0.32	0.31	0.30	0.31	0.29	0.27
	Natural resources	..	..	..	..	1.76	1.78	1.40	1.21	1.14	0.97	1.05	1.30	1.23	1.29
	Total	..	..	..	..	38.04	34.73	35.18	33.94	35.58	38.41	39.04	42.65	43.62	40.82
Denmark	Unskilled employees	a9.40	a9.92	a10.26	a10.24	a9.94	a10.03	a9.93	10.98	11.12	11.04	11.94	13.08	13.48	13.68
	Skilled employees	a5.76	a6.12	a6.35	a6.34	a6.13	a6.18	a6.15	6.19	6.19	6.25	6.97	7.77	8.03	8.12
	Capital	a10.28	a10.61	a11.14	a10.85	a10.42	a10.37	a10.20	9.57	9.42	9.08	10.00	11.82	11.87	12.05
	Land	a0.28	a0.28	a0.29	a0.27	a0.28	a0.28	a0.26	0.14	0.14	0.12	0.11	0.11	0.11	0.11
	Natural resources	a1.05	a1.01	a1.10	a1.04	a0.92	a0.88	a0.88	0.98	0.90	0.70	0.81	1.36	1.18	1.28
	Total	a26.77	a27.94	a29.14	a28.74	a27.68	a27.73	a27.42	27.86	27.77	27.19	29.83	34.15	34.68	35.23
Estonia	Unskilled employees	..	..	..	..	..	..	16.10	18.85	22.70	22.73	22.37	28.38	28.37	25.65
	Skilled employees	..	..	..	..	..	..	5.10	6.12	6.33	6.67	6.53	7.06	7.34	6.98
	Capital	..	..	..	..	..	..	12.49	14.77	16.14	16.35	16.18	17.34	17.68	17.07
	Land	..	..	..	..	..	..	1.16	1.23	1.48	1.36	1.14	0.98	1.10	1.20
	Natural resources	..	..	..	..	..	..	2.89	3.40	5.33	4.28	5.29	5.93	4.91	4.99
	Total	..	..	..	..	..	..	37.75	44.37	51.97	51.38	51.51	59.68	59.41	55.89
Finland	Unskilled employees	a5.28	a5.33	a5.20	a6.18	a7.77	a8.19	a9.03	6.76	7.15	7.63	7.19	7.62	7.44	7.09
	Skilled employees	a1.95	a2.07	a2.00	a2.36	a2.95	a2.97	a3.47	3.39	3.53	3.82	3.61	3.57	3.60	3.46
	Capital	a9.69	a9.11	a8.94	a10.64	a13.09	a14.49	a15.04	16.15	16.71	16.31	16.01	18.53	17.07	16.63
	Land	a0.03	a0.03	a0.03	a0.04	a0.05	a0.06	a0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Natural resources	a0.85	a0.74	a0.73	a0.87	a1.07	a1.25	a1.21	1.60	1.62	1.42	1.46	1.86	1.62	1.61
	Total	a17.78	a17.27	a16.90	a20.10	a24.94	a26.97	a28.80	27.92	29.04	29.20	28.28	31.60	29.73	28.81
France	Unskilled employees	6.72	6.64	6.68	6.74	6.68	6.86	7.11	7.15	7.77	8.04	8.14	8.70	8.62	8.25
	Skilled employees	3.68	3.67	3.72	3.77	3.74	3.74	3.84	3.86	4.16	4.31	4.34	4.63	4.61	4.43
	Capital	9.17	9.15	9.27	9.38	9.40	9.18	9.32	9.37	10.03	10.20	10.23	10.96	10.82	10.47
	Land	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.06	0.05	0.05
	Natural resources	0.18	0.17	0.17	0.15	0.16	0.17	0.18	0.18	0.19	0.18	0.18	0.24	0.22	0.20
	Total	19.81	19.69	19.90	20.10	20.05	20.02	20.51	20.61	22.22	22.79	22.95	24.59	24.33	23.40
Germany	Unskilled employees	a12.97	a12.19	a11.05	a10.48	a9.81	a10.22	a10.68	8.65	9.58	10.04	10.21	11.42	12.13	12.37
	Skilled employees	a7.06	a6.65	a6.03	a5.72	a5.37	a5.59	a5.85	4.71	5.18	5.40	5.49	6.08	6.42	6.57
	Capital	a3.69	a3.50	a3.22	a3.07	a2.90	a3.00	a3.13	6.87	7.36	7.54	7.65	8.27	8.67	8.86
	Land	a0.05	a0.04	a0.04	a0.04	a0.04	a0.04	a0.04	0.02	0.03	0.03	0.03	0.03	0.03	0.03
	Natural resources	a0.51	a0.47	a0.41	a0.37	a0.32	a0.34	a0.33	0.25	0.27	0.26	0.26	0.37	0.38	0.38
	Total	a24.27	a22.85	a20.75	a19.68	a18.44	a19.18	a20.03	20.51	22.41	23.27	23.63	26.16	27.65	28.20
Greece	Unskilled employees	6.14	5.77	5.73	6.04	5.79	6.07	5.86	5.58	5.63	..	7.17	7.96	7.56	..
	Skilled employees	3.51	3.49	3.44	3.72	3.59	3.70	3.53	3.27	3.37	..	4.89	5.59	5.50	..
	Capital	5.31	5.18	5.27	5.37	5.36	5.75	5.32	5.14	5.14	..	7.08	8.47	7.83	..
	Land	0.13	0.12	0.13	0.11	0.12	0.15	0.13	0.14	0.13	..	0.13	0.19	0.13	..
	Natural resources	0.63	0.55	0.61	0.57	0.57	0.68	0.60	0.65	0.57	..	0.58	0.73	0.53	..
	Total	15.72	15.11	15.19	15.82	15.43	16.34	15.43	14.78	14.84	..	19.85	22.94	21.55	..

Table A-8: Openness based on the EDR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Hungary	Unskilled employees	10.00	9.65	9.22	9.28	6.80	7.45	9.24	10.85	12.20	13.36	13.80	15.35	15.49	13.86
	Skilled employees	2.52	2.84	2.60	2.82	2.30	2.42	3.14	3.53	3.83	4.00	4.06	4.41	4.57	4.11
	Capital	11.76	12.10	11.06	11.69	9.05	9.71	12.57	14.45	16.57	18.07	18.78	20.80	21.22	19.07
	Land	1.05	1.02	1.18	1.09	0.74	0.79	0.90	0.97	0.73	0.60	0.45	0.36	0.42	0.38
	Natural resources	1.27	1.30	1.37	1.26	1.00	1.14	1.09	1.46	1.23	1.17	1.08	1.24	1.14	0.93
	Total	26.60	26.91	25.42	26.14	19.88	21.50	26.94	31.26	34.56	37.20	38.17	42.16	42.84	38.37
India	Unskilled employees	[a]2.71	[a]2.79	[a]3.33	[a]3.87	[a]3.80	[a]3.80	[a]4.10	3.07	3.14	3.12	3.18	3.74	3.79	4.08
	Skilled employees	[a]0.62	[a]0.64	[a]0.76	[a]0.87	[a]0.84	[a]0.85	[a]0.90	0.60	0.64	0.67	0.72	0.85	0.86	0.93
	Capital	[a]2.57	[a]2.68	[a]3.15	[a]3.68	[a]3.60	[a]3.60	[a]3.85	4.62	4.80	4.87	5.10	6.05	6.14	6.65
	Land	[a]0.40	[a]0.42	[a]0.51	[a]0.58	[a]0.59	[a]0.54	[a]0.65	0.74	0.70	0.65	0.57	0.66	0.66	0.69
	Natural resources	[a]0.05	[a]0.07	[a]0.06	[a]0.07	[a]0.07	[a]0.06	[a]0.06	0.12	0.11	0.09	0.08	0.15	0.16	0.20
	Total	[a]6.35	[a]6.60	[a]7.81	[a]9.08	[a]8.92	[a]8.85	[a]9.56	9.15	9.38	9.40	9.65	11.44	11.62	12.56
Indonesia	Unskilled employees	[a]6.23	[a]6.29	[a]6.37	[a]7.06	[a]6.98	[a]6.89	[a]6.68	4.16	4.58	8.86	6.70	7.10	6.84	6.22
	Skilled employees	[a]1.30	[a]1.32	[a]1.35	[a]1.53	[a]1.53	[a]1.48	[a]1.45	1.12	1.19	1.95	1.58	1.72	1.69	1.52
	Capital	[a]9.13	[a]9.25	[a]9.34	[a]10.39	[a]10.22	[a]10.00	[a]9.76	12.36	13.86	27.38	19.79	22.50	21.54	18.63
	Land	[a]1.23	[a]1.22	[a]1.18	[a]1.13	[a]1.05	[a]1.12	[a]1.04	0.66	0.83	1.76	1.16	0.99	0.95	1.05
	Natural resources	[a]2.78	[a]2.84	[a]2.57	[a]2.44	[a]1.97	[a]1.83	[a]1.84	2.02	2.48	4.98	3.09	3.91	3.70	3.05
	Total	[a]20.69	[a]20.92	[a]20.80	[a]22.55	[a]21.74	[a]21.32	[a]20.77	20.31	22.95	44.93	32.33	36.22	34.72	30.47
Ireland	Unskilled employees	14.00	12.95	13.17	14.01	15.41	16.11	17.22	16.93	16.88	20.60	20.62	21.78	..	..
	Skilled employees	7.60	7.44	7.60	7.80	8.34	8.66	9.07	9.31	9.51	12.72	12.35	12.98	..	..
	Capital	15.13	14.16	14.40	15.19	17.00	17.85	19.52	19.85	20.40	25.14	25.37	27.08	..	..
	Land	0.38	0.30	0.30	0.36	0.38	0.39	0.37	0.24	0.15	0.06	0.06	0.03	..	..
	Natural resources	0.49	0.42	0.40	0.44	0.46	0.46	0.44	0.33	0.27	0.18	0.16	0.16	..	..
	Total	37.60	35.27	35.87	37.81	41.58	43.47	46.61	46.66	47.20	58.70	58.56	62.03	..	..
Italy	Unskilled employees	4.70	4.68	4.42	4.53	5.40	5.78	6.49	6.34	6.33	6.30	5.98	6.41	6.38	6.14
	Skilled employees	2.60	2.68	2.52	2.63	3.05	3.22	3.55	3.46	3.50	3.47	3.27	3.48	3.47	3.34
	Capital	7.74	7.93	7.47	7.78	9.06	9.56	10.57	10.30	10.40	10.32	9.74	10.37	10.35	9.98
	Land	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Natural resources	0.14	0.13	0.12	0.12	0.14	0.13	0.13	0.12	0.14	0.12	0.12	0.19	0.18	0.17
	Total	15.21	15.45	14.56	15.10	17.70	18.74	20.80	20.28	20.42	20.25	19.16	20.49	20.44	19.68
Japan	Unskilled employees	[a]3.48	[a]3.52	[a]3.39	[a]3.39	[a]3.16	[a]3.16	[a]3.18	3.42	3.80	3.88	3.62	3.84	3.73	..
	Skilled employees	[a]2.01	[a]2.02	[a]1.96	[a]1.95	[a]1.83	[a]1.82	[a]1.83	2.06	2.28	2.33	2.18	2.31	2.24	..
	Capital	[a]4.00	[a]4.03	[a]3.90	[a]3.89	[a]3.63	[a]3.61	[a]3.64	3.57	3.96	4.04	3.77	4.00	3.89	..
	Land	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	[a]0.01	0.01	0.01	0.01	0.01	0.01	0.01	..
	Natural resources	[a]0.09	[a]0.10	[a]0.09	[a]0.10	[a]0.09	[a]0.10	[a]0.10	0.03	0.03	0.03	0.03	0.03	0.03	..
	Total	[a]9.59	[a]9.69	[a]9.35	[a]9.33	[a]8.72	[a]8.69	[a]8.76	9.08	10.09	10.29	9.61	10.18	9.91	..
Korea	Unskilled employees	[a]8.11	[a]7.28	[a]6.79	[a]6.92	[a]7.00	[a]7.06	[a]7.49	7.18	8.01	12.29	10.19	9.65	9.45	9.32
	Skilled employees	[a]2.76	[a]2.52	[a]2.34	[a]2.38	[a]2.41	[a]2.46	[a]2.60	2.57	2.78	4.02	3.40	3.12	3.11	3.15
	Capital	[a]10.96	[a]9.87	[a]9.23	[a]9.42	[a]9.53	[a]9.63	[a]10.22	10.04	11.82	18.57	15.33	15.63	15.04	13.95
	Land	[a]0.39	[a]0.32	[a]0.29	[a]0.28	[a]0.27	[a]0.27	[a]0.27	0.21	0.24	0.30	0.27	0.25	0.26	0.24
	Natural resources	[a]0.22	[a]0.20	[a]0.24	[a]0.25	[a]0.25	[a]0.23	[a]0.26	0.47	0.70	1.11	0.93	1.21	1.12	0.83
	Total	[a]22.44	[a]20.19	[a]18.89	[a]19.25	[a]19.46	[a]19.65	[a]20.83	20.47	23.55	36.30	30.12	29.87	28.98	27.49
Latvia	Unskilled employees	..	..	..	..	..	10.28	13.30	14.27	13.99	13.68	12.52	12.98	12.41	12.17
	Skilled employees	..	..	..	..	..	3.45	3.85	4.74	4.19	4.05	3.63	3.85	3.78	3.65
	Capital	..	..	..	..	..	9.00	10.67	12.17	11.27	10.75	9.65	10.16	10.03	9.79
	Land	..	..	..	..	..	0.30	0.45	0.47	0.44	0.32	0.23	0.22	0.27	0.31
	Natural resources	..	..	..	..	..	0.58	1.34	1.13	1.46	1.69	1.69	1.67	1.32	1.30
	Total	..	..	..	..	..	23.62	29.61	32.78	31.35	30.51	27.73	28.87	27.81	27.23
Lithuania	Unskilled employees	..	..	..	..	..	10.59	12.05	12.68	11.90	10.59	9.29	10.34	11.56	..
	Skilled employees	..	..	..	..	..	1.97	2.39	2.66	2.66	2.58	2.58	2.33	2.34	..
	Capital	..	..	..	..	..	9.60	11.34	12.16	11.62	10.64	9.78	10.10	10.93	..
	Land	..	..	..	..	..	1.04	0.83	0.76	0.65	0.51	0.47	0.52	0.58	..
	Natural resources	..	..	..	..	..	3.19	3.67	4.07	4.00	3.48	2.43	3.88	4.74	..
	Total	..	..	..	..	..	26.41	30.27	32.33	30.83	27.80	24.55	27.17	30.14	..

Table A-8: Openness based on the EDR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Malawi	Unskilled employees	6.99	9.25	8.94	..	..	10.87	11.69	8.58	8.97	10.59	10.56	9.54	11.42	..
	Skilled employees	1.04	1.21	1.07	..	..	1.66	1.32	1.01	1.03	1.21	1.29	1.14	1.29	..
	Capital	5.92	7.65	7.16	..	..	9.52	9.49	7.06	7.29	8.68	8.66	7.65	9.19	..
	Land	0.93	1.35	1.35	..	..	1.41	1.81	1.25	1.33	1.64	1.57	1.43	1.76	..
	Natural resources	0.20	0.26	0.29	..	..	0.31	0.37	0.31	0.33	0.31	0.33	0.32	0.38	..
	Total	15.09	19.73	18.80	..	..	23.76	24.68	18.21	18.94	22.44	22.41	20.08	24.03	..
Malaysia	Unskilled employees	..	..	[a]7.59	[a]8.76	[a]9.90	[a]11.76	[a]12.15	20.22	20.66	28.25	29.29	27.59	26.54	25.79
	Skilled employees	..	..	[a]1.98	[a]2.23	[a]2.63	[a]3.13	[a]3.24	5.70	5.90	6.63	6.52	6.15	6.32	6.20
	Capital	..	..	[a]26.35	[a]27.31	[a]28.37	[a]30.83	[a]31.39	26.37	26.51	34.63	36.40	36.42	34.24	33.43
	Land	..	..	[a]2.16	[a]2.14	[a]1.90	[a]2.12	[a]2.09	0.89	0.88	1.43	1.19	0.81	0.82	1.01
	Natural resources	..	..	[a]8.42	[a]7.24	[a]6.03	[a]5.17	[a]4.91	4.52	4.31	4.52	4.96	6.19	5.44	5.44
	Total	..	..	[a]46.50	[a]47.68	[a]48.83	[a]53.01	[a]53.78	57.71	58.26	75.46	78.37	77.17	73.37	71.87
Malta	Unskilled employees	14.51	15.05	15.27	17.27	17.44	..	..	16.18	16.38	..	17.68	..	16.96	..
	Skilled employees	7.22	7.05	7.15	7.39	7.99	..	..	7.34	7.56	..	7.67	..	7.26	..
	Capital	24.44	25.42	25.80	29.28	29.52	..	..	27.35	27.66	..	29.93	..	28.64	..
	Land	0.02	0.02	0.02	0.02	0.02	..	..	0.02	0.03	..	0.03	..	0.04	..
	Natural resources	0.40	0.34	0.18	0.22	0.26	..	..	0.05	0.18	..	0.32	..	0.11	..
	Total	46.60	47.88	48.42	54.18	55.23	..	..	50.94	51.81	..	55.63	..	53.02	..
Mexico	Unskilled employees	[a]2.40	[a]2.24	[a]2.19	[a]2.19	[a]2.30	[a]2.57	[a]4.53	4.77	4.52	4.67	4.66	4.53	4.20	4.14
	Skilled employees	[a]0.84	[a]0.79	[a]0.78	[a]0.82	[a]0.84	[a]0.94	[a]1.45	1.48	1.41	1.46	1.44	1.40	1.31	1.29
	Capital	[a]9.76	[a]9.50	[a]8.30	[a]7.58	[a]7.65	[a]8.43	[a]15.25	16.17	15.01	14.82	15.07	15.11	13.65	13.59
	Land	[a]0.29	[a]0.27	[a]0.25	[a]0.14	[a]0.15	[a]0.15	[a]0.29	0.27	0.24	0.24	0.22	0.21	0.20	0.20
	Natural resources	[a]2.34	[a]2.47	[a]1.70	[a]0.92	[a]0.74	[a]0.72	[a]1.58	1.41	1.08	0.60	0.74	1.03	0.72	0.81
	Total	[a]15.62	[a]15.28	[a]13.21	[a]11.65	[a]11.67	[a]12.82	[a]23.09	24.09	22.27	21.79	22.13	22.28	20.08	20.02
Morocco	Unskilled employees	[a]7.40	[a]8.15	[a]7.33	[a]7.20	[a]7.65	[a]8.61	[a]9.48	9.49	10.18	9.91	10.47	10.59	11.01	11.61
	Skilled employees	[a]2.12	[a]2.30	[a]1.93	[a]2.11	[a]2.18	[a]2.20	[a]2.28	2.41	2.51	2.64	2.81	2.87	3.25	3.37
	Capital	[a]7.60	[a]8.33	[a]7.30	[a]7.39	[a]7.82	[a]8.57	[a]9.27	8.14	8.71	8.70	9.28	9.45	10.04	10.49
	Land	[a]0.27	[a]0.31	[a]0.31	[a]0.26	[a]0.27	[a]0.36	[a]0.45	0.44	0.46	0.29	0.31	0.34	0.31	0.32
	Natural resources	[a]0.12	[a]0.14	[a]0.10	[a]0.10	[a]0.10	[a]0.14	[a]0.17	0.10	0.12	0.06	0.10	0.13	0.12	0.10
	Total	[a]17.52	[a]19.23	[a]16.98	[a]17.06	[a]18.02	[a]19.88	[a]21.65	20.59	21.99	21.60	22.97	23.38	24.73	25.89
Mozambique	Unskilled employees	..	..	..	..	..	5.08	5.80	5.61	5.21	..	..	..	9.69	..
	Skilled employees	..	..	..	..	..	0.98	1.25	1.17	1.09	..	..	..	1.74	..
	Capital	..	..	..	..	..	5.16	6.41	6.13	5.66	..	..	..	9.63	..
	Land	..	..	..	..	..	0.47	0.47	0.52	0.47	..	..	..	0.35	..
	Natural resources	..	..	..	..	..	0.15	0.14	0.12	0.12	..	..	..	0.20	..
	Total	..	..	..	..	..	11.84	14.07	13.55	12.55	..	..	..	21.61	..
Netherlands	Unskilled employees	10.25	10.08	10.22	9.99	10.58	11.21	11.99	12.15	13.64	13.71	13.38	13.91	14.37	15.83
	Skilled employees	6.04	5.93	6.07	6.05	6.28	6.57	6.85	6.96	7.87	7.82	7.64	7.94	8.10	8.65
	Capital	15.51	15.40	15.68	15.01	15.65	16.13	16.62	17.26	18.41	18.18	18.00	20.28	19.68	18.12
	Land	0.21	0.21	0.21	0.20	0.22	0.22	0.22	0.21	0.17	0.19	0.19	0.18	0.20	0.25
	Natural resources	2.40	2.46	2.48	2.13	2.21	2.16	2.13	2.40	2.18	2.05	2.13	3.19	2.59	0.94
	Total	34.41	34.08	34.65	33.38	34.94	36.29	37.81	38.98	42.27	41.94	41.34	45.50	44.95	43.78
New Zealand	Unskilled employees	[a]7.80	[a]8.03	[a]8.80	[a]9.26	[a]9.13	[a]9.07	[a]8.78	8.07	7.98	8.43	8.53	9.64	10.34	9.48
	Skilled employees	[a]2.86	[a]2.90	[a]3.13	[a]3.26	[a]3.24	[a]3.34	[a]3.36	3.10	3.05	3.24	3.39	3.60	3.72	3.59
	Capital	[a]9.75	[a]9.86	[a]10.50	[a]10.88	[a]10.95	[a]11.08	[a]10.73	10.82	10.48	10.66	10.83	12.53	12.83	11.97
	Land	[a]0.48	[a]0.52	[a]0.57	[a]0.61	[a]0.58	[a]0.53	[a]0.48	0.44	0.44	0.44	0.42	0.57	0.64	0.55
	Natural resources	[a]1.14	[a]1.13	[a]1.14	[a]1.14	[a]1.20	[a]1.18	[a]1.05	1.24	1.15	1.04	1.01	1.40	1.35	1.21
	Total	[a]22.03	[a]22.44	[a]24.14	[a]25.16	[a]25.11	[a]25.21	[a]24.39	23.68	23.09	23.82	24.17	27.74	28.88	26.80
Peru	Unskilled employees	3.33	2.36	2.64	1.78	1.89	1.91	1.86	2.02	2.22	1.95	2.26	2.50	2.46	2.53
	Skilled employees	0.99	0.74	0.80	0.58	0.59	0.59	0.58	0.65	0.68	0.72	0.75	0.76	0.73	0.73
	Capital	13.60	9.98	11.25	7.82	7.96	7.94	7.90	8.15	8.77	8.37	9.34	10.04	10.00	10.28
	Land	0.55	0.35	0.46	0.30	0.37	0.41	0.38	0.39	0.47	0.31	0.42	0.48	0.49	0.49
	Natural resources	0.40	0.28	0.22	0.11	0.10	0.06	0.08	0.13	0.14	0.05	0.11	0.21	0.20	0.24
	Total	18.88	13.70	15.37	10.58	10.91	10.91	10.80	11.34	12.28	11.40	12.88	13.99	13.87	14.27

Table A-8: Openness based on the EDR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Philippines	Unskilled employees	[a]5.59	[a]5.43	[a]5.94	[a]5.91	[a]6.01	[a]6.54	[a]7.52	4.54	5.20	5.93	5.72	6.13	5.18	5.18
	Skilled employees	[a]1.44	[a]1.45	[a]1.59	[a]1.71	[a]1.71	[a]1.99	[a]2.30	2.65	3.00	2.19	1.66	1.59	1.41	1.36
	Capital	[a]9.23	[a]8.98	[a]9.85	[a]10.04	[a]10.20	[a]11.33	[a]13.15	15.90	19.40	27.02	28.95	31.07	25.45	25.76
	Land	[a]0.79	[a]0.75	[a]0.80	[a]0.72	[a]0.71	[a]0.67	[a]0.70	0.65	0.64	0.70	0.53	0.63	0.60	0.59
	Natural resources	[a]0.37	[a]0.33	[a]0.35	[a]0.32	[a]0.31	[a]0.28	[a]0.30	0.26	0.25	0.20	0.20	0.32	0.22	0.24
	Total	[a]17.42	[a]16.93	[a]18.53	[a]18.69	[a]18.94	[a]20.80	[a]23.97	24.01	28.49	36.03	37.06	39.73	32.87	33.12
Poland	Unskilled employees	..	10.07	7.14	7.07	6.60	7.44	9.22	7.86	7.09	7.38	6.94	7.86	7.92	8.26
	Skilled employees	..	2.53	1.98	2.12	1.96	2.29	2.93	2.49	2.19	2.36	2.13	2.45	2.34	2.39
	Capital	..	9.83	7.19	7.46	7.03	8.10	10.25	8.77	7.81	8.31	7.68	8.80	8.63	8.92
	Land	..	0.36	0.33	0.31	0.25	0.27	0.28	0.26	0.28	0.25	0.21	0.20	0.22	0.22
	Natural resources	..	1.67	1.32	1.13	0.86	0.91	1.05	0.71	0.56	0.51	0.46	0.53	0.58	0.56
	Total	..	24.46	17.96	18.09	16.70	19.01	23.72	20.09	17.93	18.81	17.41	19.84	19.68	20.35
Portugal	Unskilled employees	7.88	8.03	7.55	7.12	7.63	7.87	8.41	8.81	8.96	9.04	8.54	8.66	8.88	..
	Skilled employees	5.28	5.42	5.11	4.76	5.38	5.41	5.69	5.78	5.92	6.03	5.78	5.95	6.05	..
	Capital	8.85	8.45	7.18	6.63	6.94	7.57	7.94	7.56	7.74	7.46	7.20	7.74	7.36	..
	Land	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	..
	Natural resources	0.88	0.74	0.50	0.44	0.39	0.53	0.54	0.40	0.41	0.32	0.33	0.44	0.31	..
	Total	22.91	22.67	20.35	18.98	20.36	21.40	22.61	22.57	23.06	22.88	21.87	22.81	22.63	..
Russian Federation	Unskilled employees	..	..	..	..	..	..	..	6.82	6.39	8.81	10.24	9.05	7.73	..
	Skilled employees	..	..	..	..	..	..	..	1.86	1.80	2.28	2.30	1.92	1.82	..
	Capital	..	..	..	..	..	..	..	10.51	10.24	12.66	17.94	19.02	15.71	..
	Land	..	..	..	..	..	..	..	0.11	0.10	0.13	0.11	0.12	0.11	..
	Natural resources	..	..	..	..	..	..	..	4.80	4.82	5.46	9.59	11.51	9.19	..
	Total	..	..	..	..	..	..	..	24.10	23.34	29.34	40.18	41.60	34.56	..
Singapore	Unskilled employees	18.67	..	17.86	18.03	17.81	20.94	21.34	20.70	19.98	22.20	21.77	21.58	21.84	22.42
	Skilled employees	5.77	..	5.79	6.85	7.01	8.62	9.28	8.94	8.85	9.50	9.40	8.90	9.53	9.73
	Capital	34.09	..	32.64	31.31	30.84	35.02	35.07	34.50	33.02	36.60	36.48	37.22	36.76	37.70
	Land	1.82	..	1.66	1.37	1.20	1.10	0.90	0.85	0.75	0.77	0.69	0.72	0.63	0.64
	Natural resources	4.14	..	3.84	2.85	2.58	2.19	1.71	1.80	1.54	1.63	1.72	2.16	1.69	1.74
	Total	64.49	..	61.79	60.41	59.43	67.86	68.30	66.79	64.13	70.70	70.06	70.59	70.46	72.23
Slovak Republic	Unskilled employees	..	..	..	..	..	15.21	14.96	12.96	13.58	14.01	15.48	18.56	..	..
	Skilled employees	..	..	..	..	..	4.24	4.00	3.38	3.59	3.82	3.66	3.76	..	..
	Capital	..	..	..	..	..	18.28	17.62	14.84	15.88	16.88	17.17	18.60	..	..
	Land	..	..	..	..	..	0.17	0.16	0.10	0.10	0.10	0.13	0.09	..	..
	Natural resources	..	..	..	..	..	2.35	2.26	2.34	2.06	1.70	2.29	3.69	..	..
	Total	..	..	..	..	..	40.25	38.99	33.62	35.22	36.50	38.73	44.70	..	..
Slovenia	Unskilled employees	..	..	..	20.26	17.25	18.29	16.43	16.55	17.12	17.12	15.65	17.16	18.07	15.84
	Skilled employees	..	..	..	5.95	5.53	6.30	5.72	5.87	5.91	5.81	5.45	5.82	5.97	5.65
	Capital	..	..	..	13.29	12.30	12.68	11.48	11.58	11.86	11.67	10.79	11.66	12.10	11.11
	Land	..	..	..	0.35	0.26	0.24	0.20	0.20	0.19	0.18	0.18	0.18	0.18	0.18
	Natural resources	..	..	..	1.27	1.71	0.70	0.68	0.53	0.66	0.58	0.46	0.53	0.59	0.51
	Total	..	..	..	41.12	37.04	38.21	34.52	34.74	35.74	35.37	32.53	35.36	36.92	33.30
Spain	Unskilled employees	4.85	4.59	4.60	4.63	5.60	6.44	6.89	7.22	7.43	7.74	7.25	7.84	7.97	7.46
	Skilled employees	2.61	2.45	2.45	2.52	2.94	3.33	3.53	3.67	3.79	3.98	3.85	4.08	4.20	3.94
	Capital	6.18	5.75	5.72	5.79	6.75	7.61	8.04	8.42	8.74	9.11	8.80	9.54	9.71	9.22
	Land	0.06	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.08	0.07	0.08	0.08	0.08
	Natural resources	0.37	0.32	0.29	0.21	0.25	0.27	0.30	0.35	0.38	0.36	0.32	0.55	0.45	0.51
	Total	14.06	13.16	13.11	13.20	15.60	17.73	18.83	19.74	20.42	21.27	20.30	22.10	22.42	21.20
Sri Lanka	Unskilled employees	[a]6.27	[a]6.69	[a]6.36	[a]7.05	[a]7.32	[a]7.27	..	..	8.22	..	8.04	..	9.18	8.41
	Skilled employees	[a]1.28	[a]1.41	[a]1.48	[a]1.67	[a]1.67	[a]1.70	..	..	1.77	..	1.80	..	2.21	2.03
	Capital	[a]8.17	[a]8.56	[a]8.15	[a]10.02	[a]10.69	[a]10.55	..	..	12.16	..	11.53	..	12.60	11.38
	Land	[a]2.34	[a]2.46	[a]1.96	[a]1.64	[a]1.74	[a]1.63	..	..	1.86	..	1.78	..	1.86	1.75
	Natural resources	[a]0.34	[a]0.31	[a]0.24	[a]0.21	[a]0.21	[a]0.20	..	..	0.26	..	0.25	..	0.25	0.24
	Total	[a]18.39	[a]19.44	[a]18.19	[a]20.58	[a]21.63	[a]21.35	..	..	24.27	..	23.40	..	26.09	23.81

Table A-8: Openness based on the EDR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sweden	Unskilled employees	a7.28	a7.09	a6.97	a7.03	a7.93	a9.30	a9.76	10.12	10.75	11.21	12.26	12.62	11.22	10.83
	Skilled employees	a3.39	a3.43	a3.53	a3.58	a3.93	a4.55	a4.75	5.97	6.28	6.63	7.61	7.72	6.83	6.69
	Capital	a11.76	a11.03	a10.37	a10.42	a11.95	a13.81	a14.42	10.86	11.78	11.40	10.15	11.00	12.78	12.02
	Land	a0.02	a0.02	a0.02	a0.02	a0.02	a0.02	a0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	Natural resources	a1.02	a0.89	a0.76	a0.75	a0.93	a1.12	a1.19	1.07	1.20	1.03	0.52	0.68	1.32	1.18
	Total	a23.46	a22.45	a21.65	a21.80	a24.76	a28.81	a30.16	28.03	30.03	30.29	30.56	32.04	32.16	30.74
Switzerland	Unskilled employees	10.59	10.30	10.04	10.37	10.54	10.47	10.26	10.53	11.41	11.57	12.05	12.94	12.40	..
	Skilled employees	7.33	7.14	6.96	7.19	7.33	7.26	7.11	7.33	7.91	8.04	8.37	8.93	8.59	..
	Capital	10.13	9.87	9.57	9.91	10.07	10.01	9.80	10.08	10.92	11.08	11.55	12.38	11.90	..
	Land	0.09	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.09	0.10	0.10	0.10	..
	Natural resources	0.11	0.10	0.10	0.10	0.09	0.10	0.10	0.09	0.11	0.11	0.11	0.16	0.13	..
	Total	28.25	27.49	26.76	27.66	28.12	27.94	27.37	28.13	30.47	30.89	32.18	34.51	33.12	..
Tanzania	Unskilled employees	..	..	..	..	..	..	..	..	6.18	4.56	4.47	4.75	5.06	..
	Skilled employees	..	..	..	..	..	..	..	..	0.79	0.73	0.74	0.77	0.86	..
	Capital	..	..	..	..	..	..	..	..	6.08	5.59	5.53	5.81	6.47	..
	Land	..	..	..	..	..	..	..	..	0.63	0.45	0.43	0.46	0.46	..
	Natural resources	..	..	..	..	..	..	..	..	0.24	0.13	0.12	0.13	0.14	..
	Total	..	..	..	..	..	..	..	..	13.91	11.45	11.29	11.92	12.99	..
Thailand	Unskilled employees	a6.43	a5.92	a6.11	a6.31	a6.24	a6.30	a6.63	6.09	7.89	9.76	9.59	10.25	10.00	..
	Skilled employees	a1.44	a1.45	a1.48	a1.60	a1.67	a1.61	a1.72	1.74	1.98	2.22	2.24	2.02	2.05	..
	Capital	a19.71	a19.72	a21.02	a22.00	a23.03	a23.66	a25.29	16.22	20.65	25.58	25.27	26.86	25.97	..
	Land	a2.58	a2.04	a2.02	a1.98	a1.67	a1.70	a1.67	1.54	2.05	2.41	2.33	2.42	2.50	..
	Natural resources	a0.51	a0.42	a0.41	a0.41	a0.38	a0.41	a0.46	1.57	2.20	2.23	2.23	3.39	3.04	..
	Total	a30.67	a29.53	a31.05	a32.30	a32.99	a33.67	a35.77	27.16	34.78	42.19	41.65	44.94	43.56	..
Turkey	Unskilled employees	a3.59	a2.95	a3.16	a3.21	a3.00	a4.60	a4.24	4.33	5.14	5.42	5.00	4.86	6.55	5.48
	Skilled employees	a1.08	a0.94	a0.97	a1.04	a1.01	a1.43	a1.42	1.49	1.91	2.11	1.79	1.88	2.16	1.77
	Capital	a8.78	a7.29	a7.60	a8.01	a7.54	a11.47	a10.86	9.81	11.77	12.63	11.71	11.50	15.51	13.15
	Land	a0.58	a0.45	a0.54	a0.48	a0.43	a0.70	a0.56	0.17	0.18	0.16	0.15	0.12	0.19	0.14
	Natural resources	a0.15	a0.12	a0.12	a0.09	a0.08	a0.14	a0.12	0.13	0.12	0.13	0.14	0.12	0.21	0.19
	Total	a14.19	a11.74	a12.39	a12.83	a12.07	a18.33	a17.19	15.93	19.12	20.45	18.79	18.48	24.61	20.72
Uganda	Unskilled employees	..	..	..	..	..	6.41	5.05	5.61	5.11	4.79	5.25	4.34	4.50	4.39
	Skilled employees	..	..	..	..	..	0.27	0.29	0.37	0.42	0.37	0.45	0.47	0.48	0.50
	Capital	..	..	..	..	..	2.80	2.55	3.31	3.45	2.75	3.51	3.35	3.40	3.27
	Land	..	..	..	..	..	0.99	0.75	0.79	0.68	0.69	0.72	0.56	0.59	0.58
	Natural resources	..	..	..	..	..	0.14	0.11	0.17	0.14	0.12	0.24	0.24	0.24	0.19
	Total	..	..	..	..	..	10.61	8.75	10.25	9.80	8.72	10.17	8.96	9.21	8.94
United Kingdom	Unskilled employees	a7.84	a8.11	a7.95	a8.05	a8.50	a8.92	a9.50	9.15	9.07	8.70	8.45	8.52	8.25	7.94
	Skilled employees	a4.22	a4.34	a4.25	a4.35	a4.59	a4.79	a5.07	5.37	5.34	5.17	5.10	5.20	5.04	4.91
	Capital	a6.04	a6.32	a6.10	a6.18	a6.59	a6.85	a7.21	8.09	7.92	7.38	7.39	7.90	7.59	7.34
	Land	a0.03	a0.04	a0.04	a0.04	a0.04	a0.04	a0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Natural resources	a0.44	a0.54	a0.44	a0.40	a0.49	a0.49	a0.47	0.68	0.58	0.33	0.42	0.76	0.69	0.62
	Total	a18.57	a19.35	a18.78	a19.03	a20.21	a21.09	a22.29	23.31	22.94	21.60	21.38	22.40	21.58	20.82
United States	Unskilled employees	a2.89	a3.01	a3.20	a3.25	a3.23	a3.33	a3.54	3.50	3.62	3.46	3.37	3.42	3.17	2.98
	Skilled employees	a1.79	a1.88	a2.00	a2.03	a2.03	a2.10	a2.22	2.24	2.33	2.25	2.20	2.23	2.07	1.96
	Capital	a2.97	a3.09	a3.24	a3.26	a3.20	a3.30	a3.55	3.54	3.61	3.42	3.33	3.40	3.17	2.98
	Land	a0.06	a0.05	a0.05	a0.05	a0.05	a0.05	a0.06	0.06	0.05	0.04	0.04	0.04	0.04	0.04
	Natural resources	a0.34	a0.35	a0.34	a0.31	a0.26	a0.26	a0.33	0.31	0.29	0.22	0.19	0.24	0.21	0.19
	Total	a8.05	a8.39	a8.84	a8.90	a8.78	a9.05	a9.69	9.65	9.89	9.39	9.12	9.33	8.67	8.14
Uruguay	Unskilled employees	a6.98	a6.83	a5.48	a5.25	a4.85	a4.96	a4.82	5.32	5.43	5.27	4.61	4.77	4.77	6.33
	Skilled employees	a1.09	a1.08	a1.01	a1.04	a1.07	a1.14	a1.06	1.17	1.18	1.17	1.07	1.10	1.08	1.26
	Capital	a10.15	a10.04	a8.96	a9.05	a9.09	a9.60	a9.04	8.61	8.67	8.48	7.68	7.91	7.79	9.49
	Land	a2.03	a1.99	a1.42	a1.31	a1.06	a1.04	a1.08	1.12	1.13	1.01	0.85	0.88	0.91	1.42
	Natural resources	a0.20	a0.19	a0.14	a0.13	a0.10	a0.10	a0.10	0.11	0.10	0.08	0.07	0.07	0.08	0.13
	Total	a20.45	a20.14	a17.01	a16.77	a16.17	a16.83	a16.10	16.33	16.50	16.01	14.28	14.74	14.62	18.63

Table A-8: Openness based on the EDR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Venezuela	Unskilled employees	3.74	4.05	3.34	2.91	3.12	3.66	3.27	3.83	3.08	2.76	2.62	2.92	2.69	3.30
	Skilled employees	1.24	1.31	1.15	1.05	1.09	1.23	1.11	1.22	1.02	0.95	0.88	0.92	0.89	1.03
	Capital	15.88	19.18	14.63	11.69	12.38	14.50	12.41	17.34	12.47	8.99	10.17	13.71	11.35	14.91
	Land	0.09	0.11	0.09	0.08	0.10	0.12	0.10	0.12	0.10	0.10	0.08	0.07	0.06	0.08
	Natural resources	7.92	10.22	7.36	5.50	5.84	6.91	5.71	9.06	6.05	3.63	4.78	7.32	5.65	7.80
	Total	28.88	34.87	26.57	21.23	22.52	26.43	22.61	31.56	22.72	16.43	18.52	24.93	20.64	27.12
Zambia	Unskilled employees	..	..	..	..	..	..	..	..	7.39	9.12	10.44	6.00	..	..
	Skilled employees	..	..	..	..	..	..	..	..	1.92	2.06	2.10	1.68	..	..
	Capital	..	..	..	..	..	..	..	..	11.74	15.26	17.15	8.67	..	..
	Land	..	..	..	..	..	..	..	..	0.21	0.27	0.36	0.22	..	..
	Natural resources	..	..	..	..	..	..	..	..	0.23	0.29	0.42	0.19	..	..
	Total	..	..	..	..	..	..	..	..	21.50	27.01	30.47	16.77	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

Table A-9: Openness based on the IFR_g measure of 56 countries, 1989-2002, % of current GDP

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	Unskilled employees	a3.29	a1.84	a2.41	a3.38	a3.73	a4.24	a4.01	4.26	4.95	5.01	4.43	4.42	3.88	4.77
	Skilled employees	a1.83	a1.03	a1.32	a1.83	a2.02	a2.28	a2.16	2.26	2.61	2.64	2.36	2.36	2.08	2.60
	Capital	a3.38	a1.90	a2.44	a3.37	a3.70	a4.21	a4.01	4.70	5.43	5.49	4.88	4.89	4.31	5.36
	Land	a0.05	a0.03	a0.04	a0.06	a0.06	a0.07	a0.07	0.07	0.08	0.08	0.07	0.07	0.07	0.07
	Natural resources	a0.23	a0.12	a0.15	a0.17	a0.18	a0.22	a0.23	0.23	0.26	0.25	0.22	0.23	0.20	0.26
	Total	a8.78	a4.92	a6.35	a8.81	a9.69	a11.02	a10.48	11.51	13.33	13.47	11.96	11.98	10.55	13.05
Australia	Unskilled employees	a7.23	a6.79	a6.58	a6.96	a7.34	a7.59	a7.99	7.42	7.45	8.11	7.91	8.44	7.99	8.12
	Skilled employees	a3.85	a3.63	a3.51	a3.71	a3.90	a4.04	a4.24	3.86	3.88	4.22	4.11	4.36	4.14	4.19
	Capital	a7.28	a6.85	a6.63	a7.01	a7.40	a7.61	a8.01	8.22	8.25	8.92	8.74	9.39	8.90	8.99
	Land	a0.13	a0.12	a0.12	a0.12	a0.13	a0.13	a0.14	0.13	0.13	0.14	0.14	0.15	0.14	0.14
	Natural resources	a0.47	a0.44	a0.42	a0.45	a0.49	a0.46	a0.49	0.49	0.48	0.48	0.51	0.63	0.59	0.57
	Total	a18.94	a17.82	a17.26	a18.26	a19.26	a19.84	a20.88	20.11	20.18	21.87	21.40	22.97	21.76	22.02
Austria	Unskilled employees	14.39	14.30	14.31	13.86	13.43	13.93	14.56	15.39	16.70	16.82	17.57	19.67	20.44	19.99
	Skilled employees	7.51	7.45	7.48	7.30	7.14	7.39	7.78	8.22	8.93	8.95	9.37	10.49	10.90	10.69
	Capital	16.06	15.96	15.97	15.45	15.03	15.55	16.33	17.29	18.72	18.73	19.63	22.12	23.01	22.56
	Land	0.26	0.26	0.25	0.24	0.23	0.24	0.26	0.28	0.31	0.31	0.32	0.35	0.38	0.38
	Natural resources	1.01	1.02	0.99	0.89	0.82	0.84	0.88	0.93	0.96	0.92	0.99	1.25	1.30	1.28
	Total	39.23	38.99	39.01	37.73	36.66	37.95	39.80	42.12	45.62	45.73	47.88	53.88	56.04	54.90
Bangladesh	Unskilled employees	5.70	4.93	4.65	5.00	5.21	..	7.45	6.94	6.95	6.74	..	..	7.68	..
	Skilled employees	2.64	2.30	2.22	2.38	2.53	..	3.61	3.34	3.34	3.27	..	..	3.71	..
	Capital	6.42	5.70	5.24	5.65	5.90	..	8.27	7.70	7.81	7.53	..	..	8.53	..
	Land	0.34	0.25	0.21	0.24	0.22	..	0.32	0.30	0.31	0.27	..	..	0.32	..
	Natural resources	0.60	0.66	0.49	0.53	0.54	..	0.62	0.60	0.68	0.62	..	..	0.67	..
	Total	15.70	13.85	12.81	13.79	14.39	..	20.27	18.88	19.09	18.44	..	..	20.91	..
Belgium	Unskilled employees	..	..	..	..	..	..	..	..	29.04	..	31.44	36.61	37.08	..
	Skilled employees	..	..	..	..	..	..	..	..	14.58	..	15.90	18.51	18.78	..
	Capital	..	..	..	..	..	..	..	..	31.97	..	34.72	40.91	41.37	..
	Land	..	..	..	..	..	..	..	..	0.81	..	0.87	0.95	0.95	..
	Natural resources	..	..	..	..	..	..	..	..	1.96	..	2.08	2.91	2.86	..
	Total	..	..	..	..	..	..	..	..	78.36	..	85.00	99.89	101.04	..
Brazil	Unskilled employees	a2.00	a2.26	a2.61	a2.74	a3.06	a3.12	a3.57	3.21	3.56	3.53	4.44	4.48	5.31	..
	Skilled employees	a1.02	a1.16	a1.33	a1.41	a1.59	a1.61	a1.84	1.61	1.81	1.81	2.29	2.31	2.76	..
	Capital	a2.16	a2.44	a2.79	a2.95	a3.25	a3.22	a3.63	3.64	4.00	3.94	4.99	5.11	6.03	..
	Land	a0.07	a0.07	a0.09	a0.09	a0.09	a0.10	a0.11	0.10	0.10	0.10	0.11	0.10	0.11	..
	Natural resources	a0.31	a0.35	a0.38	a0.40	a0.40	a0.34	a0.34	0.34	0.34	0.29	0.40	0.47	0.52	..
	Total	a5.56	a6.28	a7.19	a7.59	a8.39	a8.38	a9.50	8.90	9.81	9.67	12.23	12.46	14.74	..
Canada	Unskilled employees	a10.01	a9.94	a9.99	a10.64	a11.76	a12.86	a13.19	12.80	13.98	14.82	14.77	14.97	14.24	..
	Skilled employees	a5.26	a5.23	a5.27	a5.62	a6.21	a6.78	a6.95	6.60	7.19	7.62	7.61	7.69	7.31	..
	Capital	a10.02	a10.02	a10.01	a10.64	a11.73	a12.80	a13.13	14.08	15.36	16.21	16.15	16.47	15.71	..
	Land	a0.20	a0.21	a0.21	a0.22	a0.24	a0.26	a0.26	0.26	0.27	0.29	0.28	0.28	0.28	..
	Natural resources	a0.62	a0.67	a0.60	a0.62	a0.67	a0.71	a0.75	0.75	0.82	0.81	0.80	0.92	0.89	..
	Total	a26.11	a26.07	a26.09	a27.74	a30.62	a33.42	a34.28	34.48	37.63	39.75	39.61	40.33	38.44	..
Chile	Unskilled employees	a12.26	a11.87	a10.91	a11.31	a11.65	a10.88	a11.28	11.34	11.49	12.15	10.13	10.91	12.21	..
	Skilled employees	a6.48	a6.21	a5.67	a5.89	a6.09	a5.68	a5.88	5.73	5.82	6.18	5.17	5.52	6.23	..
	Capital	a12.71	a12.44	a11.41	a11.63	a11.89	a11.09	a11.45	12.68	12.80	13.49	11.50	12.59	14.05	..
	Land	a0.21	a0.23	a0.24	a0.25	a0.25	a0.25	a0.25	0.27	0.26	0.28	0.26	0.27	0.30	..
	Natural resources	a1.17	a1.29	a1.18	a1.04	a0.98	a0.90	a0.90	1.00	0.96	0.94	0.94	1.26	1.31	..
	Total	a32.83	a32.04	a29.42	a30.12	a30.86	a28.80	a29.76	31.01	31.33	33.05	28.01	30.56	34.10	..
China	Unskilled employees	a6.99	a6.21	a6.86	a8.18	a10.21	a9.28	a8.50	7.18	6.79	6.39	7.21	8.65	8.81	9.74
	Skilled employees	a3.54	a3.17	a3.52	a4.26	a5.36	a4.87	a4.46	3.73	3.56	3.36	3.79	4.51	4.60	5.10
	Capital	a6.96	a6.13	a6.83	a8.15	a10.15	a9.20	a8.49	8.03	7.70	7.15	8.08	9.84	9.92	10.92
	Land	a0.19	a0.16	a0.14	a0.14	a0.14	a0.15	a0.18	0.13	0.12	0.10	0.11	0.13	0.13	0.13
	Natural resources	a0.56	a0.45	a0.54	a0.62	a0.75	a0.64	a0.61	0.56	0.59	0.47	0.56	0.83	0.76	0.80
	Total	a18.23	a16.11	a17.89	a21.35	a26.61	a24.14	a22.23	19.64	18.76	17.47	19.73	23.96	24.22	26.69

Table A-9: Openness based on the IFR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Colombia	Unskilled employees	[a]6.26	[a]6.85	[a]6.12	[a]6.55	[a]8.30	[a]6.83	[a]6.97	6.53	6.63	6.78	6.03	6.58	7.38	7.35
	Skilled employees	[a]3.31	[a]3.62	[a]3.27	[a]3.43	[a]4.33	[a]3.55	[a]3.60	3.30	3.36	3.43	3.08	3.36	3.78	3.74
	Capital	[a]6.32	[a]6.93	[a]6.20	[a]6.61	[a]8.28	[a]6.77	[a]6.90	7.13	7.25	7.38	6.62	7.23	8.07	8.01
	Land	[a]0.13	[a]0.15	[a]0.13	[a]0.17	[a]0.20	[a]0.18	[a]0.19	0.21	0.19	0.21	0.19	0.20	0.21	0.22
	Natural resources	[a]0.43	[a]0.49	[a]0.43	[a]0.46	[a]0.52	[a]0.39	[a]0.41	0.36	0.37	0.36	0.32	0.35	0.37	0.37
	Total	[a]16.46	[a]18.04	[a]16.14	[a]17.22	[a]21.64	[a]17.72	[a]18.07	17.52	17.80	18.16	16.23	17.72	19.81	19.70
Croatia	Unskilled employees	..	..	..	..	19.24	16.03	17.10	17.30	20.41	17.43	17.86	18.34	19.81	21.21
	Skilled employees	..	..	..	..	9.71	8.03	8.39	8.61	10.31	8.80	9.11	9.25	9.94	10.69
	Capital	..	..	..	..	21.65	18.04	19.24	19.48	22.89	19.32	20.17	20.91	22.41	23.95
	Land	..	..	..	..	0.53	0.50	0.60	0.56	0.60	0.49	0.46	0.48	0.54	0.57
	Natural resources	..	..	..	..	1.68	1.42	1.66	1.59	1.67	1.26	1.54	1.87	1.91	1.96
	Total	..	..	..	..	52.82	44.01	46.98	47.55	55.87	47.29	49.13	50.85	54.63	58.38
Czech Republic	Unskilled employees	..	..	..	..	19.31	19.43	21.14	21.49	22.43	22.03	22.78	26.76	27.19	24.59
	Skilled employees	..	..	..	..	9.85	9.93	10.72	10.96	11.38	11.26	11.66	13.55	13.74	12.38
	Capital	..	..	..	..	21.82	21.93	23.50	23.99	24.97	24.31	25.16	29.80	30.14	27.78
	Land	..	..	..	..	0.47	0.50	0.47	0.48	0.49	0.44	0.44	0.51	0.50	0.46
	Natural resources	..	..	..	..	1.74	1.66	1.70	1.73	1.83	1.56	1.62	2.31	2.28	2.56
	Total	..	..	..	..	53.18	53.45	57.52	58.65	61.09	59.60	61.66	72.93	73.85	67.78
Denmark	Unskilled employees	[a]12.79	[a]12.33	[a]12.67	[a]12.03	[a]11.44	[a]12.24	[a]12.70	12.04	12.76	13.39	13.56	15.20	15.28	15.67
	Skilled employees	[a]6.60	[a]6.38	[a]6.55	[a]6.21	[a]5.92	[a]6.35	[a]6.59	6.16	6.51	6.90	7.08	8.03	8.11	8.33
	Capital	[a]12.98	[a]12.48	[a]12.73	[a]12.06	[a]11.49	[a]12.27	[a]12.67	13.38	14.16	14.85	15.13	17.19	17.23	17.69
	Land	[a]0.41	[a]0.38	[a]0.40	[a]0.40	[a]0.39	[a]0.39	[a]0.40	0.39	0.41	0.41	0.39	0.41	0.41	0.42
	Natural resources	[a]0.98	[a]0.91	[a]0.85	[a]0.78	[a]0.74	[a]0.77	[a]0.76	0.73	0.78	0.75	0.74	0.93	0.84	0.86
	Total	[a]33.76	[a]32.48	[a]33.20	[a]31.48	[a]29.98	[a]32.02	[a]33.12	32.68	34.61	36.30	36.89	41.75	41.88	42.99
Estonia	Unskilled employees	..	..	..	..	..	..	22.51	31.53	40.62	38.47	34.87	42.40	41.40	40.95
	Skilled employees	..	..	..	..	..	..	10.95	15.29	19.57	18.75	17.31	21.11	20.66	20.62
	Capital	..	..	..	..	..	..	25.25	35.08	44.83	42.21	38.66	47.02	45.83	45.62
	Land	..	..	..	..	..	..	0.85	1.27	1.71	1.59	1.18	1.21	1.23	1.25
	Natural resources	..	..	..	..	..	..	2.16	2.77	3.33	2.71	2.67	3.44	3.19	3.11
	Total	..	..	..	..	..	..	61.72	85.94	110.07	103.73	94.69	115.18	112.31	111.55
Finland	Unskilled employees	[a]9.92	[a]9.43	[a]8.84	[a]9.80	[a]10.57	[a]11.37	[a]11.32	11.39	11.80	11.56	11.28	12.80	12.16	11.49
	Skilled employees	[a]5.21	[a]4.98	[a]4.69	[a]5.20	[a]5.61	[a]5.99	[a]6.01	5.86	6.05	5.92	5.77	6.56	6.23	5.88
	Capital	[a]10.14	[a]9.70	[a]9.16	[a]10.16	[a]10.94	[a]11.70	[a]11.57	12.82	13.22	12.83	12.57	14.44	13.73	12.97
	Land	[a]0.20	[a]0.18	[a]0.19	[a]0.21	[a]0.23	[a]0.26	[a]0.23	0.25	0.26	0.25	0.24	0.25	0.25	0.24
	Natural resources	[a]0.85	[a]0.86	[a]0.83	[a]0.94	[a]0.98	[a]1.03	[a]0.93	1.00	1.00	0.89	0.92	1.21	1.15	1.09
	Total	[a]26.32	[a]25.15	[a]23.72	[a]26.30	[a]28.34	[a]30.35	[a]30.06	31.32	32.33	31.45	30.79	35.27	33.53	31.68
France	Unskilled employees	8.79	8.75	8.73	8.38	8.09	8.16	8.32	8.45	9.00	9.45	9.62	11.08	10.83	10.08
	Skilled employees	4.41	4.42	4.42	4.27	4.13	4.09	4.17	4.24	4.52	4.77	4.84	5.54	5.43	5.07
	Capital	9.76	9.75	9.73	9.33	9.02	9.00	9.15	9.33	9.93	10.34	10.54	12.26	11.97	11.14
	Land	0.26	0.25	0.26	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	0.29	0.28	0.27
	Natural resources	0.74	0.74	0.73	0.65	0.62	0.63	0.62	0.67	0.71	0.65	0.69	0.96	0.91	0.82
	Total	23.97	23.90	23.86	22.87	22.11	22.14	22.51	22.94	24.42	25.46	25.95	30.12	29.42	27.39
Germany	Unskilled employees	[a]9.34	[a]9.30	[a]9.69	[a]9.10	[a]8.14	[a]8.46	[a]8.74	8.87	9.71	10.10	10.48	12.06	12.05	11.45
	Skilled employees	[a]4.75	[a]4.75	[a]4.95	[a]4.67	[a]4.21	[a]4.37	[a]4.52	4.51	4.94	5.16	5.37	6.17	6.19	5.89
	Capital	[a]10.45	[a]10.42	[a]10.83	[a]10.14	[a]9.11	[a]9.42	[a]9.71	10.15	11.11	11.48	11.92	13.86	13.84	13.14
	Land	[a]0.31	[a]0.30	[a]0.30	[a]0.29	[a]0.25	[a]0.26	[a]0.26	0.26	0.28	0.28	0.27	0.29	0.29	0.28
	Natural resources	[a]0.74	[a]0.74	[a]0.75	[a]0.67	[a]0.61	[a]0.60	[a]0.61	0.66	0.72	0.67	0.69	0.95	0.91	0.84
	Total	[a]25.59	[a]25.51	[a]26.53	[a]24.87	[a]22.31	[a]23.11	[a]23.84	24.45	26.76	27.68	28.73	33.33	33.29	31.61
Greece	Unskilled employees	9.99	9.87	9.96	9.79	9.87	9.12	9.39	9.49	9.45	..	12.08	13.88	12.02	..
	Skilled employees	4.79	4.75	4.81	4.73	4.77	4.40	4.54	4.57	4.59	..	6.14	7.11	6.21	..
	Capital	11.02	10.94	11.10	10.89	11.00	10.16	10.36	10.49	10.44	..	13.39	15.89	13.88	..
	Land	0.43	0.41	0.39	0.39	0.39	0.39	0.39	0.38	0.37	..	0.39	0.42	0.37	..
	Natural resources	0.82	0.85	0.92	0.88	0.90	0.81	0.74	0.80	0.75	..	0.75	1.26	1.13	..
	Total	27.05	26.82	27.17	26.67	26.94	24.87	25.42	25.74	25.62	..	32.74	38.55	33.60	..

Table A-9: Openness based on the IFR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Hungary	Unskilled employees	12.96	13.64	14.26	13.11	14.01	15.26	15.45	17.58	20.18	23.75	25.23	29.55	28.35	25.05
	Skilled employees	6.48	6.86	7.12	6.66	7.07	7.69	7.89	8.94	10.29	12.14	12.94	15.13	14.58	12.89
	Capital	14.73	15.63	16.33	15.06	16.01	17.27	17.53	20.03	22.52	26.12	27.66	32.22	31.06	27.68
	Land	0.32	0.35	0.32	0.28	0.31	0.36	0.32	0.36	0.37	0.40	0.37	0.41	0.41	0.37
	Natural resources	1.38	1.50	1.68	1.46	1.53	1.52	1.49	1.82	1.69	1.68	1.71	1.91	1.86	1.83
	Total	35.88	37.98	39.71	36.57	38.93	42.10	42.67	48.73	55.05	64.09	67.92	79.22	76.26	67.81
India	Unskilled employees	[a]3.25	[a]3.28	[a]3.43	[a]4.33	[a]3.76	[a]3.85	[a]4.50	4.32	4.53	4.84	4.89	4.96	4.70	4.98
	Skilled employees	[a]1.71	[a]1.70	[a]1.79	[a]2.24	[a]1.95	[a]2.00	[a]2.34	2.20	2.32	2.48	2.51	2.52	2.40	2.55
	Capital	[a]3.51	[a]3.68	[a]3.88	[a]4.89	[a]4.20	[a]4.24	[a]4.96	5.29	5.44	5.72	6.00	6.21	5.81	6.14
	Land	[a]0.06	[a]0.07	[a]0.07	[a]0.09	[a]0.07	[a]0.09	[a]0.09	0.08	0.09	0.12	0.11	0.10	0.10	0.11
	Natural resources	[a]0.44	[a]0.59	[a]0.64	[a]0.81	[a]0.65	[a]0.61	[a]0.71	0.78	0.71	0.65	0.85	1.02	0.88	0.92
	Total	[a]8.98	[a]9.31	[a]9.81	[a]12.36	[a]10.64	[a]10.79	[a]12.60	12.67	13.09	13.81	14.36	14.81	13.89	14.70
Indonesia	Unskilled employees	[a]8.02	[a]9.07	[a]9.43	[a]9.48	[a]9.00	[a]9.13	[a]9.97	9.17	9.67	14.60	8.88	11.10	11.20	9.68
	Skilled employees	[a]4.24	[a]4.79	[a]4.96	[a]5.00	[a]4.79	[a]4.84	[a]5.25	4.72	5.06	7.64	4.57	5.77	5.89	5.09
	Capital	[a]8.23	[a]9.33	[a]9.71	[a]9.74	[a]9.23	[a]9.38	[a]10.25	10.38	10.99	16.74	10.39	13.09	13.25	11.51
	Land	[a]0.18	[a]0.17	[a]0.19	[a]0.20	[a]0.18	[a]0.20	[a]0.25	0.26	0.23	0.39	0.32	0.31	0.30	0.28
	Natural resources	[a]0.67	[a]0.80	[a]0.86	[a]0.82	[a]0.74	[a]0.76	[a]0.86	0.80	0.83	1.32	0.99	1.37	1.33	1.19
	Total	[a]21.34	[a]24.16	[a]25.13	[a]25.23	[a]23.94	[a]24.32	[a]26.57	25.33	26.78	40.70	25.15	31.63	31.98	27.75
Ireland	Unskilled employees	21.29	20.12	20.40	20.30	20.46	22.91	24.20	24.00	24.34	30.61	28.29	30.49	..	..
	Skilled employees	10.79	10.19	10.37	10.42	10.55	11.86	12.65	12.65	12.89	16.92	15.41	16.63	..	..
	Capital	23.50	22.28	22.57	22.48	22.67	25.33	26.74	26.65	27.03	34.58	31.75	34.33	..	..
	Land	0.63	0.58	0.61	0.60	0.56	0.61	0.57	0.55	0.53	0.55	0.53	0.54	..	..
	Natural resources	1.39	1.39	1.32	1.22	1.21	1.27	1.26	1.25	1.23	1.26	1.25	1.47	..	..
	Total	57.60	54.57	55.27	55.02	55.46	61.99	65.43	65.11	66.01	83.92	77.25	83.45	..	..
Italy	Unskilled employees	7.66	7.47	7.09	7.24	7.14	7.65	8.60	7.78	8.35	8.57	8.58	9.90	9.62	9.33
	Skilled employees	3.75	3.72	3.51	3.66	3.61	3.84	4.32	3.91	4.22	4.36	4.34	4.98	4.86	4.72
	Capital	8.56	8.39	7.90	8.08	8.01	8.55	9.56	8.66	9.28	9.43	9.43	11.01	10.68	10.35
	Land	0.28	0.26	0.26	0.24	0.25	0.26	0.28	0.25	0.26	0.25	0.25	0.27	0.26	0.26
	Natural resources	0.79	0.76	0.68	0.63	0.65	0.70	0.76	0.69	0.72	0.64	0.67	0.93	0.86	0.81
	Total	21.05	20.59	19.44	19.85	19.65	21.00	23.53	21.30	22.83	23.26	23.26	27.08	26.29	25.47
Japan	Unskilled employees	[a]3.39	[a]3.64	[a]3.24	[a]3.01	[a]2.73	[a]2.83	[a]3.13	3.53	3.69	3.46	3.30	3.60	3.81	..
	Skilled employees	[a]1.72	[a]1.85	[a]1.64	[a]1.53	[a]1.38	[a]1.43	[a]1.59	1.75	1.83	1.73	1.64	1.77	1.87	..
	Capital	[a]3.72	[a]4.03	[a]3.57	[a]3.29	[a]2.96	[a]3.01	[a]3.29	4.19	4.39	4.07	3.88	4.27	4.51	..
	Land	[a]0.16	[a]0.17	[a]0.16	[a]0.15	[a]0.13	[a]0.14	[a]0.14	0.15	0.15	0.14	0.13	0.14	0.15	..
	Natural resources	[a]0.53	[a]0.59	[a]0.51	[a]0.45	[a]0.39	[a]0.36	[a]0.37	0.43	0.46	0.37	0.37	0.48	0.49	..
	Total	[a]9.51	[a]10.29	[a]9.12	[a]8.42	[a]7.60	[a]7.78	[a]8.52	10.04	10.53	9.77	9.32	10.24	10.84	..
Korea	Unskilled employees	[a]11.52	[a]11.41	[a]11.49	[a]10.90	[a]10.28	[a]10.91	[a]12.01	12.22	12.86	12.97	12.74	14.60	14.31	13.79
	Skilled employees	[a]5.85	[a]5.80	[a]5.85	[a]5.55	[a]5.25	[a]5.61	[a]6.21	6.16	6.48	6.63	6.47	7.38	7.25	7.00
	Capital	[a]12.24	[a]12.27	[a]12.27	[a]11.74	[a]11.08	[a]11.55	[a]12.67	14.01	14.87	15.08	14.71	17.03	16.75	15.99
	Land	[a]0.29	[a]0.28	[a]0.28	[a]0.28	[a]0.25	[a]0.25	[a]0.27	0.29	0.30	0.31	0.29	0.32	0.34	0.32
	Natural resources	[a]1.58	[a]1.70	[a]1.62	[a]1.63	[a]1.52	[a]1.42	[a]1.49	1.62	1.83	1.78	1.72	2.22	2.17	1.93
	Total	[a]31.49	[a]31.46	[a]31.51	[a]30.10	[a]28.38	[a]29.74	[a]32.65	34.30	36.34	36.77	35.93	41.55	40.83	39.02
Latvia	Unskilled employees	..	..	..	..	..	9.19	14.80	20.75	21.53	23.47	19.60	19.79	20.26	20.75
	Skilled employees	..	..	..	..	..	4.40	7.09	10.37	10.67	11.69	9.73	9.84	10.02	10.19
	Capital	..	..	..	..	..	11.04	17.18	24.38	24.45	26.28	21.99	22.35	22.67	23.06
	Land	..	..	..	..	..	0.34	0.51	0.74	0.77	0.80	0.66	0.66	0.69	0.73
	Natural resources	..	..	..	..	..	1.60	2.10	2.63	2.12	1.97	1.73	1.86	1.78	1.76
	Total	..	..	..	..	..	26.57	41.69	58.87	59.54	64.22	53.71	54.50	55.42	56.48
Lithuania	Unskilled employees	..	..	..	..	..	15.32	22.56	23.48	24.28	22.23	18.85	19.07	20.73	..
	Skilled employees	..	..	..	..	..	7.17	10.67	11.22	11.78	10.81	9.18	9.11	9.91	..
	Capital	..	..	..	..	..	18.69	26.27	27.11	27.89	25.25	21.52	22.38	24.13	..
	Land	..	..	..	..	..	0.57	0.93	0.93	0.82	0.74	0.63	0.65	0.68	..
	Natural resources	..	..	..	..	..	3.12	3.30	3.13	3.03	2.52	2.21	2.96	3.07	..
	Total	..	..	..	..	..	44.87	63.72	65.87	67.80	61.55	52.39	54.17	58.52	..

Table A-9: Openness based on the IFR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Malawi	Unskilled employees	16.68	16.20	17.35	..	..	20.08	15.95	12.11	14.33	14.24	17.23	14.69	14.31	..
	Skilled employees	8.80	8.61	9.30	..	..	10.09	8.09	6.17	7.25	7.08	8.70	7.49	7.27	..
	Capital	19.02	18.47	19.83	..	..	22.31	17.98	13.67	16.20	15.97	19.45	16.88	16.54	..
	Land	0.44	0.37	0.37	..	..	0.78	0.54	0.36	0.44	0.64	0.55	0.43	0.45	..
	Natural resources	1.22	1.16	1.21	..	..	1.32	1.26	0.99	1.24	1.06	1.48	1.46	1.51	..
	Total	46.16	44.82	48.06	..	..	54.58	43.82	33.30	39.47	38.99	47.40	40.95	40.08	..
Malaysia	Unskilled employees	..	..	[a]33.76	[a]30.71	[a]31.72	[a]37.09	[a]40.27	35.37	36.05	36.69	37.35	40.53	37.92	37.53
	Skilled employees	..	..	[a]17.58	[a]16.01	[a]16.65	[a]19.53	[a]21.21	18.31	18.68	18.97	19.34	20.93	19.59	19.31
	Capital	..	..	[a]33.35	[a]30.34	[a]31.33	[a]36.49	[a]39.57	38.48	39.29	40.01	40.72	44.35	41.65	41.02
	Land	..	..	[a]0.71	[a]0.64	[a]0.63	[a]0.67	[a]0.69	0.63	0.65	0.68	0.68	0.67	0.69	0.69
	Natural resources	..	..	[a]1.97	[a]1.78	[a]1.76	[a]1.91	[a]2.05	1.85	1.91	2.00	2.01	2.48	2.36	2.26
	Total	..	..	[a]87.36	[a]79.48	[a]82.09	[a]95.70	[a]103.79	94.64	96.58	98.34	100.09	108.95	102.21	100.81
Malta	Unskilled employees	36.39	39.42	39.16	39.20	41.59	..	..	38.58	35.33	..	36.29	..	34.94	..
	Skilled employees	18.52	20.11	19.88	19.96	21.35	..	..	19.57	17.89	..	18.49	..	17.75	..
	Capital	40.30	43.37	42.97	42.98	45.73	..	..	42.35	38.79	..	39.86	..	38.85	..
	Land	1.12	1.08	1.10	1.07	1.08	..	..	1.10	1.08	..	1.01	..	1.01	..
	Natural resources	2.32	2.35	2.33	2.28	2.36	..	..	2.32	2.10	..	2.13	..	2.47	..
	Total	98.65	106.33	105.44	105.49	112.10	..	..	103.91	95.18	..	97.78	..	95.03	..
Mexico	Unskilled employees	[a]7.59	[a]7.86	[a]7.71	[a]8.17	[a]7.72	[a]8.82	[a]11.52	11.80	11.94	12.90	12.62	12.75	11.60	11.28
	Skilled employees	[a]3.81	[a]4.01	[a]3.93	[a]4.22	[a]4.00	[a]4.53	[a]5.93	5.89	5.98	6.47	6.34	6.42	5.83	5.66
	Capital	[a]7.49	[a]7.73	[a]7.60	[a]7.99	[a]7.53	[a]8.59	[a]11.22	12.43	12.62	13.59	13.27	13.44	12.23	11.89
	Land	[a]0.30	[a]0.28	[a]0.25	[a]0.21	[a]0.18	[a]0.23	[a]0.25	0.28	0.25	0.26	0.24	0.22	0.22	0.23
	Natural resources	[a]0.53	[a]0.49	[a]0.51	[a]0.47	[a]0.43	[a]0.49	[a]0.66	0.65	0.69	0.73	0.69	0.73	0.66	0.63
	Total	[a]19.72	[a]20.36	[a]20.00	[a]21.06	[a]19.86	[a]22.66	[a]29.58	31.04	31.48	33.95	33.16	33.56	30.54	29.69
Morocco	Unskilled employees	[a]10.04	[a]11.10	[a]10.42	[a]10.99	[a]10.74	[a]11.47	[a]12.71	10.73	11.50	12.04	11.79	13.95	13.24	13.42
	Skilled employees	[a]4.91	[a]5.49	[a]5.18	[a]5.38	[a]5.20	[a]5.59	[a]6.05	4.99	5.39	5.82	5.71	6.64	6.33	6.47
	Capital	[a]10.66	[a]11.89	[a]11.01	[a]11.62	[a]11.25	[a]12.15	[a]13.34	12.33	13.29	13.42	13.31	16.05	15.26	15.36
	Land	[a]0.40	[a]0.38	[a]0.35	[a]0.46	[a]0.51	[a]0.49	[a]0.68	0.56	0.55	0.47	0.44	0.57	0.55	0.54
	Natural resources	[a]1.36	[a]1.57	[a]1.33	[a]1.43	[a]1.32	[a]1.53	[a]1.62	1.41	1.58	1.12	1.25	1.83	1.71	1.60
	Total	[a]27.38	[a]30.43	[a]28.30	[a]29.87	[a]29.02	[a]31.23	[a]34.40	30.02	32.31	32.88	32.50	39.03	37.10	37.39
Mozambique	Unskilled employees	..	..	..	..	..	22.21	16.41	13.70	11.31	..	..	..	16.25	..
	Skilled employees	..	..	..	..	..	11.04	8.39	6.90	5.69	..	..	..	8.47	..
	Capital	..	..	..	..	..	25.36	18.80	15.61	12.95	..	..	..	19.21	..
	Land	..	..	..	..	..	0.96	0.75	0.64	0.56	..	..	..	0.62	..
	Natural resources	..	..	..	..	..	2.09	1.26	1.09	0.93	..	..	..	1.67	..
	Total	..	..	..	..	..	61.65	45.61	37.95	31.44	..	..	..	46.22	..
Netherlands	Unskilled employees	19.71	19.14	19.18	18.85	18.23	19.92	20.17	20.83	22.78	22.59	23.37	26.24	24.85	24.08
	Skilled employees	9.78	9.50	9.60	9.45	9.15	9.93	10.02	10.34	11.42	11.36	11.74	13.17	12.50	12.10
	Capital	22.04	21.38	21.40	20.99	20.41	22.16	22.33	23.13	25.29	24.91	25.83	29.39	27.89	26.83
	Land	0.70	0.65	0.66	0.66	0.66	0.75	0.72	0.74	0.69	0.69	0.71	0.75	0.73	0.76
	Natural resources	1.68	1.63	1.50	1.41	1.42	1.49	1.49	1.63	1.76	1.56	1.68	2.29	2.15	1.87
	Total	53.92	52.31	52.34	51.37	49.86	54.24	54.73	56.68	61.94	61.10	63.33	71.84	68.13	65.65
New Zealand	Unskilled employees	[a]10.59	[a]11.10	[a]10.59	[a]11.97	[a]11.33	[a]11.76	[a]11.70	10.76	10.77	11.48	12.36	13.16	12.65	12.33
	Skilled employees	[a]5.65	[a]5.92	[a]5.67	[a]6.41	[a]6.05	[a]6.26	[a]6.23	5.62	5.63	6.00	6.45	6.84	6.55	6.38
	Capital	[a]10.64	[a]11.23	[a]10.71	[a]12.06	[a]11.41	[a]11.79	[a]11.72	11.97	12.00	12.80	13.73	14.84	14.23	13.83
	Land	[a]0.22	[a]0.23	[a]0.23	[a]0.25	[a]0.25	[a]0.25	[a]0.25	0.23	0.23	0.28	0.27	0.30	0.30	0.30
	Natural resources	[a]0.64	[a]0.74	[a]0.68	[a]0.73	[a]0.70	[a]0.69	[a]0.68	0.67	0.67	0.70	0.75	1.02	0.95	0.90
	Total	[a]27.75	[a]29.22	[a]27.87	[a]31.42	[a]29.73	[a]30.75	[a]30.57	29.26	29.31	31.25	33.56	36.15	34.68	33.75
Peru	Unskilled employees	5.36	5.08	6.03	5.34	5.82	5.82	6.41	6.52	6.69	6.79	6.75	6.44	6.37	6.31
	Skilled employees	2.77	2.54	3.06	2.65	2.89	2.89	3.20	3.23	3.34	3.40	3.40	3.25	3.22	3.19
	Capital	6.12	5.78	6.85	6.00	6.48	6.42	7.12	7.27	7.48	7.55	7.57	7.37	7.24	7.19
	Land	0.23	0.25	0.26	0.26	0.26	0.24	0.22	0.26	0.24	0.26	0.24	0.20	0.22	0.22
	Natural resources	0.39	0.43	0.47	0.41	0.42	0.40	0.50	0.53	0.55	0.50	0.54	0.66	0.59	0.60
	Total	14.87	14.07	16.67	14.66	15.87	15.76	17.45	17.80	18.30	18.51	18.50	17.93	17.65	17.49

Table A-9: Openness based on the IFR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Philippines	Unskilled employees	[a]11.16	[a]12.35	[a]12.01	[a]12.54	[a]15.12	[a]16.07	[a]17.97	19.16	23.32	23.42	19.35	19.57	18.73	18.73
	Skilled employees	[a]5.58	[a]6.16	[a]6.04	[a]6.34	[a]7.72	[a]8.30	[a]9.34	9.84	12.24	12.16	9.85	9.83	9.33	9.29
	Capital	[a]11.55	[a]12.86	[a]12.53	[a]13.01	[a]15.52	[a]16.36	[a]18.27	21.47	26.22	26.08	21.46	21.96	20.90	20.59
	Land	[a]0.36	[a]0.41	[a]0.35	[a]0.35	[a]0.39	[a]0.41	[a]0.45	0.45	0.50	0.56	0.47	0.48	0.49	0.46
	Natural resources	[a]1.21	[a]1.41	[a]1.39	[a]1.36	[a]1.45	[a]1.35	[a]1.45	1.51	1.64	1.54	1.43	1.83	1.71	1.55
	Total	[a]29.86	[a]33.19	[a]32.31	[a]33.60	[a]40.20	[a]42.48	[a]47.47	52.45	63.93	63.74	52.57	53.68	51.16	50.61
Poland	Unskilled employees	..	8.59	9.94	9.54	10.05	9.53	11.87	12.14	11.89	12.53	12.57	13.36	12.26	12.46
	Skilled employees	..	4.32	4.80	4.72	4.96	4.71	6.02	6.03	5.91	6.27	6.32	6.76	6.19	6.30
	Capital	..	10.14	11.51	11.01	11.35	10.69	13.36	13.54	13.09	13.75	13.85	14.99	13.71	13.86
	Land	..	0.23	0.39	0.32	0.33	0.30	0.33	0.36	0.31	0.31	0.28	0.29	0.27	0.26
	Natural resources	..	1.19	1.30	1.12	1.00	0.90	1.01	1.06	0.94	0.93	0.96	1.21	1.08	1.05
	Total	..	24.47	27.94	26.71	27.69	26.13	32.59	33.13	32.15	33.78	33.98	36.61	33.52	33.92
Portugal	Unskilled employees	14.37	14.80	13.67	12.83	12.48	13.08	13.29	13.62	14.29	14.82	14.98	15.99	15.24	..
	Skilled employees	6.96	7.21	6.67	6.28	6.18	6.41	6.54	6.69	7.04	7.31	7.37	7.85	7.45	..
	Capital	16.13	16.63	15.25	14.23	13.96	14.60	14.83	15.13	15.88	16.31	16.51	17.86	16.97	..
	Land	0.51	0.50	0.49	0.44	0.45	0.49	0.48	0.49	0.49	0.50	0.50	0.52	0.52	..
	Natural resources	1.46	1.49	1.24	1.09	1.05	1.13	1.14	1.13	1.19	1.09	1.15	1.48	1.36	..
	Total	39.42	40.64	37.32	34.87	34.13	35.71	36.28	37.05	38.88	40.03	40.52	43.70	41.54	..
Russian Federation	Unskilled employees	..	..	..	..	..	..	..	8.26	8.54	10.16	9.93	8.59	8.81	..
	Skilled employees	..	..	..	..	..	..	..	4.03	4.16	4.97	4.89	4.32	4.47	..
	Capital	..	..	..	..	..	..	..	9.05	9.38	11.13	10.92	9.54	9.72	..
	Land	..	..	..	..	..	..	..	0.46	0.48	0.56	0.57	0.42	0.41	..
	Natural resources	..	..	..	..	..	..	..	0.42	0.46	0.50	0.46	0.45	0.38	..
	Total	..	..	..	..	..	..	..	22.22	23.01	27.32	26.78	23.31	23.78	..
Singapore	Unskilled employees	68.33	..	63.43	60.50	61.20	61.59	64.49	61.73	59.82	54.26	59.76	63.41	60.38	59.56
	Skilled employees	33.81	..	31.48	30.03	30.55	30.95	32.78	31.38	30.41	27.78	30.78	32.52	31.12	30.71
	Capital	77.08	..	71.39	67.62	67.82	67.73	70.95	68.25	66.15	59.79	66.28	71.00	67.93	67.17
	Land	1.67	..	1.48	1.39	1.31	1.20	1.14	1.08	1.04	0.92	0.97	0.98	0.98	0.97
	Natural resources	7.45	..	6.74	6.03	5.50	4.95	4.86	4.95	4.82	3.95	4.53	5.63	5.39	5.44
	Total	188.34	..	174.51	165.58	166.37	166.42	174.22	167.39	162.24	146.70	162.33	173.55	165.80	163.85
Slovak Republic	Unskilled employees	..	..	..	..	..	19.08	19.96	23.08	23.49	25.53	23.21	26.47	..	..
	Skilled employees	..	..	..	..	..	9.54	9.99	11.50	11.72	12.85	11.61	13.11	..	..
	Capital	..	..	..	..	..	22.22	22.66	26.22	26.83	28.59	26.18	30.37	..	..
	Land	..	..	..	..	..	0.54	0.55	0.62	0.58	0.57	0.54	0.60	..	..
	Natural resources	..	..	..	..	..	2.40	2.02	2.44	2.64	2.32	2.33	3.28	..	..
	Total	..	..	..	..	..	53.78	55.19	63.86	65.26	69.85	63.87	73.82	..	..
Slovenia	Unskilled employees	..	..	..	20.74	21.63	21.54	21.40	21.20	21.66	21.95	21.09	23.26	22.55	21.17
	Skilled employees	..	..	..	10.25	10.69	10.70	10.66	10.58	10.80	11.03	10.61	11.62	11.29	10.66
	Capital	..	..	..	23.47	24.36	23.99	23.78	23.58	24.11	24.14	23.27	25.97	25.04	23.45
	Land	..	..	..	0.61	0.60	0.59	0.55	0.53	0.53	0.49	0.45	0.51	0.49	0.45
	Natural resources	..	..	..	2.16	2.19	1.89	1.85	1.83	1.92	1.65	1.65	2.17	1.96	1.71
	Total	..	..	..	57.23	59.48	58.72	58.24	57.72	59.03	59.26	57.08	63.52	61.33	57.45
Spain	Unskilled employees	7.61	7.31	7.28	7.29	6.92	7.72	8.45	8.64	9.09	10.26	10.06	12.06	11.76	10.70
	Skilled employees	3.74	3.60	3.58	3.62	3.43	3.81	4.15	4.28	4.53	5.13	5.07	6.03	5.90	5.40
	Capital	8.59	8.24	8.16	8.16	7.78	8.63	9.40	9.65	10.14	11.32	11.14	13.59	13.22	12.03
	Land	0.25	0.24	0.25	0.25	0.25	0.28	0.31	0.29	0.30	0.32	0.29	0.34	0.35	0.31
	Natural resources	0.79	0.73	0.68	0.65	0.62	0.67	0.71	0.74	0.76	0.74	0.73	1.14	1.05	0.91
	Total	20.97	20.13	19.95	19.96	19.00	21.11	23.02	23.60	24.81	27.77	27.29	33.16	32.28	29.37
Sri Lanka	Unskilled employees	[a]14.81	[a]15.50	[a]15.91	[a]16.83	[a]17.89	[a]18.92	..	..	17.53	..	17.40	..	16.49	15.50
	Skilled employees	[a]7.32	[a]7.66	[a]7.95	[a]8.46	[a]9.05	[a]9.53	..	..	8.70	..	8.67	..	8.11	7.49
	Capital	[a]15.04	[a]15.87	[a]16.22	[a]17.01	[a]18.01	[a]18.91	..	..	19.23	..	19.12	..	18.32	17.46
	Land	[a]0.72	[a]0.72	[a]0.68	[a]0.67	[a]0.64	[a]0.73	..	..	0.66	..	0.65	..	0.61	0.61
	Natural resources	[a]1.27	[a]1.46	[a]1.41	[a]1.34	[a]1.36	[a]1.31	..	..	1.12	..	1.10	..	1.33	1.59
	Total	[a]39.15	[a]41.21	[a]42.16	[a]44.30	[a]46.95	[a]49.40	..	..	47.24	..	46.93	..	44.87	42.64

Table A-9: Openness based on the IFR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sweden	Unskilled employees	[a]12.06	[a]11.29	[a]10.26	[a]10.21	[a]10.99	[a]12.86	[a]13.02	11.96	13.02	13.78	13.76	15.28	14.88	13.56
	Skilled employees	[a]6.38	[a]5.99	[a]5.45	[a]5.45	[a]5.80	[a]6.74	[a]6.86	6.17	6.75	7.18	7.18	7.96	7.80	7.08
	Capital	[a]12.19	[a]11.47	[a]10.40	[a]10.37	[a]11.15	[a]12.95	[a]13.05	13.34	14.52	15.32	15.33	17.19	16.80	15.32
	Land	[a]0.24	[a]0.23	[a]0.22	[a]0.22	[a]0.25	[a]0.30	[a]0.28	0.26	0.28	0.29	0.30	0.31	0.32	0.31
	Natural resources	[a]0.88	[a]0.87	[a]0.76	[a]0.75	[a]0.85	[a]0.93	[a]0.86	0.85	0.90	0.86	0.86	1.14	1.10	1.01
	Total	[a]31.75	[a]29.85	[a]27.09	[a]27.00	[a]29.03	[a]33.78	[a]34.08	32.58	35.47	37.43	37.43	41.90	40.90	37.29
Switzerland	Unskilled employees	13.96	13.14	12.38	11.83	11.34	11.48	11.54	11.93	13.07	13.54	13.79	15.37	15.10	..
	Skilled employees	7.04	6.63	6.24	5.99	5.76	5.83	5.87	6.08	6.64	6.90	7.05	7.84	7.72	..
	Capital	15.23	14.36	13.52	12.93	12.38	12.51	12.56	13.02	14.28	14.71	15.00	16.79	16.51	..
	Land	0.29	0.27	0.26	0.25	0.24	0.24	0.23	0.24	0.26	0.27	0.27	0.29	0.28	..
	Natural resources	0.90	0.86	0.80	0.75	0.69	0.68	0.66	0.69	0.81	0.75	0.75	0.94	0.91	..
	Total	37.41	35.26	33.21	31.74	30.41	30.75	30.86	31.97	35.05	36.16	36.87	41.23	40.52	..
Tanzania	Unskilled employees	..	..	..	..	..	..	..	..	9.52	10.03	9.59	8.34	9.00	..
	Skilled employees	..	..	..	..	..	..	..	..	4.97	5.29	4.99	4.26	4.58	..
	Capital	..	..	..	..	..	..	..	..	11.03	11.50	10.87	9.76	10.31	..
	Land	..	..	..	..	..	..	..	..	0.34	0.38	0.34	0.30	0.33	..
	Natural resources	..	..	..	..	..	..	..	..	0.80	0.66	0.64	0.91	0.81	..
	Total	..	..	..	..	..	..	..	..	26.67	27.85	26.43	23.57	25.02	..
Thailand	Unskilled employees	[a]15.69	[a]17.25	[a]17.37	[a]17.23	[a]17.66	[a]18.26	[a]20.17	18.35	20.73	17.28	18.98	23.11	24.16	..
	Skilled employees	[a]8.09	[a]8.94	[a]9.03	[a]9.05	[a]9.34	[a]9.70	[a]10.71	9.54	10.76	8.97	9.84	11.92	12.40	..
	Capital	[a]16.02	[a]17.59	[a]17.74	[a]17.52	[a]17.86	[a]18.42	[a]20.34	20.57	23.24	19.31	21.29	26.10	27.23	..
	Land	[a]0.34	[a]0.35	[a]0.36	[a]0.35	[a]0.32	[a]0.31	[a]0.33	0.30	0.37	0.33	0.34	0.40	0.46	..
	Natural resources	[a]1.56	[a]1.68	[a]1.68	[a]1.54	[a]1.46	[a]1.44	[a]1.59	1.56	1.74	1.38	1.61	2.22	2.31	..
	Total	[a]41.70	[a]45.81	[a]46.19	[a]45.68	[a]46.63	[a]48.14	[a]53.14	50.32	56.85	47.26	52.06	63.75	66.57	..
Turkey	Unskilled employees	[a]6.10	[a]6.04	[a]5.81	[a]6.05	[a]6.77	[a]7.54	[a]8.82	9.92	10.96	10.21	9.72	11.38	11.57	10.93
	Skilled employees	[a]3.04	[a]2.99	[a]2.94	[a]3.06	[a]3.43	[a]3.83	[a]4.45	4.92	5.52	5.23	4.96	5.71	5.80	5.44
	Capital	[a]6.57	[a]6.50	[a]6.18	[a]6.41	[a]7.08	[a]8.01	[a]9.23	11.30	12.35	11.42	11.05	12.95	13.28	12.47
	Land	[a]0.18	[a]0.19	[a]0.15	[a]0.15	[a]0.16	[a]0.17	[a]0.23	0.24	0.23	0.20	0.19	0.22	0.22	0.21
	Natural resources	[a]0.92	[a]0.93	[a]0.79	[a]0.80	[a]0.82	[a]1.02	[a]1.07	1.19	1.13	0.90	1.02	1.34	1.47	1.37
	Total	[a]16.81	[a]16.65	[a]15.86	[a]16.47	[a]18.26	[a]20.58	[a]23.81	27.57	30.19	27.95	26.94	31.59	32.35	30.43
Uganda	Unskilled employees	..	..	..	..	..	11.98	10.34	11.04	11.63	11.83	10.64	12.09	13.29	13.78
	Skilled employees	..	..	..	..	..	6.30	5.48	5.85	6.04	6.17	5.37	6.04	6.74	6.91
	Capital	..	..	..	..	..	13.47	11.57	12.75	13.01	13.56	12.13	14.00	15.37	15.92
	Land	..	..	..	..	..	0.40	0.33	0.34	0.48	0.43	0.37	0.45	0.43	0.50
	Natural resources	..	..	..	..	..	0.65	0.47	0.84	0.57	0.87	0.97	1.35	1.40	1.48
	Total	..	..	..	..	..	32.80	28.20	30.83	31.73	32.87	29.48	33.93	37.23	38.60
United Kingdom	Unskilled employees	[a]10.59	[a]10.19	[a]9.30	[a]9.62	[a]10.15	[a]10.56	[a]11.01	10.93	10.54	10.43	10.46	11.22	10.91	10.40
	Skilled employees	[a]5.42	[a]5.22	[a]4.76	[a]4.94	[a]5.23	[a]5.47	[a]5.71	5.52	5.34	5.33	5.37	5.77	5.60	5.34
	Capital	[a]10.73	[a]10.36	[a]9.44	[a]9.74	[a]10.25	[a]10.63	[a]11.06	12.11	11.67	11.53	11.58	12.50	12.15	11.58
	Land	[a]0.31	[a]0.31	[a]0.29	[a]0.30	[a]0.30	[a]0.30	[a]0.31	0.31	0.28	0.27	0.26	0.26	0.26	0.25
	Natural resources	[a]0.76	[a]0.75	[a]0.68	[a]0.66	[a]0.67	[a]0.65	[a]0.66	0.64	0.60	0.54	0.54	0.65	0.63	0.59
	Total	[a]27.80	[a]26.82	[a]24.46	[a]25.25	[a]26.60	[a]27.61	[a]28.74	29.51	28.43	28.11	28.21	30.40	29.55	28.16
United States	Unskilled employees	[a]3.98	[a]3.98	[a]3.83	[a]3.91	[a]4.03	[a]4.32	[a]4.59	4.41	4.52	4.55	4.81	5.29	4.88	4.83
	Skilled employees	[a]1.93	[a]1.94	[a]1.87	[a]1.90	[a]1.96	[a]2.11	[a]2.24	2.06	2.11	2.13	2.25	2.46	2.27	2.24
	Capital	[a]4.08	[a]4.11	[a]3.93	[a]4.01	[a]4.14	[a]4.42	[a]4.66	5.09	5.22	5.22	5.55	6.16	5.69	5.61
	Land	[a]0.09	[a]0.10	[a]0.09	[a]0.09	[a]0.09	[a]0.10	[a]0.10	0.09	0.10	0.09	0.10	0.10	0.10	0.10
	Natural resources	[a]0.29	[a]0.31	[a]0.28	[a]0.29	[a]0.30	[a]0.30	[a]0.30	0.29	0.30	0.28	0.32	0.40	0.37	0.36
	Total	[a]10.37	[a]10.43	[a]9.99	[a]10.21	[a]10.53	[a]11.25	[a]11.88	11.95	12.25	12.27	13.03	14.42	13.30	13.15
Uruguay	Unskilled employees	[a]6.80	[a]6.72	[a]6.68	[a]7.43	[a]8.14	[a]8.34	[a]7.53	7.37	7.67	7.75	7.06	7.48	7.40	7.57
	Skilled employees	[a]3.57	[a]3.48	[a]3.44	[a]3.84	[a]4.28	[a]4.33	[a]3.90	3.70	3.86	3.90	3.54	3.73	3.71	3.80
	Capital	[a]7.15	[a]7.15	[a]7.04	[a]7.62	[a]8.29	[a]8.49	[a]7.75	8.33	8.59	8.58	7.97	8.59	8.43	8.78
	Land	[a]0.16	[a]0.17	[a]0.17	[a]0.20	[a]0.19	[a]0.24	[a]0.22	0.22	0.22	0.22	0.22	0.24	0.23	0.28
	Natural resources	[a]0.73	[a]0.83	[a]0.77	[a]0.66	[a]0.62	[a]0.65	[a]0.68	0.68	0.65	0.56	0.65	0.82	0.73	0.83
	Total	[a]18.40	[a]18.34	[a]18.11	[a]19.76	[a]21.52	[a]22.05	[a]20.08	20.30	20.99	21.01	19.44	20.86	20.51	21.26

Table A-9: Openness based on the IFR_g measure of 56 countries, 1989-2002, continued

Country name	Income category	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Venezuela	Unskilled employees	8.23	7.37	9.96	11.16	10.42	8.63	8.22	7.56	7.70	7.66	6.52	6.26	6.71	6.13
	Skilled employees	4.16	3.81	5.13	5.77	5.43	4.57	4.25	3.97	3.93	3.89	3.33	3.19	3.41	3.16
	Capital	9.03	8.17	10.95	12.19	11.44	9.62	9.10	8.41	8.43	8.32	7.12	6.85	7.32	6.72
	Land	0.25	0.21	0.26	0.28	0.28	0.25	0.26	0.25	0.22	0.23	0.20	0.18	0.19	0.18
	Natural resources	0.50	0.43	0.54	0.54	0.47	0.40	0.43	0.35	0.42	0.37	0.32	0.35	0.36	0.29
	Total	22.17	19.99	26.84	29.93	28.04	23.46	22.27	20.54	20.70	20.47	17.48	16.83	17.99	16.48
Zambia	Unskilled employees	..	..	..	..	..	..	..	..	10.19	15.52	12.98	14.48	..	..
	Skilled employees	..	..	..	..	..	..	..	..	5.23	7.81	6.74	7.46	..	..
	Capital	..	..	..	..	..	..	..	..	11.58	17.51	14.70	16.87	..	..
	Land	..	..	..	..	..	..	..	..	0.31	0.49	0.34	0.35	..	..
	Natural resources	..	..	..	..	..	..	..	..	0.85	1.36	1.00	1.64	..	..
	Total	..	..	..	..	..	..	..	..	28.15	42.68	35.76	40.79	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

Table A-10: Openness based on the EFR_i measure of 56 countries, 1989-2002, % of current GDP

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	Food	[a]0.04	[a]0.02	[a]0.03	[a]0.04	[a]0.04	[a]0.05	[a]0.06	0.06	0.08	0.07	0.06	0.06	0.06	0.13
	Other primary products	[a]0.11	[a]0.04	[a]0.03	[a]0.02	[a]0.03	[a]0.03	[a]0.05	0.03	0.04	0.03	0.03	0.04	0.04	0.13
	Manufactures	[a]0.57	[a]0.20	[a]0.22	[a]0.28	[a]0.34	[a]0.43	[a]0.52	0.49	0.65	0.68	0.52	0.57	0.51	1.36
	Services	[a]0.09	[a]0.05	[a]0.04	[a]0.04	[a]0.05	[a]0.05	[a]0.06	0.02	0.02	0.02	0.02	0.02	0.02	0.07
	Total	[a]0.81	[a]0.30	[a]0.32	[a]0.39	[a]0.45	[a]0.57	[a]0.69	0.61	0.79	0.81	0.63	0.69	0.63	1.68
Australia	Food	[a]0.06	[a]0.06	[a]0.06	[a]0.07	[a]0.07	[a]0.08	[a]0.08	0.05	0.05	0.05	0.05	0.05	0.06	0.06
	Other primary products	[a]0.27	[a]0.28	[a]0.28	[a]0.30	[a]0.35	[a]0.29	[a]0.33	0.37	0.36	0.31	0.36	0.59	0.56	0.48
	Manufactures	[a]1.27	[a]1.25	[a]1.24	[a]1.34	[a]1.48	[a]1.56	[a]1.72	1.66	1.68	1.88	1.75	2.03	1.92	1.90
	Services	[a]0.35	[a]0.38	[a]0.38	[a]0.40	[a]0.42	[a]0.43	[a]0.45	0.47	0.47	0.48	0.45	0.51	0.50	0.46
	Total	[a]1.95	[a]1.97	[a]1.96	[a]2.11	[a]2.32	[a]2.36	[a]2.58	2.54	2.56	2.72	2.61	3.19	3.04	2.90
Austria	Food	0.21	0.20	0.20	0.18	0.17	0.18	0.21	0.24	0.30	0.31	0.34	0.37	0.42	0.44
	Other primary products	1.29	1.35	1.26	1.05	0.93	0.92	1.00	1.10	1.09	0.97	1.14	1.74	1.86	1.87
	Manufactures	6.79	6.86	6.79	6.40	5.83	6.15	6.33	6.71	7.57	8.01	8.35	9.67	10.11	9.75
	Services	2.00	1.97	2.06	2.07	2.24	2.24	2.56	2.84	3.19	3.00	3.36	4.04	4.46	4.50
	Total	10.29	10.37	10.30	9.70	9.18	9.49	10.10	10.89	12.15	12.29	13.18	15.82	16.86	16.57
Bangladesh	Food	0.05	0.03	0.03	0.03	0.04	..	0.06	0.05	0.06	0.05	..	..	0.06	..
	Other primary products	0.44	0.57	0.38	0.48	0.54	..	0.62	0.60	0.82	0.73	..	..	0.80	..
	Manufactures	0.72	0.68	0.71	0.87	1.02	..	1.73	1.61	1.69	1.74	..	..	2.06	..
	Services	0.05	0.05	0.05	0.06	0.07	..	0.11	0.08	0.10	0.09	..	..	0.11	..
	Total	1.26	1.32	1.16	1.44	1.67	..	2.51	2.35	2.66	2.60	..	..	3.02	..
Belgium	Food	..	..	..	..	..	..	..	..	2.01	..	2.24	2.42	2.46	..
	Other primary products	..	..	..	..	..	..	..	..	3.37	..	3.65	6.30	6.07	..
	Manufactures	..	..	..	..	..	..	..	..	26.76	..	28.94	34.21	34.80	..
	Services	..	..	..	..	..	..	..	..	5.45	..	6.95	8.65	8.97	..
	Total	..	..	..	..	..	..	..	..	37.60	..	41.77	51.57	52.29	..
Brazil	Food	[a]0.03	[a]0.03	[a]0.04	[a]0.04	[a]0.05	[a]0.05	[a]0.05	0.05	0.05	0.05	0.07	0.06	0.08	..
	Other primary products	[a]0.15	[a]0.15	[a]0.18	[a]0.22	[a]0.21	[a]0.15	[a]0.12	0.11	0.12	0.09	0.18	0.25	0.31	..
	Manufactures	[a]0.20	[a]0.21	[a]0.28	[a]0.34	[a]0.36	[a]0.36	[a]0.38	0.30	0.37	0.37	0.62	0.65	0.90	..
	Services	[a]0.06	[a]0.08	[a]0.09	[a]0.11	[a]0.14	[a]0.11	[a]0.10	0.07	0.08	0.10	0.17	0.18	0.25	..
	Total	[a]0.45	[a]0.47	[a]0.59	[a]0.72	[a]0.75	[a]0.67	[a]0.65	0.54	0.62	0.61	1.03	1.13	1.53	..
Canada	Food	[a]0.16	[a]0.17	[a]0.17	[a]0.19	[a]0.21	[a]0.24	[a]0.25	0.24	0.25	0.27	0.25	0.24	0.27	..
	Other primary products	[a]0.68	[a]0.82	[a]0.64	[a]0.66	[a]0.72	[a]0.78	[a]0.89	0.95	1.06	0.94	0.93	1.35	1.32	..
	Manufactures	[a]5.04	[a]4.82	[a]4.78	[a]5.33	[a]6.23	[a]7.40	[a]8.03	7.73	8.62	9.49	9.65	9.81	8.98	..
	Services	[a]0.40	[a]0.44	[a]0.45	[a]0.50	[a]0.57	[a]0.61	[a]0.63	0.83	0.86	0.92	0.92	0.93	0.92	..
	Total	[a]6.27	[a]6.25	[a]6.04	[a]6.68	[a]7.74	[a]9.03	[a]9.80	9.75	10.79	11.61	11.75	12.34	11.50	..
Chile	Food	[a]0.17	[a]0.20	[a]0.25	[a]0.27	[a]0.24	[a]0.27	[a]0.27	0.34	0.31	0.36	0.35	0.33	0.40	..
	Other primary products	[a]1.80	[a]2.04	[a]1.79	[a]1.35	[a]1.10	[a]1.07	[a]1.07	1.19	1.14	0.98	1.22	1.88	2.01	..
	Manufactures	[a]4.28	[a]3.93	[a]3.49	[a]3.53	[a]3.41	[a]3.35	[a]3.68	3.34	3.53	3.55	2.76	3.05	3.59	..
	Services	[a]0.98	[a]0.92	[a]0.80	[a]0.76	[a]0.72	[a]0.72	[a]0.70	0.83	0.86	0.95	1.03	1.05	1.37	..
	Total	[a]7.25	[a]7.10	[a]6.34	[a]5.91	[a]5.47	[a]5.40	[a]5.72	5.70	5.84	5.84	5.35	6.31	7.36	..
China	Food	[a]0.10	[a]0.09	[a]0.08	[a]0.07	[a]0.06	[a]0.08	[a]0.10	0.08	0.07	0.06	0.05	0.07	0.07	0.07
	Other primary products	[a]0.37	[a]0.31	[a]0.43	[a]0.51	[a]0.60	[a]0.51	[a]0.50	0.48	0.59	0.40	0.48	0.93	0.79	0.85
	Manufactures	[a]2.20	[a]2.24	[a]2.78	[a]3.36	[a]4.40	[a]4.12	[a]3.36	2.96	2.92	2.80	3.19	4.10	4.26	5.11
	Services	[a]0.09	[a]0.11	[a]0.11	[a]0.24	[a]0.30	[a]0.35	[a]0.40	0.23	0.28	0.25	0.28	0.32	0.32	0.37
	Total	[a]2.76	[a]2.76	[a]3.40	[a]4.18	[a]5.35	[a]5.06	[a]4.36	3.75	3.86	3.50	4.00	5.42	5.43	6.40
Colombia	Food	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Other primary products	[a]0.10	[a]0.13	[a]0.14	[a]0.12	[a]0.12	[a]0.06	[a]0.07	0.08	0.10	0.08	0.08	0.10	0.08	0.08
	Manufactures	[a]0.06	[a]0.07	[a]0.07	[a]0.07	[a]0.10	[a]0.06	[a]0.06	0.73	0.77	0.81	0.77	0.94	1.10	1.07
	Services	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	[a]0.00	0.26	0.26	0.26	0.31	0.36	0.40	0.36
	Total	[a]0.16	[a]0.22	[a]0.22	[a]0.20	[a]0.22	[a]0.12	[a]0.14	1.16	1.22	1.26	1.26	1.49	1.68	1.61
Croatia	Food	..	..	..	..	0.58	0.50	0.44	0.45	0.48	0.38	0.32	0.34	0.42	0.46
	Other primary products	..	..	..	..	3.12	2.49	2.57	2.32	2.09	1.52	2.21	3.13	3.07	2.88
	Manufactures	..	..	..	..	8.37	6.31	5.70	5.61	6.26	6.02	5.89	6.48	7.19	7.24
	Services	..	..	..	..	1.67	1.21	0.77	1.03	1.42	1.11	1.32	1.35	1.44	1.60
	Total	..	..	..	..	13.74	10.50	9.48	9.40	10.24	9.04	9.74	11.30	12.13	12.18

Table A-10: Openness based on the EFR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Czech Republic	Food	..	..	..	..	0.40	0.38	0.33	0.32	0.33	0.29	0.28	0.32	0.31	0.23
	Other primary products	..	..	..	..	2.60	2.26	2.17	2.18	2.39	1.87	1.98	3.46	3.34	4.18
	Manufactures	..	..	..	..	12.35	11.45	14.06	13.61	15.12	15.91	16.61	20.70	21.73	18.18
	Services	..	..	..	..	2.40	2.33	1.94	2.21	2.11	2.19	2.29	2.38	2.19	1.92
	Total	..	..	..	..	17.75	16.43	18.51	18.32	19.95	20.25	21.17	26.86	27.58	24.52
Denmark	Food	[a]0.87	[a]0.82	[a]0.91	[a]0.89	[a]0.87	[a]0.86	[a]0.86	0.95	1.00	0.98	0.93	1.00	1.03	1.04
	Other primary products	[a]1.21	[a]1.12	[a]0.97	[a]0.87	[a]0.82	[a]0.82	[a]0.74	0.69	0.75	0.64	0.66	1.09	0.89	0.93
	Manufactures	[a]5.15	[a]5.15	[a]5.48	[a]5.18	[a]4.69	[a]5.13	[a]5.46	5.75	6.19	6.44	6.52	7.24	7.36	7.56
	Services	[a]2.18	[a]2.16	[a]2.29	[a]2.13	[a]2.16	[a]2.28	[a]2.19	1.75	1.75	1.98	2.52	3.54	3.76	3.94
	Total	[a]9.42	[a]9.26	[a]9.64	[a]9.06	[a]8.55	[a]9.09	[a]9.25	9.14	9.68	10.04	10.64	12.87	13.05	13.46
Estonia	Food	..	..	..	..	..	..	1.43	2.47	3.96	3.64	2.27	2.26	2.49	2.55
	Other primary products	..	..	..	..	..	..	3.20	4.36	5.37	3.83	4.13	5.77	5.24	5.02
	Manufactures	..	..	..	..	..	..	11.89	18.56	26.25	24.74	22.67	30.63	29.76	27.06
	Services	..	..	..	..	..	..	2.02	3.23	4.13	4.58	4.70	5.21	5.55	6.59
	Total	..	..	..	..	..	..	18.54	28.62	39.71	36.79	33.78	43.87	43.04	41.23
Finland	Food	[a]0.09	[a]0.08	[a]0.08	[a]0.11	[a]0.15	[a]0.18	[a]0.15	0.19	0.21	0.19	0.17	0.16	0.16	0.16
	Other primary products	[a]1.19	[a]1.24	[a]1.22	[a]1.52	[a]1.73	[a]1.82	[a]1.60	1.78	1.74	1.42	1.52	2.29	2.15	2.02
	Manufactures	[a]3.84	[a]3.50	[a]2.98	[a]3.57	[a]4.23	[a]4.94	[a]5.15	6.59	7.02	7.16	6.85	7.82	7.24	6.78
	Services	[a]0.68	[a]0.70	[a]0.77	[a]0.98	[a]1.23	[a]1.21	[a]1.29	1.28	1.25	1.12	1.08	1.32	1.23	1.15
	Total	[a]5.80	[a]5.51	[a]5.06	[a]6.18	[a]7.34	[a]8.16	[a]8.19	9.84	10.23	9.88	9.62	11.60	10.79	10.12
France	Food	0.22	0.20	0.21	0.20	0.20	0.21	0.22	0.21	0.23	0.23	0.22	0.23	0.23	0.22
	Other primary products	0.82	0.82	0.81	0.69	0.67	0.67	0.65	0.75	0.83	0.67	0.75	1.31	1.20	1.04
	Manufactures	2.69	2.62	2.60	2.48	2.37	2.61	2.76	2.82	3.20	3.51	3.63	4.40	4.25	3.80
	Services	0.64	0.68	0.71	0.75	0.76	0.59	0.59	0.61	0.68	0.70	0.68	0.74	0.76	0.75
	Total	4.36	4.32	4.32	4.12	4.00	4.09	4.22	4.39	4.94	5.11	5.29	6.69	6.44	5.80
Germany	Food	[a]0.17	[a]0.15	[a]0.15	[a]0.14	[a]0.11	[a]0.12	[a]0.12	0.10	0.11	0.11	0.11	0.11	0.13	0.12
	Other primary products	[a]1.03	[a]0.97	[a]0.92	[a]0.76	[a]0.68	[a]0.65	[a]0.65	0.73	0.85	0.71	0.74	1.29	1.24	1.15
	Manufactures	[a]3.46	[a]3.28	[a]3.26	[a]2.92	[a]2.42	[a]2.59	[a]2.80	3.21	3.73	4.08	4.25	5.20	5.33	5.12
	Services	[a]0.72	[a]0.73	[a]0.70	[a]0.69	[a]0.67	[a]0.70	[a]0.74	0.80	0.93	0.97	1.06	1.25	1.35	1.33
	Total	[a]5.37	[a]5.14	[a]5.03	[a]4.50	[a]3.87	[a]4.06	[a]4.32	4.85	5.61	5.87	6.15	7.85	8.05	7.72
Greece	Food	0.21	0.18	0.17	0.18	0.16	0.17	0.17	0.16	0.15	..	0.18	0.19	0.15	..
	Other primary products	0.59	0.58	0.64	0.61	0.62	0.56	0.47	0.51	0.48	..	0.44	1.14	0.97	..
	Manufactures	1.40	1.32	1.31	1.34	1.32	1.21	1.26	1.22	1.24	..	1.91	2.24	1.72	..
	Services	0.20	0.20	0.20	0.23	0.22	0.23	0.21	0.18	0.21	..	0.61	0.92	0.87	..
	Total	2.40	2.28	2.32	2.37	2.32	2.17	2.11	2.07	2.07	..	3.14	4.49	3.71	..
Hungary	Food	0.53	0.56	0.45	0.37	0.35	0.45	0.43	0.52	0.52	0.54	0.39	0.44	0.45	0.35
	Other primary products	1.84	2.06	2.32	2.05	1.84	1.80	1.96	2.69	2.33	2.02	1.99	2.15	2.20	2.35
	Manufactures	7.49	7.40	8.22	7.35	7.02	8.08	8.93	10.98	14.63	18.67	20.54	25.49	24.20	19.96
	Services	1.02	1.43	1.13	1.44	1.17	1.29	1.81	2.18	2.28	2.52	2.53	2.88	3.30	2.81
	Total	10.87	11.45	12.12	11.20	10.38	11.62	13.13	16.37	19.76	23.76	25.46	30.97	30.15	25.47
India	Food	[a]0.00	[a]0.00	[a]0.00	[a]0.01	[a]0.01	[a]0.01	[a]0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02
	Other primary products	[a]0.16	[a]0.23	[a]0.30	[a]0.43	[a]0.35	[a]0.31	[a]0.38	0.54	0.48	0.42	0.60	0.84	0.71	0.78
	Manufactures	[a]0.24	[a]0.24	[a]0.27	[a]0.39	[a]0.36	[a]0.35	[a]0.44	0.59	0.65	0.68	0.62	0.71	0.69	0.77
	Services	[a]0.06	[a]0.06	[a]0.08	[a]0.12	[a]0.10	[a]0.10	[a]0.13	0.17	0.19	0.23	0.28	0.32	0.31	0.37
	Total	[a]0.46	[a]0.53	[a]0.66	[a]0.95	[a]0.81	[a]0.77	[a]0.96	1.31	1.34	1.36	1.51	1.88	1.73	1.93
Indonesia	Food	[a]0.05	[a]0.04	[a]0.04	[a]0.05	[a]0.04	[a]0.06	[a]0.07	0.14	0.13	0.39	0.24	0.20	0.19	0.17
	Other primary products	[a]0.53	[a]0.66	[a]0.74	[a]0.76	[a]0.67	[a]0.69	[a]0.78	0.96	1.05	2.53	1.77	2.71	2.59	2.17
	Manufactures	[a]2.34	[a]2.88	[a]3.19	[a]3.35	[a]3.11	[a]3.05	[a]3.29	2.55	2.79	5.53	2.39	3.44	3.29	2.49
	Services	[a]0.13	[a]0.14	[a]0.13	[a]0.17	[a]0.18	[a]0.19	[a]0.19	0.80	0.97	2.29	1.24	1.56	1.71	1.48
	Total	[a]3.05	[a]3.71	[a]4.10	[a]4.32	[a]4.00	[a]3.99	[a]4.33	4.44	4.95	10.75	5.63	7.90	7.78	6.32
Ireland	Food	1.44	1.25	1.35	1.38	1.31	1.46	1.35	1.19	1.04	1.17	1.10	1.07	..	..
	Other primary products	2.05	2.09	1.92	1.69	1.72	1.68	1.52	1.55	1.44	1.29	1.37	1.96	..	..
	Manufactures	18.60	16.87	17.09	17.05	18.06	20.56	22.14	21.25	21.46	25.27	24.72	27.35	..	..
	Services	1.71	1.58	1.75	2.00	2.11	2.48	2.77	2.97	3.03	7.01	5.56	6.21	..	..
	Total	23.79	21.79	22.10	22.12	23.19	26.17	27.78	26.96	26.98	34.74	32.75	36.58	..	..

Table A-10: Openness based on the EFR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Italy	Food	0.24	0.21	0.22	0.21	0.24	0.26	0.29	0.26	0.26	0.26	0.24	0.26	0.26	0.25
	Other primary products	0.89	0.84	0.70	0.63	0.75	0.83	0.95	0.86	0.87	0.69	0.73	1.21	1.10	0.99
	Manufactures	2.65	2.49	2.31	2.30	2.47	2.91	3.65	3.20	3.49	3.67	3.67	4.48	4.33	4.05
	Services	0.71	0.83	0.72	0.91	1.07	1.06	1.21	1.10	1.21	1.26	1.10	1.23	1.25	1.23
	Total	4.49	4.38	3.94	4.04	4.52	5.07	6.10	5.42	5.84	5.87	5.73	7.18	6.94	6.53
Japan	Food	[a]0.05	[a]0.05	[a]0.04	[a]0.04	[a]0.04	[a]0.04	[a]0.04	0.03	0.03	0.03	0.03	0.03	0.03	..
	Other primary products	[a]0.39	[a]0.45	[a]0.37	[a]0.33	[a]0.27	[a]0.25	[a]0.25	0.37	0.44	0.33	0.32	0.47	0.48	..
	Manufactures	[a]0.38	[a]0.41	[a]0.36	[a]0.32	[a]0.28	[a]0.31	[a]0.37	0.56	0.63	0.61	0.58	0.68	0.72	..
	Services	[a]0.18	[a]0.19	[a]0.17	[a]0.17	[a]0.14	[a]0.14	[a]0.15	0.13	0.15	0.15	0.13	0.13	0.14	..
	Total	[a]1.00	[a]1.11	[a]0.94	[a]0.86	[a]0.73	[a]0.74	[a]0.82	1.08	1.25	1.12	1.06	1.31	1.36	..
Korea	Food	[a]0.30	[a]0.25	[a]0.25	[a]0.25	[a]0.22	[a]0.22	[a]0.24	0.15	0.16	0.23	0.18	0.17	0.19	0.18
	Other primary products	[a]2.65	[a]2.79	[a]2.52	[a]2.60	[a]2.45	[a]2.18	[a]2.32	2.36	3.03	3.85	3.30	4.50	4.32	3.59
	Manufactures	[a]6.23	[a]5.67	[a]5.53	[a]5.10	[a]4.78	[a]5.29	[a]6.04	5.73	6.35	7.72	7.21	8.08	7.54	7.36
	Services	[a]0.47	[a]0.46	[a]0.45	[a]0.47	[a]0.49	[a]0.53	[a]0.64	0.63	0.78	1.35	1.01	1.08	1.16	1.04
	Total	[a]9.65	[a]9.17	[a]8.74	[a]8.43	[a]7.93	[a]8.22	[a]9.24	8.87	10.32	13.15	11.69	13.84	13.21	12.18
Latvia	Food	..	..	..	..	..	0.26	0.52	0.87	0.90	0.86	0.58	0.59	0.66	0.73
	Other primary products	..	..	..	..	..	1.84	2.60	3.63	2.38	1.92	1.58	1.82	1.65	1.56
	Manufactures	..	..	..	..	..	3.64	7.68	9.54	10.81	12.07	9.44	9.52	10.10	10.64
	Services	..	..	..	..	..	0.69	0.95	3.23	2.46	2.48	1.81	1.97	1.77	1.61
	Total	..	..	..	..	..	6.43	11.74	17.27	16.54	17.32	13.40	13.89	14.18	14.53
Lithuania	Food	..	..	..	..	..	0.58	1.16	1.19	0.98	0.79	0.59	0.59	0.66	..
	Other primary products	..	..	..	..	..	7.05	7.31	6.93	6.37	4.83	4.13	6.39	6.69	..
	Manufactures	..	..	..	..	..	5.66	9.67	10.71	11.26	10.14	7.95	8.02	9.41	..
	Services	..	..	..	..	..	0.65	1.12	1.38	1.48	1.20	1.05	0.89	0.89	..
	Total	..	..	..	..	..	13.94	19.25	20.20	20.09	16.95	13.71	15.89	17.64	..
Malawi	Food	0.21	0.21	0.19	..	..	0.71	0.43	0.19	0.25	0.49	0.35	0.24	0.29	..
	Other primary products	0.38	0.45	0.38	..	..	0.75	0.70	0.44	0.59	0.49	0.81	0.76	1.13	..
	Manufactures	2.17	2.69	2.58	..	..	4.71	3.31	1.94	2.37	2.46	3.33	2.44	2.69	..
	Services	0.86	1.04	1.08	..	..	1.22	0.93	0.50	0.59	0.74	0.83	0.70	0.84	..
	Total	3.62	4.39	4.23	..	..	7.38	5.37	3.07	3.79	4.19	5.33	4.13	4.94	..
Malaysia	Food	..	..	[a]1.28	[a]1.18	[a]1.13	[a]1.27	[a]1.30	0.98	1.03	1.33	1.26	1.00	1.09	1.15
	Other primary products	..	..	[a]2.42	[a]2.19	[a]2.10	[a]2.04	[a]2.11	2.13	2.27	2.79	2.79	4.16	4.00	3.60
	Manufactures	..	..	[a]26.34	[a]24.30	[a]25.55	[a]32.25	[a]35.95	28.01	28.67	33.15	34.40	37.34	33.06	33.10
	Services	..	..	[a]1.97	[a]1.87	[a]2.21	[a]2.73	[a]2.88	3.69	3.92	4.62	4.84	4.72	4.67	4.18
	Total	..	..	[a]32.02	[a]29.54	[a]30.99	[a]38.29	[a]42.24	34.80	35.89	41.90	43.30	47.22	42.83	42.04
Malta	Food	1.18	1.06	1.11	1.15	1.25	..	..	1.17	1.24	..	1.15	..	1.11	..
	Other primary products	4.42	4.06	4.00	3.90	4.00	..	..	4.11	3.69	..	3.74	..	5.48	..
	Manufactures	18.85	21.62	21.90	22.85	24.43	..	..	21.98	19.97	..	21.31	..	19.35	..
	Services	5.50	5.43	5.11	5.47	6.64	..	..	5.20	5.03	..	5.39	..	5.23	..
	Total	29.96	32.17	32.12	33.38	36.31	..	..	32.46	29.93	..	31.59	..	31.17	..
Mexico	Food	[a]0.24	[a]0.20	[a]0.17	[a]0.09	[a]0.08	[a]0.12	[a]0.21	0.28	0.22	0.23	0.20	0.17	0.16	0.17
	Other primary products	[a]0.38	[a]0.31	[a]0.32	[a]0.26	[a]0.23	[a]0.28	[a]0.57	0.32	0.37	0.35	0.31	0.37	0.31	0.29
	Manufactures	[a]2.01	[a]2.02	[a]2.02	[a]2.59	[a]2.59	[a]3.27	[a]6.63	6.78	6.79	7.58	7.53	7.60	6.57	6.28
	Services	[a]0.40	[a]0.43	[a]0.37	[a]0.37	[a]0.35	[a]0.39	[a]0.62	0.57	0.54	0.56	0.55	0.54	0.48	0.47
	Total	[a]3.03	[a]2.96	[a]2.88	[a]3.30	[a]3.26	[a]4.06	[a]8.04	7.95	7.92	8.73	8.59	8.68	7.52	7.21
Morocco	Food	[a]0.20	[a]0.19	[a]0.17	[a]0.23	[a]0.28	[a]0.30	[a]0.52	0.32	0.32	0.22	0.22	0.29	0.28	0.29
	Other primary products	[a]1.00	[a]1.29	[a]0.95	[a]1.00	[a]0.95	[a]1.26	[a]1.40	1.48	1.80	1.10	1.37	2.26	2.14	2.01
	Manufactures	[a]2.13	[a]2.68	[a]2.29	[a]2.20	[a]2.17	[a]2.64	[a]2.95	2.59	3.03	3.66	3.67	4.26	4.04	4.32
	Services	[a]0.34	[a]0.40	[a]0.34	[a]0.40	[a]0.40	[a]0.43	[a]0.47	0.43	0.48	0.53	0.59	0.64	0.75	0.82
	Total	[a]3.66	[a]4.55	[a]3.75	[a]3.82	[a]3.81	[a]4.63	[a]5.33	4.82	5.64	5.51	5.86	7.44	7.21	7.44
Mozambique	Food	..	..	..	..	..	0.28	0.25	0.23	0.19	..	..	..	0.27	..
	Other primary products	..	..	..	..	..	0.58	0.39	0.37	0.26	..	..	..	1.13	..
	Manufactures	..	..	..	..	..	2.10	1.59	1.37	0.96	..	..	..	1.63	..
	Services	..	..	..	..	..	1.17	1.44	1.03	0.80	..	..	..	1.75	..
	Total	..	..	..	..	..	4.14	3.67	3.00	2.20	..	..	..	4.78	..

Table A-10: Openness based on the EFR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Netherlands	Food	2.74	2.51	2.56	2.62	2.65	3.11	2.98	3.03	2.63	2.69	2.74	2.77	2.79	3.10
	Other primary products	3.86	3.73	3.28	2.94	3.14	3.19	3.16	3.64	3.96	3.15	3.56	5.79	5.41	4.32
	Manufactures	11.77	11.57	11.46	11.04	10.54	11.97	12.80	13.27	15.50	15.48	15.90	18.01	16.63	16.14
	Services	2.82	2.62	2.98	3.07	3.17	3.26	2.95	3.05	3.49	3.47	3.53	4.09	4.17	4.11
	Total	21.20	20.44	20.28	19.67	19.50	21.52	21.88	22.99	25.58	24.80	25.73	30.65	28.99	27.67
New Zealand	Food	[a]0.34	[a]0.33	[a]0.36	[a]0.40	[a]0.40	[a]0.40	[a]0.39	0.30	0.30	0.38	0.36	0.42	0.45	0.43
	Other primary products	[a]0.48	[a]0.65	[a]0.64	[a]0.67	[a]0.62	[a]0.58	[a]0.56	0.56	0.58	0.63	0.68	1.24	1.16	1.01
	Manufactures	[a]2.60	[a]2.80	[a]2.73	[a]3.28	[a]3.09	[a]3.34	[a]3.31	2.89	2.88	3.13	3.60	3.95	3.87	3.63
	Services	[a]0.81	[a]0.85	[a]0.97	[a]1.09	[a]0.98	[a]0.99	[a]0.95	1.04	1.04	1.21	1.23	1.46	1.42	1.30
	Total	[a]4.23	[a]4.64	[a]4.70	[a]5.44	[a]5.09	[a]5.31	[a]5.20	4.80	4.81	5.36	5.87	7.07	6.90	6.39
Peru	Food	0.19	0.13	0.17	0.11	0.14	0.14	0.12	0.15	0.15	0.13	0.15	0.12	0.13	0.13
	Other primary products	0.30	0.26	0.30	0.19	0.18	0.15	0.23	0.25	0.28	0.23	0.30	0.45	0.38	0.39
	Manufactures	1.02	0.76	1.06	0.74	0.87	0.95	1.11	1.09	1.20	1.18	1.26	1.24	1.20	1.19
	Services	0.24	0.15	0.19	0.11	0.11	0.09	0.09	0.11	0.12	0.14	0.15	0.15	0.14	0.15
	Total	1.74	1.30	1.73	1.15	1.30	1.34	1.55	1.60	1.75	1.68	1.85	1.95	1.86	1.86
Philippines	Food	[a]0.18	[a]0.20	[a]0.17	[a]0.16	[a]0.18	[a]0.19	[a]0.23	0.19	0.22	0.29	0.20	0.21	0.21	0.19
	Other primary products	[a]1.89	[a]2.26	[a]2.32	[a]2.20	[a]2.24	[a]2.00	[a]2.23	2.94	3.19	2.88	2.86	4.34	3.84	3.17
	Manufactures	[a]4.84	[a]5.31	[a]5.48	[a]5.77	[a]7.29	[a]7.91	[a]9.18	12.00	14.94	15.92	13.44	13.59	12.70	13.60
	Services	[a]0.14	[a]0.15	[a]0.17	[a]0.21	[a]0.26	[a]0.39	[a]0.57	1.05	1.74	1.45	0.78	0.65	0.51	0.38
	Total	[a]7.06	[a]7.93	[a]8.13	[a]8.34	[a]9.97	[a]10.49	[a]12.21	16.18	20.09	20.55	17.28	18.79	17.26	17.33
Poland	Food	..	0.16	0.25	0.18	0.15	0.15	0.18	0.18	0.15	0.14	0.11	0.10	0.10	0.09
	Other primary products	..	1.74	1.54	1.34	1.04	0.92	1.15	1.07	0.80	0.75	0.80	1.30	1.16	1.13
	Manufactures	..	2.77	2.75	2.75	3.00	3.11	4.36	4.21	4.05	4.48	4.30	4.86	4.54	4.90
	Services	..	0.55	0.37	0.49	0.39	0.40	0.86	0.55	0.38	0.44	0.42	0.61	0.52	0.51
	Total	..	5.21	4.91	4.76	4.58	4.58	6.55	6.01	5.38	5.80	5.63	6.88	6.33	6.63
Portugal	Food	0.31	0.30	0.28	0.23	0.24	0.28	0.30	0.31	0.31	0.32	0.30	0.32	0.33	..
	Other primary products	1.93	1.97	1.44	1.16	1.15	1.30	1.36	1.34	1.44	1.18	1.25	1.93	1.73	..
	Manufactures	4.31	4.46	3.86	3.55	3.30	3.63	3.89	4.14	4.47	4.75	4.70	5.11	4.86	..
	Services	0.56	0.63	0.57	0.48	0.69	0.67	0.72	0.69	0.73	0.73	0.69	0.75	0.70	..
	Total	7.10	7.35	6.15	5.42	5.38	5.89	6.26	6.48	6.95	6.98	6.94	8.11	7.62	..
Russian Federation	Food	..	..	..	..	..	..	..	0.06	0.05	0.08	0.09	0.07	0.06	..
	Other primary products	..	..	..	..	..	..	..	0.27	0.31	0.37	0.40	0.48	0.25	..
	Manufactures	..	..	..	..	..	..	..	1.25	1.25	1.88	1.92	1.62	1.50	..
	Services	..	..	..	..	..	..	..	0.33	0.34	0.53	0.66	0.56	0.53	..
	Total	..	..	..	..	..	..	..	1.91	1.95	2.86	3.08	2.73	2.34	..
Singapore	Food	3.55	..	3.02	2.91	2.64	2.47	2.21	2.00	1.85	1.68	1.66	1.41	1.50	1.48
	Other primary products	24.54	..	21.73	18.62	15.81	13.28	12.50	13.43	13.00	9.91	12.00	16.88	16.47	16.96
	Manufactures	76.97	..	71.80	69.91	72.14	76.70	80.01	75.11	71.89	65.56	71.11	75.10	69.87	68.99
	Services	12.34	..	11.34	10.38	10.37	11.11	14.02	13.52	12.66	12.80	16.16	16.10	17.77	18.11
	Total	117.40	..	107.89	101.82	100.97	103.56	108.74	104.06	99.40	89.95	100.93	109.48	105.61	105.54
Slovak Republic	Food	..	..	..	..	..	0.41	0.45	0.42	0.35	0.35	0.32	0.34	..	..
	Other primary products	..	..	..	..	..	4.63	3.41	3.85	4.40	3.49	3.82	6.33	..	..
	Manufactures	..	..	..	..	..	10.99	12.23	13.25	13.94	16.45	15.06	18.07	..	..
	Services	..	..	..	..	..	2.46	2.15	1.96	2.01	2.17	1.91	2.09	..	..
	Total	..	..	..	..	..	18.49	18.25	19.49	20.71	22.47	21.11	26.83	..	..
Slovenia	Food	..	..	..	0.71	0.58	0.61	0.47	0.47	0.46	0.42	0.35	0.39	0.40	0.34
	Other primary products	..	..	..	4.19	3.97	3.19	2.93	2.91	3.15	2.31	2.31	3.63	3.18	2.55
	Manufactures	..	..	..	15.06	15.48	16.10	15.52	15.40	16.01	16.67	15.35	17.38	17.33	15.62
	Services	..	..	..	2.02	1.88	1.95	1.73	1.80	1.76	1.75	1.62	1.78	1.78	1.74
	Total	..	..	..	21.97	21.90	21.85	20.65	20.57	21.39	21.15	19.63	23.17	22.68	20.26
Spain	Food	0.17	0.15	0.17	0.16	0.20	0.26	0.31	0.30	0.31	0.34	0.28	0.33	0.36	0.31
	Other primary products	0.82	0.73	0.66	0.61	0.68	0.78	0.85	0.94	0.95	0.84	0.81	1.68	1.49	1.21
	Manufactures	2.04	1.90	1.91	1.91	1.97	2.51	2.96	3.12	3.34	4.07	3.77	4.80	4.62	3.91
	Services	0.38	0.37	0.37	0.43	0.51	0.57	0.60	0.67	0.77	0.86	0.92	1.08	1.16	1.09
	Total	3.41	3.16	3.11	3.11	3.37	4.13	4.73	5.02	5.37	6.11	5.78	7.89	7.62	6.53

Table A-10: Openness based on the EFR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sri Lanka	Food	a0.31	a0.32	a0.25	a0.23	a0.22	a0.26	..	..	0.34	..	0.32	..	0.31	0.27
	Other primary products	a1.81	a2.33	a2.16	a2.09	a2.09	a1.83	..	..	1.70	..	1.65	..	2.57	3.47
	Manufactures	a4.45	a5.02	a5.28	a6.43	a7.46	a7.77	..	..	7.98	..	7.75	..	7.65	6.83
	Services	a1.86	a1.96	a2.05	a2.22	a2.25	a2.39	..	..	2.09	..	2.20	..	2.03	1.54
	Total	a8.43	a9.63	a9.74	a10.97	a12.02	a12.26	..	..	12.11	..	11.92	..	12.56	12.11
Sweden	Food	a0.07	a0.07	a0.07	a0.07	a0.08	a0.12	a0.11	0.15	0.18	0.18	0.19	0.19	0.22	0.22
	Other primary products	a1.28	a1.26	a1.06	a1.05	a1.32	a1.48	a1.29	1.53	1.63	1.40	1.39	2.28	2.21	2.03
	Manufactures	a5.20	a4.58	a3.98	a3.83	a4.67	a6.23	a6.60	7.45	8.23	8.76	8.72	9.72	9.04	8.07
	Services	a1.47	a1.42	a1.37	a1.49	a1.49	a1.64	a1.68	1.62	1.92	2.14	2.25	2.54	2.79	2.47
	Total	a8.02	a7.34	a6.47	a6.43	a7.56	a9.47	a9.68	10.76	11.96	12.48	12.56	14.73	14.26	12.79
Switzerland	Food	0.09	0.08	0.08	0.07	0.07	0.08	0.07	0.07	0.08	0.08	0.08	0.09	0.08	..
	Other primary products	1.08	1.07	0.98	0.90	0.80	0.74	0.68	0.76	1.00	0.77	0.78	1.21	1.14	..
	Manufactures	6.94	6.42	6.00	5.82	5.62	5.69	5.72	5.94	6.77	7.11	7.35	8.43	8.10	..
	Services	0.90	0.84	0.82	0.86	0.87	0.86	0.86	0.95	1.04	1.09	1.20	1.32	1.31	..
	Total	9.00	8.41	7.88	7.66	7.36	7.37	7.32	7.72	8.89	9.05	9.41	11.05	10.63	..
Tanzania	Food	..	..	..	..	..	..	..	..	0.03	0.03	0.03	0.02	0.03	..
	Other primary products	..	..	..	..	..	..	..	..	0.35	0.27	0.21	0.48	0.48	..
	Manufactures	..	..	..	..	..	..	..	..	0.62	0.58	0.60	0.53	0.71	..
	Services	..	..	..	..	..	..	..	..	1.00	1.05	0.82	0.69	0.72	..
	Total	..	..	..	..	..	..	..	..	2.01	1.94	1.67	1.72	1.94	..
Thailand	Food	a0.20	a0.18	a0.20	a0.19	a0.16	a0.15	a0.15	0.33	0.51	0.53	0.51	0.56	0.69	..
	Other primary products	a0.79	a0.85	a0.91	a0.83	a0.79	a0.78	a0.90	2.19	2.96	2.56	3.14	4.99	5.08	..
	Manufactures	a3.50	a3.85	a3.99	a4.02	a4.35	a4.60	a5.48	8.64	11.64	11.03	12.15	15.58	16.13	..
	Services	a0.02	a0.02	a0.03	a0.03	a0.04	a0.04	a0.04	1.52	2.12	2.04	2.20	2.61	2.56	..
	Total	a4.51	a4.90	a5.12	a5.08	a5.33	a5.56	a6.57	12.69	17.23	16.16	18.00	23.75	24.45	..
Turkey	Food	a0.07	a0.06	a0.05	a0.05	a0.05	a0.07	a0.10	0.11	0.11	0.09	0.08	0.07	0.09	0.07
	Other primary products	a0.91	a0.77	a0.65	a0.70	a0.64	a1.21	a1.15	1.10	1.08	0.82	1.04	1.40	2.04	1.70
	Manufactures	a1.27	a1.07	a1.11	a1.24	a1.38	a2.12	a2.41	2.43	3.11	3.01	2.72	3.31	4.18	3.66
	Services	a0.28	a0.22	a0.24	a0.26	a0.24	a0.47	a0.47	0.58	0.89	1.04	0.92	0.83	1.05	0.70
	Total	a2.53	a2.12	a2.05	a2.25	a2.31	a3.87	a4.13	4.23	5.19	4.96	4.76	5.61	7.35	6.12
Uganda	Food	..	..	..	..	..	0.13	0.09	0.10	0.15	0.12	0.11	0.11	0.11	0.13
	Other primary products	..	..	..	..	..	0.14	0.09	0.53	0.23	0.36	0.41	0.87	0.89	0.91
	Manufactures	..	..	..	..	..	0.58	0.52	0.69	0.77	0.65	0.79	0.91	1.05	1.06
	Services	..	..	..	..	..	0.37	0.35	0.54	0.53	0.51	0.37	0.44	0.54	0.54
	Total	..	..	..	..	..	1.23	1.05	1.85	1.69	1.64	1.68	2.33	2.58	2.64
United Kingdom	Food	a0.21	a0.21	a0.20	a0.22	a0.22	a0.23	a0.24	0.24	0.21	0.19	0.17	0.16	0.15	0.15
	Other primary products	a0.68	a0.73	a0.64	a0.59	a0.61	a0.56	a0.55	0.65	0.57	0.41	0.42	0.64	0.60	0.54
	Manufactures	a3.62	a3.50	a3.14	a3.25	a3.56	a3.83	a4.18	4.21	4.05	3.86	3.78	4.14	3.94	3.62
	Services	a0.32	a0.33	a0.32	a0.36	a0.40	a0.43	a0.45	0.55	0.54	0.55	0.59	0.65	0.61	0.60
	Total	a4.84	a4.78	a4.30	a4.42	a4.79	a5.04	a5.42	5.66	5.37	5.02	4.95	5.58	5.31	4.91
United States	Food	a0.03	a0.03	a0.02	a0.03	a0.02	a0.02	a0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02
	Other primary products	a0.19	a0.22	a0.19	a0.19	a0.18	a0.18	a0.20	0.29	0.30	0.21	0.24	0.38	0.33	0.29
	Manufactures	a0.46	a0.46	a0.48	a0.50	a0.52	a0.59	a0.67	0.78	0.83	0.82	0.84	0.94	0.81	0.76
	Services	a0.06	a0.07	a0.08	a0.07	a0.07	a0.08	a0.08	0.10	0.10	0.10	0.10	0.11	0.10	0.10
	Total	a0.74	a0.78	a0.77	a0.79	a0.81	a0.88	a0.98	1.20	1.26	1.16	1.22	1.46	1.27	1.17
Uruguay	Food	a0.10	a0.10	a0.10	a0.12	a0.10	a0.14	a0.13	0.12	0.13	0.14	0.11	0.12	0.11	0.19
	Other primary products	a0.82	a0.96	a0.76	a0.53	a0.44	a0.48	a0.51	0.52	0.48	0.37	0.46	0.69	0.58	0.85
	Manufactures	a1.62	a1.60	a1.48	a1.65	a1.73	a1.78	a1.49	1.41	1.58	1.66	1.26	1.32	1.31	1.42
	Services	a0.41	a0.35	a0.29	a0.35	a0.46	a0.49	a0.41	0.33	0.32	0.30	0.27	0.31	0.31	0.45
	Total	a2.95	a3.01	a2.63	a2.65	a2.73	a2.89	a2.54	2.37	2.51	2.47	2.10	2.44	2.31	2.91
Venezuela	Food	0.37	0.30	0.33	0.32	0.35	0.34	0.35	0.36	0.26	0.29	0.22	0.20	0.21	0.24
	Other primary products	0.21	0.20	0.18	0.12	0.10	0.12	0.14	0.11	0.13	0.08	0.07	0.09	0.09	0.08
	Manufactures	2.56	2.26	2.74	2.88	2.67	2.14	2.04	1.91	2.08	2.03	1.49	1.49	1.60	1.62
	Services	0.58	0.69	0.77	0.80	0.88	1.02	0.75	0.86	0.50	0.46	0.42	0.38	0.40	0.48
	Total	3.72	3.45	4.02	4.13	4.01	3.62	3.27	3.24	2.97	2.86	2.20	2.17	2.30	2.41

Table A-10: Openness based on the EFR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Zambia	Food	..	..	..	..	..	..	..	..	0.04	0.08	0.06	0.04	..	..
	Other primary products	..	..	..	..	..	..	..	..	1.47	2.54	1.79	3.03	..	..
	Manufactures	..	..	..	..	..	..	..	..	2.31	4.08	3.46	2.99	..	..
	Services	..	..	..	..	..	..	..	..	0.95	1.26	1.48	1.27	..	..
	Total	..	..	..	..	..	..	..	..	4.76	7.96	6.79	7.32	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

Table A-11: Openness based on the IDR_i measure of 56 countries, 1989-2002, % of current GDP

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	Food	a0.002	a0.001	a0.001	a0.001	a0.001	a0.001	a0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.006
	Other primary products	a0.001	a0.001	a0.001	a0.001	a0.001	a0.002	a0.002	0.004	0.004	0.003	0.003	0.005	0.004	0.013
	Manufactures	a0.003	a0.001	a0.001	a0.001	a0.002	a0.002	a0.003	0.004	0.005	0.005	0.004	0.005	0.004	0.012
	Services	a0.001	a0.000	a0.000	a0.001	a0.001	a0.001	a0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.003
	Total	a0.007	a0.003	a0.003	a0.004	a0.004	a0.006	a0.007	0.011	0.013	0.012	0.011	0.013	0.012	0.033
Australia	Food	a0.003	a0.002	a0.002	a0.003	a0.003	a0.003	a0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004
	Other primary products	a0.017	a0.016	a0.017	a0.018	a0.018	a0.017	a0.019	0.021	0.023	0.025	0.021	0.029	0.029	0.027
	Manufactures	a0.012	a0.012	a0.012	a0.013	a0.014	a0.015	a0.017	0.020	0.020	0.023	0.021	0.026	0.026	0.024
	Services	a0.004	a0.004	a0.004	a0.005	a0.006	a0.006	a0.007	0.008	0.008	0.008	0.008	0.010	0.009	0.008
	Total	a0.035	a0.034	a0.035	a0.038	a0.041	a0.041	a0.046	0.052	0.055	0.061	0.053	0.069	0.068	0.064
Austria	Food	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003
	Other primary products	0.007	0.007	0.006	0.005	0.004	0.005	0.005	0.005	0.006	0.006	0.008	0.010	0.012	0.013
	Manufactures	0.062	0.064	0.061	0.057	0.050	0.053	0.060	0.064	0.080	0.086	0.091	0.116	0.124	0.123
	Services	0.025	0.025	0.026	0.024	0.023	0.023	0.024	0.027	0.029	0.028	0.032	0.040	0.044	0.042
	Total	0.094	0.096	0.094	0.086	0.078	0.083	0.090	0.098	0.117	0.122	0.133	0.168	0.183	0.180
Bangladesh	Food	0.000	0.000	0.000	0.000	0.000	..	0.000	0.000	0.000	0.000	..	..	0.000	..
	Other primary products	0.000	0.000	0.000	0.000	0.000	..	0.000	0.000	0.000	0.000	..	..	0.000	..
	Manufactures	0.001	0.001	0.001	0.001	0.001	..	0.003	0.002	0.003	0.003	..	..	0.004	..
	Services	0.000	0.000	0.000	0.000	0.000	..	0.000	0.000	0.000	0.000	..	..	0.000	..
	Total	0.001	0.001	0.001	0.001	0.002	..	0.003	0.003	0.003	0.003	..	..	0.004	..
Belgium	Food	..	..	..	..	..	..	..	..	0.022	..	0.025	0.029	0.030	..
	Other primary products	..	..	..	..	..	..	..	..	0.038	..	0.043	0.080	0.074	..
	Manufactures	..	..	..	..	..	..	..	..	0.403	..	0.450	0.597	0.614	..
	Services	..	..	..	..	..	..	..	..	0.056	..	0.077	0.110	0.111	..
	Total	..	..	..	..	..	..	..	..	0.519	..	0.594	0.815	0.830	..
Brazil	Food	a0.002	a0.001	a0.002	a0.002	a0.002	a0.003	a0.002	0.002	0.003	0.002	0.004	0.003	0.005	..
	Other primary products	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	a0.002	0.001	0.001	0.001	0.003	0.004	0.007	..
	Manufactures	a0.006	a0.006	a0.008	a0.010	a0.011	a0.010	a0.009	0.010	0.012	0.011	0.020	0.022	0.030	..
	Services	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	0.001	0.001	0.002	0.003	0.003	0.005	..
	Total	a0.009	a0.009	a0.012	a0.015	a0.016	a0.015	a0.015	0.014	0.017	0.017	0.030	0.032	0.047	..
Canada	Food	a0.004	a0.005	a0.005	a0.006	a0.006	a0.007	a0.008	0.008	0.009	0.010	0.009	0.009	0.010	..
	Other primary products	a0.045	a0.044	a0.042	a0.048	a0.061	a0.075	a0.084	0.101	0.110	0.103	0.110	0.150	0.137	..
	Manufactures	a0.084	a0.081	a0.078	a0.091	a0.113	a0.144	a0.167	0.200	0.226	0.261	0.273	0.281	0.247	..
	Services	a0.010	a0.010	a0.011	a0.012	a0.015	a0.017	a0.019	0.023	0.026	0.031	0.031	0.032	0.030	..
	Total	a0.143	a0.140	a0.136	a0.157	a0.195	a0.244	a0.278	0.333	0.373	0.405	0.422	0.471	0.423	..
Chile	Food	a0.002	a0.002	a0.002	a0.002	a0.002	a0.002	a0.002	0.002	0.002	0.002	0.002	0.002	0.003	..
	Other primary products	a0.003	a0.003	a0.003	a0.003	a0.003	a0.003	a0.004	0.004	0.004	0.004	0.003	0.004	0.005	..
	Manufactures	a0.014	a0.012	a0.010	a0.009	a0.008	a0.008	a0.010	0.012	0.013	0.012	0.010	0.012	0.015	..
	Services	a0.002	a0.003	a0.002	a0.002	a0.002	a0.002	a0.002	0.003	0.003	0.003	0.002	0.003	0.004	..
	Total	a0.021	a0.019	a0.017	a0.016	a0.015	a0.015	a0.017	0.020	0.022	0.021	0.018	0.022	0.026	..
China	Food	a0.006	a0.005	a0.005	a0.005	a0.006	a0.006	a0.005	0.004	0.003	0.002	0.002	0.003	0.003	0.003
	Other primary products	a0.019	a0.017	a0.017	a0.017	a0.019	a0.015	a0.012	0.012	0.012	0.008	0.009	0.014	0.014	0.015
	Manufactures	a0.053	a0.056	a0.072	a0.092	a0.125	a0.120	a0.102	0.104	0.108	0.101	0.116	0.164	0.168	0.213
	Services	a0.004	a0.004	a0.005	a0.007	a0.010	a0.011	a0.009	0.010	0.010	0.009	0.010	0.013	0.014	0.017
	Total	a0.081	a0.082	a0.099	a0.122	a0.160	a0.151	a0.128	0.130	0.133	0.120	0.138	0.194	0.199	0.247
Colombia	Food	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Other primary products	a0.004	a0.006	a0.004	a0.004	a0.004	a0.002	a0.003	0.005	0.004	0.005	0.006	0.008	0.008	0.008
	Manufactures	a0.001	a0.002	a0.002	a0.002	a0.003	a0.002	a0.002	0.002	0.002	0.002	0.002	0.003	0.004	0.004
	Services	a0.001	a0.001	a0.001	a0.001	a0.002	a0.001	a0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Total	a0.007	a0.010	a0.009	a0.008	a0.010	a0.006	a0.006	0.009	0.008	0.009	0.010	0.013	0.014	0.013
Croatia	Food	..	..	..	..	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Other primary products	..	..	..	..	0.003	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002
	Manufactures	..	..	..	..	0.008	0.005	0.005	0.004	0.005	0.005	0.005	0.005	0.005	0.005
	Services	..	..	..	..	0.004	0.003	0.002	0.003	0.004	0.003	0.003	0.004	0.005	0.005
	Total	..	..	..	..	0.015	0.010	0.009	0.009	0.011	0.009	0.009	0.011	0.012	0.013

Table A-11: Openness based on the IDR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Czech Republic	Food	..	..	..	..	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Other primary products	..	..	..	..	0.007	0.007	0.007	0.006	0.006	0.005	0.006	0.008	0.008	0.007
	Manufactures	..	..	..	..	0.033	0.030	0.038	0.036	0.043	0.047	0.051	0.072	0.078	0.065
	Services	..	..	..	..	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.011	0.011	0.008
	Total	..	..	..	..	0.050	0.046	0.054	0.053	0.059	0.062	0.067	0.092	0.097	0.081
Denmark	Food	a0.010	a0.009	a0.010	a0.009	a0.009	a0.009	a0.009	0.007	0.007	0.007	0.007	0.007	0.008	0.008
	Other primary products	a0.007	a0.007	a0.007	a0.007	a0.005	a0.006	a0.006	0.008	0.007	0.006	0.007	0.013	0.011	0.012
	Manufactures	a0.033	a0.032	a0.034	a0.033	a0.029	a0.033	a0.036	0.034	0.038	0.040	0.041	0.048	0.049	0.052
	Services	a0.011	a0.012	a0.014	a0.012	a0.010	a0.011	a0.011	0.011	0.010	0.012	0.016	0.023	0.024	0.025
	Total	a0.061	a0.060	a0.064	a0.060	a0.054	a0.059	a0.062	0.059	0.064	0.065	0.070	0.091	0.092	0.096
Estonia	Food	..	..	..	..	..	..	0.000	0.000	0.001	0.001	0.000	0.000	0.001	0.001
	Other primary products	..	..	..	..	..	..	0.001	0.001	0.002	0.002	0.002	0.003	0.002	0.002
	Manufactures	..	..	..	..	..	..	0.002	0.004	0.006	0.006	0.005	0.009	0.008	0.007
	Services	..	..	..	..	..	..	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.003
	Total	..	..	..	..	..	..	0.004	0.007	0.012	0.011	0.010	0.015	0.014	0.013
Finland	Food	a0.000	a0.000	a0.000	a0.000	a0.000	a0.001	a0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
	Other primary products	a0.005	a0.004	a0.004	a0.005	a0.006	a0.008	a0.007	0.008	0.008	0.007	0.007	0.010	0.008	0.008
	Manufactures	a0.019	a0.017	a0.015	a0.019	a0.025	a0.030	a0.033	0.035	0.039	0.040	0.038	0.049	0.044	0.039
	Services	a0.002	a0.002	a0.002	a0.003	a0.004	a0.004	a0.005	0.005	0.005	0.004	0.004	0.005	0.004	0.004
	Total	a0.026	a0.024	a0.021	a0.027	a0.036	a0.043	a0.045	0.048	0.052	0.052	0.049	0.064	0.056	0.051
France	Food	0.017	0.015	0.015	0.014	0.015	0.015	0.015	0.015	0.017	0.017	0.016	0.018	0.017	0.016
	Other primary products	0.017	0.016	0.016	0.014	0.014	0.015	0.016	0.017	0.019	0.018	0.019	0.029	0.026	0.021
	Manufactures	0.170	0.166	0.164	0.154	0.145	0.165	0.178	0.184	0.216	0.241	0.254	0.330	0.318	0.274
	Services	0.045	0.047	0.049	0.048	0.047	0.039	0.038	0.038	0.044	0.047	0.047	0.059	0.057	0.052
	Total	0.249	0.244	0.244	0.231	0.220	0.234	0.247	0.254	0.296	0.323	0.336	0.436	0.417	0.363
Germany	Food	a0.016	a0.014	a0.015	a0.014	a0.011	a0.012	a0.012	0.010	0.011	0.012	0.012	0.013	0.015	0.014
	Other primary products	a0.026	a0.024	a0.023	a0.020	a0.015	a0.017	a0.017	0.018	0.021	0.021	0.022	0.035	0.035	0.032
	Manufactures	a0.521	a0.482	a0.458	a0.398	a0.318	a0.349	a0.380	0.365	0.446	0.491	0.519	0.689	0.715	0.678
	Services	a0.041	a0.042	a0.043	a0.039	a0.035	a0.036	a0.040	0.039	0.048	0.051	0.055	0.072	0.076	0.077
	Total	a0.604	a0.563	a0.540	a0.470	a0.379	a0.413	a0.448	0.433	0.526	0.575	0.608	0.809	0.841	0.802
Greece	Food	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	..	0.002	0.002	0.001	..
	Other primary products	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.003	0.002	..	0.003	0.005	0.003	..
	Manufactures	0.007	0.006	0.006	0.006	0.006	0.005	0.006	0.006	0.006	..	0.007	0.009	0.006	..
	Services	0.005	0.005	0.005	0.006	0.006	0.006	0.005	0.005	0.005	..	0.012	0.017	0.014	..
	Total	0.017	0.015	0.016	0.015	0.015	0.015	0.015	0.015	0.015	..	0.023	0.032	0.025	..
Hungary	Food	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.002	0.002	0.001
	Other primary products	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.003	0.003
	Manufactures	0.012	0.011	0.012	0.010	0.009	0.011	0.013	0.018	0.028	0.042	0.050	0.069	0.063	0.049
	Services	0.001	0.003	0.003	0.003	0.003	0.003	0.004	0.006	0.006	0.007	0.007	0.009	0.010	0.007
	Total	0.017	0.017	0.018	0.016	0.014	0.017	0.020	0.028	0.039	0.054	0.061	0.084	0.079	0.060
India	Food	a0.000	a0.000	a0.000	a0.001	a0.001	a0.001	a0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Other primary products	a0.000	a0.001	a0.001	a0.001	a0.001	a0.000	a0.001	0.001	0.001	0.001	0.000	0.002	0.002	0.002
	Manufactures	a0.004	a0.004	a0.005	a0.007	a0.006	a0.006	a0.008	0.010	0.011	0.011	0.011	0.013	0.012	0.013
	Services	a0.001	a0.001	a0.001	a0.002	a0.001	a0.001	a0.002	0.002	0.003	0.003	0.004	0.005	0.005	0.006
	Total	a0.006	a0.006	a0.007	a0.011	a0.009	a0.009	a0.011	0.014	0.015	0.016	0.016	0.021	0.020	0.023
Indonesia	Food	a0.002	a0.002	a0.002	a0.002	a0.002	a0.002	a0.002	0.002	0.003	0.009	0.004	0.004	0.003	0.003
	Other primary products	a0.027	a0.033	a0.031	a0.029	a0.022	a0.020	a0.022	0.022	0.027	0.068	0.025	0.040	0.038	0.027
	Manufactures	a0.011	a0.014	a0.017	a0.020	a0.020	a0.019	a0.021	0.021	0.024	0.078	0.031	0.048	0.045	0.031
	Services	a0.002	a0.002	a0.002	a0.003	a0.003	a0.003	a0.003	0.003	0.004	0.009	0.004	0.005	0.006	0.005
	Total	a0.042	a0.051	a0.052	a0.053	a0.046	a0.044	a0.048	0.049	0.058	0.164	0.064	0.097	0.093	0.066
Ireland	Food	0.009	0.007	0.008	0.008	0.008	0.009	0.009	0.007	0.005	0.006	0.005	0.005	..	..
	Other primary products	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002	..	..
	Manufactures	0.054	0.047	0.048	0.048	0.054	0.066	0.078	0.080	0.085	0.113	0.110	0.131	..	..
	Services	0.005	0.006	0.006	0.006	0.006	0.007	0.007	0.007	0.007	0.024	0.019	0.022	..	..
	Total	0.072	0.063	0.064	0.065	0.071	0.086	0.098	0.096	0.101	0.145	0.136	0.160	..	..

Table A-11: Openness based on the IDR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Italy	Food	0.005	0.004	0.004	0.004	0.005	0.006	0.007	0.006	0.006	0.006	0.006	0.007	0.007	0.007
	Other primary products	0.007	0.007	0.006	0.006	0.006	0.006	0.007	0.006	0.007	0.006	0.007	0.012	0.011	0.010
	Manufactures	0.119	0.108	0.097	0.097	0.110	0.134	0.177	0.153	0.166	0.172	0.170	0.221	0.211	0.194
	Services	0.019	0.023	0.020	0.024	0.026	0.028	0.034	0.029	0.033	0.033	0.029	0.037	0.036	0.033
	Total	0.149	0.143	0.127	0.130	0.148	0.174	0.225	0.193	0.212	0.218	0.212	0.276	0.264	0.243
Japan	Food	a0.001	a0.001	a0.001	a0.001	a0.000	a0.000	a0.000	0.000	0.001	0.000	0.000	0.000	0.001	..
	Other primary products	a0.003	a0.003	a0.003	a0.002	a0.002	a0.002	a0.003	0.002	0.003	0.002	0.002	0.002	0.003	..
	Manufactures	a0.138	a0.153	a0.130	a0.116	a0.098	a0.102	a0.117	0.120	0.141	0.133	0.121	0.146	0.149	..
	Services	a0.016	a0.018	a0.015	a0.013	a0.011	a0.012	a0.013	0.015	0.018	0.016	0.013	0.016	0.018	..
	Total	a0.158	a0.175	a0.148	a0.133	a0.112	a0.117	a0.134	0.138	0.162	0.152	0.137	0.164	0.170	..
Korea	Food	a0.002	a0.002	a0.002	a0.001	a0.001	a0.001	a0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001
	Other primary products	a0.006	a0.005	a0.007	a0.007	a0.007	a0.006	a0.008	0.010	0.015	0.019	0.018	0.027	0.024	0.018
	Manufactures	a0.125	a0.112	a0.106	a0.099	a0.091	a0.098	a0.116	0.123	0.145	0.208	0.178	0.212	0.195	0.184
	Services	a0.011	a0.011	a0.010	a0.010	a0.010	a0.011	a0.014	0.015	0.020	0.029	0.023	0.028	0.028	0.023
	Total	a0.144	a0.130	a0.125	a0.117	a0.108	a0.117	a0.139	0.150	0.181	0.259	0.221	0.268	0.248	0.225
Latvia	Food	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Other primary products	..	..	..	..	..	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Manufactures	..	..	..	..	..	0.000	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001
	Services	..	..	..	..	..	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Total	..	..	..	..	..	0.001	0.002	0.003	0.004	0.004	0.003	0.003	0.003	0.003
Lithuania	Food	..	..	..	..	..	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.000	..
	Other primary products	..	..	..	..	..	0.001	0.002	0.003	0.003	0.002	0.001	0.002	0.003	..
	Manufactures	..	..	..	..	..	0.002	0.004	0.005	0.004	0.004	0.003	0.003	0.004	..
	Services	..	..	..	..	..	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	..
	Total	..	..	..	..	..	0.004	0.008	0.009	0.009	0.008	0.005	0.006	0.008	..
Malawi	Food	0.000	0.000	0.000	..	..	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000	..
	Other primary products	0.000	0.000	0.000	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	..
	Manufactures	0.000	0.000	0.000	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	..
	Services	0.000	0.000	0.000	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	..
	Total	0.000	0.000	0.000	..	..	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	..
Malaysia	Food	..	..	a0.010	a0.009	a0.008	a0.010	a0.011	0.009	0.009	0.014	0.012	0.008	0.008	0.010
	Other primary products	..	..	a0.105	a0.082	a0.070	a0.071	a0.075	0.074	0.072	0.070	0.079	0.111	0.090	0.090
	Manufactures	..	..	a0.129	a0.123	a0.138	a0.194	a0.228	0.230	0.239	0.322	0.352	0.394	0.331	0.320
	Services	..	..	a0.016	a0.014	a0.016	a0.024	a0.028	0.034	0.036	0.037	0.036	0.040	0.040	0.038
	Total	..	..	a0.260	a0.226	a0.233	a0.300	a0.342	0.347	0.355	0.443	0.478	0.554	0.470	0.458
Malta	Food	0.000	0.000	0.000	0.000	0.000	..	..	0.000	0.000	..	0.000	..	0.000	..
	Other primary products	0.000	0.000	0.000	0.000	0.000	..	..	0.000	0.000	..	0.000	..	0.000	..
	Manufactures	0.004	0.005	0.005	0.006	0.006	..	..	0.006	0.005	..	0.006	..	0.005	..
	Services	0.002	0.002	0.002	0.002	0.003	..	..	0.002	0.002	..	0.002	..	0.002	..
	Total	0.007	0.008	0.008	0.009	0.009	..	..	0.008	0.007	..	0.008	..	0.007	..
Mexico	Food	a0.003	a0.002	a0.002	a0.001	a0.001	a0.001	a0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002
	Other primary products	a0.019	a0.021	a0.015	a0.009	a0.007	a0.008	a0.019	0.035	0.028	0.019	0.022	0.030	0.020	0.021
	Manufactures	a0.014	a0.014	a0.014	a0.019	a0.020	a0.026	a0.068	0.113	0.113	0.131	0.130	0.131	0.108	0.102
	Services	a0.003	a0.003	a0.003	a0.003	a0.002	a0.003	a0.006	0.009	0.008	0.008	0.007	0.007	0.005	0.005
	Total	a0.039	a0.041	a0.034	a0.032	a0.030	a0.039	a0.096	0.160	0.152	0.161	0.162	0.170	0.135	0.130
Morocco	Food	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	a0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
	Other primary products	a0.001	a0.001	a0.000	a0.000	a0.000	a0.001	a0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.001
	Manufactures	a0.003	a0.003	a0.003	a0.003	a0.003	a0.004	a0.004	0.004	0.005	0.006	0.006	0.007	0.006	0.007
	Services	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003
	Total	a0.005	a0.006	a0.005	a0.005	a0.005	a0.007	a0.008	0.008	0.009	0.009	0.010	0.012	0.012	0.012
Mozambique	Food	..	..	..	..	..	0.000	0.000	0.000	0.000	..	..	..	0.000	..
	Other primary products	..	..	..	..	..	0.000	0.000	0.000	0.000	..	..	..	0.000	..
	Manufactures	..	..	..	..	..	0.000	0.000	0.000	0.000	..	..	..	0.001	..
	Services	..	..	..	..	..	0.000	0.000	0.000	0.000	..	..	..	0.000	..
	Total	..	..	..	..	..	0.001	0.001	0.001	0.000	..	..	..	0.001	..

Table A-11: Openness based on the IDR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Netherlands	Food	0.036	0.033	0.033	0.033	0.034	0.040	0.039	0.040	0.034	0.036	0.037	0.040	0.040	0.046
	Other primary products	0.076	0.076	0.075	0.063	0.062	0.067	0.069	0.080	0.082	0.077	0.083	0.135	0.104	0.040
	Manufactures	0.192	0.185	0.180	0.166	0.162	0.197	0.224	0.239	0.315	0.307	0.319	0.405	0.368	0.360
	Services	0.044	0.040	0.044	0.046	0.045	0.050	0.047	0.051	0.063	0.060	0.061	0.076	0.072	0.069
	Total	0.347	0.334	0.332	0.308	0.303	0.354	0.379	0.410	0.494	0.479	0.500	0.656	0.584	0.514
New Zealand	Food	a0.002	a0.003	a0.003	a0.003	a0.003	a0.003	a0.003	0.003	0.003	0.003	0.003	0.004	0.005	0.004
	Other primary products	a0.005	a0.005	a0.005	a0.005	a0.005	a0.005	a0.005	0.005	0.005	0.004	0.005	0.007	0.006	0.005
	Manufactures	a0.003	a0.003	a0.004	a0.004	a0.004	a0.005	a0.004	0.005	0.005	0.006	0.006	0.007	0.007	0.006
	Services	a0.002	a0.002	a0.002	a0.003	a0.002	a0.003	a0.003	0.003	0.003	0.003	0.004	0.005	0.004	0.004
	Total	a0.012	a0.013	a0.013	a0.015	a0.015	a0.016	a0.015	0.016	0.015	0.017	0.018	0.023	0.022	0.020
Peru	Food	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Other primary products	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Manufactures	0.003	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003
	Services	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Total	0.006	0.004	0.005	0.003	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Philippines	Food	a0.001	a0.002	a0.001	a0.001	a0.002	a0.001	a0.002	0.001	0.002	0.002	0.001	0.002	0.002	0.001
	Other primary products	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	0.002	0.002	0.002	0.002	0.003	0.002	0.002
	Manufactures	a0.009	a0.011	a0.011	a0.011	a0.016	a0.017	a0.021	0.030	0.045	0.071	0.067	0.074	0.062	0.065
	Services	a0.003	a0.003	a0.003	a0.004	a0.005	a0.007	a0.009	0.014	0.021	0.013	0.006	0.005	0.004	0.003
	Total	a0.015	a0.017	a0.017	a0.018	a0.023	a0.026	a0.034	0.048	0.070	0.088	0.075	0.084	0.069	0.072
Poland	Food	..	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Other primary products	..	0.006	0.006	0.005	0.004	0.004	0.006	0.005	0.004	0.004	0.004	0.004	0.004	0.004
	Manufactures	..	0.017	0.014	0.013	0.015	0.015	0.023	0.022	0.021	0.023	0.024	0.029	0.027	0.029
	Services	..	0.004	0.004	0.004	0.004	0.005	0.009	0.007	0.005	0.006	0.005	0.007	0.005	0.005
	Total	..	0.028	0.026	0.024	0.024	0.025	0.039	0.035	0.031	0.035	0.034	0.040	0.037	0.039
Portugal	Food	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	..
	Other primary products	0.006	0.006	0.004	0.003	0.003	0.004	0.004	0.003	0.003	0.003	0.003	0.004	0.003	..
	Manufactures	0.026	0.027	0.022	0.020	0.018	0.020	0.022	0.024	0.027	0.028	0.027	0.031	0.029	..
	Services	0.006	0.006	0.005	0.004	0.006	0.006	0.006	0.006	0.006	0.007	0.007	0.008	0.007	..
	Total	0.039	0.040	0.032	0.028	0.027	0.031	0.033	0.034	0.037	0.038	0.038	0.043	0.040	..
Russian Federation	Food	..	..	..	..	..	..	..	0.001	0.001	0.002	0.002	0.002	0.001	..
	Other primary products	..	..	..	..	..	..	..	0.073	0.075	0.094	0.141	0.150	0.132	..
	Manufactures	..	..	..	..	..	..	..	0.031	0.029	0.055	0.063	0.048	0.038	..
	Services	..	..	..	..	..	..	..	0.007	0.008	0.012	0.012	0.009	0.009	..
	Total	..	..	..	..	..	..	..	0.113	0.114	0.163	0.218	0.208	0.180	..
Singapore	Food	0.019	..	0.015	0.014	0.012	0.011	0.010	0.008	0.008	0.007	0.006	0.005	0.005	0.005
	Other primary products	0.287	..	0.251	0.177	0.166	0.141	0.114	0.116	0.096	0.092	0.107	0.145	0.105	0.105
	Manufactures	0.611	..	0.524	0.501	0.520	0.598	0.659	0.604	0.571	0.520	0.590	0.663	0.605	0.599
	Services	0.107	..	0.099	0.097	0.095	0.098	0.109	0.100	0.091	0.071	0.093	0.098	0.100	0.100
	Total	1.025	..	0.889	0.788	0.792	0.847	0.893	0.829	0.766	0.690	0.796	0.911	0.815	0.809
Slovak Republic	Food	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	..	..
	Other primary products	..	..	..	..	..	0.002	0.002	0.003	0.003	0.002	0.003	0.005	..	..
	Manufactures	..	..	..	..	..	0.011	0.013	0.014	0.016	0.019	0.018	0.024	..	..
	Services	..	..	..	..	..	0.003	0.003	0.002	0.003	0.003	0.002	0.003	..	..
	Total	..	..	..	..	..	0.017	0.018	0.020	0.021	0.025	0.023	0.032	..	..
Slovenia	Food	..	..	..	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Other primary products	..	..	..	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Manufactures	..	..	..	0.016	0.015	0.016	0.015	0.015	0.016	0.017	0.015	0.018	0.018	0.015
	Services	..	..	..	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002
	Total	..	..	..	0.020	0.020	0.020	0.019	0.018	0.020	0.020	0.018	0.022	0.022	0.018
Spain	Food	0.003	0.003	0.003	0.003	0.004	0.005	0.006	0.006	0.007	0.008	0.006	0.008	0.008	0.007
	Other primary products	0.006	0.005	0.004	0.003	0.003	0.004	0.004	0.005	0.006	0.006	0.006	0.012	0.009	0.009
	Manufactures	0.033	0.031	0.031	0.031	0.035	0.047	0.057	0.061	0.065	0.081	0.072	0.102	0.096	0.077
	Services	0.015	0.013	0.012	0.013	0.013	0.016	0.018	0.020	0.023	0.027	0.028	0.037	0.038	0.033
	Total	0.058	0.052	0.051	0.051	0.055	0.072	0.086	0.092	0.101	0.122	0.112	0.158	0.151	0.126

Table A-11: Openness based on the IDR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Sri Lanka	Food	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	..	..	0.001	..	0.001	..	0.001	0.001
	Other primary products	a0.001	a0.000	a0.000	a0.000	a0.000	a0.000	..	..	0.000	..	0.000	..	0.000	0.000
	Manufactures	a0.002	a0.002	a0.002	a0.003	a0.004	a0.004	..	..	0.006	..	0.006	..	0.006	0.005
	Services	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	..	..	0.001	..	0.001	..	0.001	0.001
	Total	a0.004	a0.004	a0.004	a0.005	a0.006	a0.006	..	..	0.008	..	0.008	..	0.008	0.007
Sweden	Food	a0.001	a0.001	a0.000	a0.000	a0.001	a0.001	a0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Other primary products	a0.013	a0.011	a0.008	a0.008	a0.010	a0.014	a0.015	0.012	0.015	0.013	0.007	0.010	0.017	0.014
	Manufactures	a0.054	a0.047	a0.039	a0.038	a0.049	a0.073	a0.078	0.076	0.087	0.096	0.097	0.116	0.100	0.085
	Services	a0.009	a0.008	a0.008	a0.008	a0.009	a0.011	a0.011	0.011	0.013	0.014	0.016	0.019	0.022	0.019
	Total	a0.077	a0.067	a0.056	a0.054	a0.069	a0.099	a0.105	0.100	0.116	0.124	0.121	0.146	0.140	0.119
Switzerland	Food	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	..
	Other primary products	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.002	..
	Manufactures	0.100	0.091	0.081	0.078	0.074	0.076	0.075	0.080	0.096	0.101	0.105	0.129	0.124	..
	Services	0.018	0.016	0.015	0.015	0.015	0.014	0.014	0.015	0.019	0.020	0.022	0.027	0.024	..
	Total	0.120	0.109	0.098	0.095	0.091	0.092	0.092	0.097	0.117	0.123	0.130	0.160	0.151	..
Tanzania	Food	..	..	..	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	..
	Other primary products	..	..	..	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	..
	Manufactures	..	..	..	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	..
	Services	..	..	..	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	..
	Total	..	..	..	..	..	..	..	..	0.001	0.001	0.001	0.001	0.001	..
Thailand	Food	a0.010	a0.009	a0.009	a0.008	a0.007	a0.007	a0.007	0.006	0.009	0.008	0.009	0.010	0.012	..
	Other primary products	a0.009	a0.008	a0.008	a0.008	a0.007	a0.008	a0.012	0.011	0.016	0.011	0.013	0.024	0.023	..
	Manufactures	a0.038	a0.045	a0.049	a0.049	a0.055	a0.061	a0.073	0.063	0.096	0.094	0.107	0.159	0.165	..
	Services	a0.011	a0.012	a0.012	a0.013	a0.015	a0.014	a0.017	0.017	0.023	0.019	0.022	0.026	0.027	..
	Total	a0.068	a0.073	a0.078	a0.078	a0.084	a0.090	a0.109	0.096	0.143	0.133	0.150	0.220	0.226	..
Turkey	Food	a0.001	a0.001	a0.001	a0.001	a0.001	a0.002	a0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.001
	Other primary products	a0.001	a0.001	a0.001	a0.000	a0.001	a0.001	a0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002
	Manufactures	a0.007	a0.006	a0.005	a0.006	a0.007	a0.012	a0.013	0.019	0.023	0.021	0.022	0.026	0.040	0.035
	Services	a0.003	a0.003	a0.003	a0.003	a0.004	a0.006	a0.007	0.009	0.014	0.014	0.011	0.014	0.015	0.011
	Total	a0.013	a0.010	a0.010	a0.011	a0.012	a0.020	a0.023	0.031	0.040	0.038	0.035	0.042	0.059	0.049
Uganda	Food	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Other primary products	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Manufactures	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Services	..	..	..	..	..	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	..	..	..	..	..	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
United Kingdom	Food	a0.008	a0.007	a0.007	a0.008	a0.008	a0.009	a0.009	0.010	0.008	0.007	0.007	0.006	0.006	0.006
	Other primary products	a0.028	a0.031	a0.024	a0.023	a0.028	a0.029	a0.030	0.043	0.037	0.024	0.029	0.049	0.044	0.038
	Manufactures	a0.159	a0.155	a0.135	a0.137	a0.153	a0.169	a0.191	0.262	0.249	0.229	0.219	0.245	0.230	0.202
	Services	a0.035	a0.035	a0.030	a0.034	a0.039	a0.043	a0.046	0.063	0.061	0.062	0.065	0.073	0.068	0.066
	Total	a0.230	a0.229	a0.196	a0.203	a0.229	a0.249	a0.276	0.378	0.355	0.322	0.319	0.373	0.347	0.312
United States	Food	a0.012	a0.011	a0.010	a0.011	a0.011	a0.011	a0.013	0.014	0.012	0.010	0.010	0.011	0.010	0.009
	Other primary products	a0.033	a0.033	a0.029	a0.027	a0.025	a0.027	a0.033	0.036	0.034	0.028	0.026	0.034	0.029	0.027
	Manufactures	a0.166	a0.171	a0.174	a0.180	a0.187	a0.212	a0.244	0.300	0.329	0.317	0.325	0.375	0.310	0.281
	Services	a0.043	a0.048	a0.049	a0.051	a0.052	a0.057	a0.063	0.078	0.080	0.078	0.085	0.095	0.082	0.079
	Total	a0.254	a0.263	a0.263	a0.270	a0.275	a0.307	a0.354	0.427	0.455	0.433	0.446	0.515	0.430	0.396
Uruguay	Food	a0.000	a0.000	a0.000	a0.000	a0.000	a0.000	a0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
	Other primary products	a0.001	a0.001	a0.000	a0.001	a0.000	a0.000	a0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Manufactures	a0.001	a0.001	a0.001	a0.001	a0.001	a0.001	a0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Services	a0.000	a0.000	a0.000	a0.000	a0.001	a0.001	a0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001
	Total	a0.002	a0.002	a0.002	a0.002	a0.002	a0.002	a0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Venezuela	Food	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Other primary products	0.029	0.030	0.034	0.031	0.029	0.024	0.021	0.026	0.022	0.015	0.015	0.021	0.018	0.021
	Manufactures	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002
	Services	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000
	Total	0.034	0.035	0.039	0.036	0.034	0.029	0.025	0.030	0.026	0.018	0.017	0.023	0.020	0.023

Table A-11: Openness based on the IDR_i measure of 56 countries, 1989-2002, continued

Country name	Intermediate product	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Zambia	Food	..	..	..	..	..	..	..	..	0.000	0.000	0.000	0.000	..	..
	Other primary products	..	..	..	..	..	..	..	..	0.000	0.000	0.000	0.000	..	..
	Manufactures	..	..	..	..	..	..	..	..	0.001	0.002	0.001	0.001	..	..
	Services	..	..	..	..	..	..	..	..	0.000	0.000	0.000	0.000	..	..
	Total	..	..	..	..	..	..	..	..	0.001	0.002	0.002	0.001	..	..

Source: own calculation based on GTAP (2003) and World Bank (2004), values marked with [a] are based on GTAP (1998) and World Bank (2004)

Table A-12: Actual and traditional openness of the EU-25, 1997

Percent of GDP, 1997	Intra-regional trade							Extra-regional trade						
	Export side				Import side			Export side				Import side		
Country name	IEDR	IEIR	IEER	IER	IIIR	IIDR	IIR	EEDR	EEIR	EEER	EER	EIER	EIDR	EIR
Austria	17.12	4.53	2.73	24.38	26.41	0.07	26.48	11.13	2.23	1.34	14.70	16.30	0.03	16.33
Belgium	25.73	16.32	8.01	50.06	43.90	0.27	44.17	14.51	6.74	3.31	24.56	31.38	0.15	31.53
Denmark	16.97	3.72	2.30	22.99	19.16	0.04	19.20	10.95	2.02	1.25	14.21	13.15	0.02	13.17
Finland	16.97	3.75	2.58	23.31	17.68	0.03	17.71	11.95	2.43	1.67	16.05	14.50	0.02	14.52
France	12.48	1.58	1.11	15.17	12.64	0.16	12.80	9.02	0.99	0.70	10.71	10.65	0.10	10.75
Germany	12.71	1.81	1.32	15.84	12.85	0.28	13.13	9.41	1.23	0.90	11.54	12.55	0.21	12.76
Greece	7.14	0.60	0.56	8.30	14.86	0.01	14.87	6.72	0.53	0.50	7.75	12.70	0.01	12.71
Ireland	30.03	13.57	7.44	51.04	38.31	0.07	38.38	16.94	7.14	3.92	28.00	33.36	0.05	33.40
Italy	10.75	1.74	1.49	13.98	12.02	0.12	12.14	9.45	1.34	1.15	11.94	10.87	0.09	10.96
Luxembourg	26.97	17.12	8.39	52.47	50.25	0.01	50.27	14.94	7.23	3.55	25.72	33.41	0.01	33.41
Netherlands	27.13	11.59	5.13	43.86	28.62	0.21	28.84	13.32	4.22	1.87	19.40	28.21	0.17	28.39
Portugal	16.35	4.12	1.59	22.06	26.86	0.03	26.89	6.73	1.26	0.48	8.48	15.19	0.01	15.20
Spain	12.85	2.59	1.48	16.92	15.62	0.07	15.69	7.76	1.22	0.70	9.68	11.68	0.04	11.73
Sweden	16.84	3.73	3.05	23.62	20.74	0.07	20.81	14.10	2.86	2.33	19.29	14.68	0.04	14.72
United Kingdom	10.98	1.43	1.32	13.74	12.76	0.16	12.92	10.38	1.20	1.11	12.69	14.98	0.16	15.14
Czech Republic	24.21	11.41	4.50	40.12	41.21	0.04	41.26	10.58	3.76	1.48	15.82	22.27	0.02	22.28
Estonia	32.16	18.07	12.12	62.35	74.24	0.01	74.25	23.28	11.09	7.43	41.80	55.10	0.01	55.11
Hungary	22.49	11.44	5.26	39.19	39.03	0.03	39.06	11.67	4.35	2.00	18.02	23.80	0.01	23.82
Latvia	24.25	11.91	9.04	45.20	60.09	0.01	60.09	19.81	8.25	6.26	34.32	44.45	0.00	44.45
Lithuania	17.69	8.16	7.56	33.41	42.53	0.01	42.53	19.06	6.17	5.72	30.96	38.98	0.00	38.98
Poland	12.32	3.22	1.88	17.42	24.37	0.03	24.40	7.76	1.53	0.90	10.18	15.26	0.01	15.28
Slovak Republic	28.87	15.38	4.93	49.18	47.27	0.02	47.29	10.17	4.24	1.36	15.77	28.83	0.01	28.84
Slovenia	23.74	9.85	5.48	39.08	43.17	0.02	43.19	14.03	4.96	2.76	21.75	21.03	0.01	21.04
Cyprus	9.47	1.21	2.37	13.05	22.44	0.00	22.44	18.04	2.56	5.04	25.64	21.24	0.00	21.24
Malta	27.37	9.19	9.66	46.21	73.62	0.01	73.62	29.64	9.23	9.71	48.58	45.41	0.00	45.41

Source: own calculation based on GTAP (2003)

Table A-13: Implementation of the model experiment with RunGTAP

Implementation	Code
Closure	Exogenous qo(PROD_COMM,REG) pop psaveslack pfactwld profitslack incomeslack endwslack cgdslack tradslack ams atm atf ats atd aosec aoreg avasec avareg afcom afsec afreg afecom afesec afereg aoall afall afeall au dppriv dpgov dpsave to tp tm tms tx txs; Rest Endogenous;
Shocks	Shock qo(PROD_COMM,"CZE") = uniform 118; Shock qo(PROD_COMM,"EST") = uniform 109; Shock qo(PROD_COMM,"HUN") = uniform 113; Shock qo(PROD_COMM,"LVA") = uniform 109; Shock qo(PROD_COMM,"LTU") = uniform 178; Shock qo(PROD_COMM,"POL") = uniform 110; Shock qo(PROD_COMM,"SVK") = uniform 70; Shock qo(PROD_COMM,"SVN") = uniform 74; Shock qo(PROD_COMM,"ROEU25") = uniform 28; Shock qo(PROD_COMM,"ROW") = uniform 33;
Solving method	Johansen 1-step

Table A-14: Simulated actual and traditional openness of the CEEC-8, 2008

Simulation	Intra-regional trade							Extra-regional trade						
Percent of GDP		Export side			Import side				Export side				Import side	
Country name	IEDR	IEIR	IEER	IER	IIIR	IIDR	IIR	EEDR	EEIR	EEER	EER	EIER	EIDR	EIR
Czech Republic	24.33	12.03	4.58	40.94	42.99	0.07	43.05	10.23	3.89	1.48	15.60	23.82	0.02	23.85
Estonia	32.40	19.80	12.42	64.61	80.22	0.01	80.23	21.73	11.55	7.24	40.52	58.07	0.01	58.08
Hungary	21.77	12.39	5.62	39.79	41.67	0.05	41.72	11.12	4.77	2.16	18.05	25.66	0.02	25.68
Latvia	23.73	12.90	9.06	45.69	63.96	0.01	63.97	17.83	8.38	5.88	32.09	44.10	0.01	44.11
Lithuania	16.88	9.18	8.08	34.14	45.11	0.01	45.12	17.25	6.81	5.99	30.04	43.24	0.01	43.25
Poland	11.64	3.19	1.83	16.65	25.29	0.04	25.33	7.12	1.54	0.88	9.55	15.91	0.02	15.93
Slovak Republic	31.21	18.03	5.04	54.27	51.65	0.03	51.68	9.58	4.36	1.22	15.16	31.41	0.01	31.42
Slovenia	24.06	10.27	5.57	39.89	44.47	0.02	44.49	13.72	5.13	2.78	21.63	21.77	0.01	21.78

Source: simulation results based on GTAP (2003)

References

Akhter, S.H. (1993), Foreign Direct Investments in Developing Countries: The Openness Hypothesis and Policy Implications, in: International Trade Journal, vol. 7, no. 6, pp. 655-672.

Alesina, A./Barro, R.J./Tenreyro, S. (2002), Optimal Currency Areas, NBER Working Paper no. 9072, Cambridge, MA.

Alesina, A./Spolaore, E./Wacziarg, R. (2000), Economic Integration and Political Disintegration, in: American Economic Review, vol. 90, no. 5, pp. 1276-1296.

Andersen, T.M./Hansen, N.L. (1995), Price Adjustment in Open Economies, in: Open Economies Review, vol. 6, no. 4, pp. 303-321.

Andersen, T.M./Herbertsson, T.T. (2003), Measuring Globalization, IZA Discussion Paper no. 817, Bonn.

Anderson, J./van Wincoop, E. (2001), Borders, Trade and Welfare, in: Collins, S.M./Rodrik, D. (eds.), Brookings Trade Forum 2001, Washington, DC, pp. 207-230.

Backé P./Thimann, C./Arratibel, O./Calvo-Gonzalez, O./Mehl, A./Nerlich, C. (2004), The Acceding Countries' Strategies Towards ERM II and the Adoption of the Euro: An Analytical Review, European Central Bank, Occasional Paper no. 10, Frankfurt a. M.

Baldwin, R.E. (2003), Openness and Growth: What's the Empirical Relationship?, NBER Working Paper no. 9578, Cambridge, MA.

Baldwin, R.E./Martin, P./Ottaviano, G.I. (2001), Global Income Divergence, Trade and Industrialization: The Geography of Growth Take-Offs, in: Journal of Economic Growth, vol. 6, no. 1, pp. 5-37.

Baldwin, R.E./Seghezza, E. (1996a), Testing for Trade-Induced Investment-Led Growth, NBER Working Paper no. 5416, Cambridge, MA.

Baldwin, R.E./Seghezza, E. (1996b), Trade-Induced Investment-Led Growth, NBER Working Paper no. 5582, Cambridge, MA.

Barro, R. (1991), Economic Growth in a Cross-Section of Countries, in: Quarterly Journal of Economics, vol. 106, no. 2, pp. 407-443.

Barro, R.J./Gordon, D.B. (1983), Rules, Discretion and Reputation in a Model of Monetary Policy, in: Journal of Monetary Economics, vol.12, no. 1, pp. 101-121.

Barro, R.J./Sala-i-Martin, X. (1995), Economic Growth, New York, NY.

Belke, A./Hebler, M. (2002), EU-Osterweiterung, Euro und Arbeitsmärkte, Munich.

Ben-David, D. (1993), Equalizing Exchange: Trade Liberalization and Income Convergence, in: Quarterly Journal of Economics, vol. 108, no. 3, pp. 653-679.

Ben-David, D. (2001), Trade Liberalization and Income Convergence: A Comment, in: Journal of International Economics, vol. 55, no. 1, pp. 229-234.

Ben-David, D./Kimhi, A. (2000), Trade and the Rate of Income Convergence, NBER Working Paper no. 7642, Cambridge, MA.

Bernard, A.B./Jensen, J.B. (1999), Exporting and Productivity, NBER Working Paper no. 7135, Cambridge, MA.

Bhatta, S.D. (2002), Has the Increase in World-Wide Openness to Trade Worsened Global Income Inequality?, in: Papers in Regional Science, vol. 81, no. 2, pp. 177-196.

Bleaney, M. (1999), The Disappearing Openness-Inflation Relationship: A Cross-Country Analysis of Inflation Rates, IMF Working Paper no. 99/161, Washington, DC.

Bloch, H./Olive, M. (2001), Does Openness Mean that Domestic Prices are Determined Abroad?, UNSW School of Economics Discussion Paper no. 2001/04, Sydney.

Bordo, M.D. (2003), Exchange Rate Regime Choice in Historical Perspective, IMF Working Paper no. 03/160, Washington, DC.

Bradford, C./Chakwin, N. (1993), Alternative Explanation of the Trade-Output Correlation in the East Asian Economies, OECD Development Centre Technical Papers no. 87, Paris.

Brahmbhatt, M. (1998), Measuring Global Economic Integration: A Review of the Literature and Recent Evidence, mimeo., World Bank, Washington, DC.

Brockmeier, M. (2001), A Graphical Exposition of the GTAP Model, Purdue University, GTAP Technical Paper No. 8, West Lafayette, IN.

Brülhart, M. (1994), Marginal Intra-Industry Trade: Measurement and Relevance for the Pattern of Industrial Adjustment, in: Weltwirtschaftliches Archiv, vol. 130, no. 3, pp. 600-613.

Brülhart, M. (2002), Marginal Intra-Industry Trade: Towards a Measure of Non-Disruptive Trade Expansion, in: Lloyd, P.J./Lee, H.-H. (eds.), Frontiers of Research on Intra-Industry Trade, Houndmills, pp. 109-130.

Bubula, A./Ötker-Robe, I. (2002), The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies, IMF Working Paper no. 02/155, Washington, DC.

Buzaglo, J. (1991), Structural Change and Openness: Strategic Alternatives in the Argentine Economy, in: Journal of Policy Modeling, vol. 13, no. 3, pp. 407-416.

Caballero, R./Engel, E.M. (1999), Explaining Investment Dynamics in US Manufacturing: A Generalized (S; s) Approach, in: Econometrica, vol. 67, pp. 741-782.

Calvo, G./Reinhart, C. (2002), Fear of Floating, in: Quarterly Journal of Economics, vol. 117, no. 2, pp. 379-408.

Cameron, G./Proudman, J./Redding, S. (1997), Productivity Convergence and International Openness, Bank of England Working Paper no. 77, London.

Cavallari, L. (2001), Inflation and Openness with Non-Atomistic Wage Setters, in: Scottish Journal of Political Economy, vol. 48, no. 2, pp. 210-225.

Chen, B.-L. (1999), Trade Openness and Economic Growth: Evidence in East Asia and Latin America, in: Journal of Economic Integration, vol. 14, no. 2, pp. 265-295.

Chen, Y.-F./Funke, M. (2003), Option Value, Policy Uncertainty, and the Foreign Direct Investment Decision, HWWA Discussion Paper no. 234, Hamburg.

Choe, J.-I. (2001), An Impact of Economic Integration through Trade: On Business Cycles for 10 East Asian Countries, in: Journal of Asian Economics, vol. 12, no. 4, pp. 569-586.

Clerides, K.S./Lach, S./Tybout, J.R. (1998), Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco, in: Quarterly Journal of Economics, vol. 113, no. 3, pp. 903-947.

Cuadros, A./Orts, V./Alguacil, M.T. (2001), Openness and Growth: Re-Examining Foreign Direct Investment, Trade and Output Linkages in Latin America, CREDIT Research Paper no. 01/04, Nottingham.

Davidson, C./Martin, L./Matusz, S. (1999), Trade and Search Generated Unemployment, in: Journal of International Economics, vol. 48, no. 2, pp. 271-299.

Davis, S. (1992), Cross-Country Patterns of Change in Relative Wages, in: Blanchard, O./Fisher, S. (eds.), NBER Macroeconomic Annual: 1992, Cambridge, MA, pp. 239-292.

Davis, D.R. (1996), Trade Liberalization and Income Distribution, NBER Working Paper no. 5693, Cambridge, MA.

De Grauwe, P. (2000), Economics of Monetary Union, 4th ed., Oxford.

De Grauwe, P./Skudelny, F. (2000), The Impact of EMU on Trade Flows, Weltwirtschaftliches Archiv, vol. 136, no. 3, pp. 381-402.

Deardorff, A.V. (1998), Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?, in: Frankel, J.A. (ed.), The Regionalization of the World Economy, Chicago, IL, pp. 7-22.

Dimaranan, B.V./McDougall, R.A. (eds.) (2002), Global Trade, Assistance, and Production: The GTAP 5 Data Base, West Lafayette, IN.

Dixon, H.D./Pompermaier, A. (1999), A Comparison of Menu Costs in Open and Closed Economies with a Mixed Industrial Structure, in: Open Economies Review, vol. 10, no. 4, pp. 365-384.

Dixon, P.B./Menon, J. (1995), Measures of Intra-Industry Trade as Indicators of Factor Market Disruption, in: Economic Record, vol. 73, no. 222, pp. 233-237.

Dollar, D. (1992), Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-85, in: Economic Development and Cultural Change, vol. 40, no. 3, pp. 523-544.

Dornbusch, R./Fischer, S./Samuelson, P.A. (1977), Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods, in: American Economic Review, vol. 67, no. 5, pp. 823-839.

Dyba, K. (1990), Growth, Structural Changes, and Openness of the Economy, in: Eastern European Economics, vol. 28, no. 4, pp. 24-38.

Edwards, S. (1998), Openness, Productivity and Growth: What Do We Really Know?, in: Economic Journal, vol. 108, no. 447, pp. 383-398.

EC Commission (1990), One Money, One Market, in: European Economy, no. 44, Brussels.

Ekholm, K./Knarvik, K.H. (2001), Relative Wages and Trade-Induced Changes in Technology, NHH Discussion Paper no. 2001-17, Bergen.

Falvey, R. (1999), Trade Liberalization and Factor Price Convergence, in: Journal of International Economics, vol. 49, no. 1, pp. 195-210.

Falvey, R./Foster, N./Greenaway, D. (2001), North-South Trade, Openness and Growth, University of Vienna, Department of Economics Working Paper no. 0108, Vienna.

Falvey, R./Gemmell, N. (1999), Factor Endowments, Nontradables Prices and Measures of 'Openness', in: Journal of Development Economics, vol. 58, no. 1, pp. 101-122.

Fidrmuc, J. (2001), The Endogeneity of the Optimum Currency Area Criteria, Intraindustry Trade, and EMU Enlargement, LICOS Discussion Paper no. 106, Leuven.

Fleissner, P./Böhme, W./Brautzsch, H.-U./Höhne, J./Siassi, J./Stark, K. (1993), Input-Output-Analyse: Eine Einführung in Theorie und Anwendungen, Wien.

Frankel, J.A./Romer, D. (1996), Trade and Growth: An Empirical Investigation, NBER Working Paper no. 5476, Cambridge, MA.

Frankel, J.A./Romer, D. (1999), Does Trade Cause Growth?, in: American Economic Review, vol. 89, no. 3, pp. 379-399.

Frankel, J.A./Romer, D./Cyrus, T. (1996), Trade and Growth in East Asian Countries: Cause and Effect?, NBER Working Paper no. 5732, Cambridge, MA.

Frankel, J.A., Rose, A.K. (1998), The Endogeneity of the Optimum Currency Area Criteria, in: Economic Journal, vol. 108, no. 127, pp. 1009–1025.

Gaston, N./Trefler, D. (1995), Union Wage Sensitivity to Trade and Protection: Theory and Evidence, in: Journal of International Economics, vol. 39, no. 1, pp. 1-25.

Gilson, N. (2004), Optimum Currency Area and the Enlargement of the Euro Zone to the East, paper for the conference "European Integration and World Economy", 3rd annual meeting, European Economics and Finance Society (EEFS) and University of Gdansk, Poland, May 13-16.

Gehlhar, M./Gray, D./Hertel, T.W./Huff, K.M./Ianchovichina, E./McDonald, B.J./McDougall, R./Tsigas, M.E./Wigle R. (1997), Overview of the GTAP Data Base, in: Hertel, T.W. (ed.), Global Trade Analysis: Modeling and Applications, Cambridge, MA, pp. 74-123.

Global Trade Analysis Project (GTAP) (1998), GTAP Data Base Version 4, Center for Global Trade Analysis, Purdue University, West Lafayette, IN.

Global Trade Analysis Project (GTAP) (2003), GTAP Data Base Version 5.4, Center for Global Trade Analysis, Purdue University, West Lafayette, IN.

Goldberg, S./Klein, W. (1998), Foreign Direct Investment, Trade, and Real Exchange Rate Linkages in Developing Countries, in: Glick, R. (ed.), Managing Capital Flows and Exchange Rates: Lessons from the Pacific Basin, Cambridge, UK, pp. 73-100.

Ghosh, A./Gulde, A.-M./Wolf, H.C. (2003), Exchange Rate Regimes: Choices and Consequences, Cambridge, MA.

Greenaway, D./Hine, R.C./Milner, C./Elliott, R. (1994), Adjustment and the Measurement of Marginal Intra-Industry Trade, in: Weltwirtschaftliches Archiv, vol. 130, no. 2, pp. 418-427.

Greenaway, D./Hine, R.C./Wright, P. (1999), An Empirical Assessment of the Impact of Trade on Employment in the United Kingdom, in: European Journal of Political Economy, vol. 15, no. 3, pp. 485-500.

Greenaway, D./Nelson, D. (2001), Globalisation and Labour Markets: Literature Review and Synthesis, GEP Research Paper no. 01/29, Nottingham.

Greenaway, D./Morgan, W./Wright, P. (1998), Trade Reform, Adjustment and Growth: What Does the Evidence Tell Us?, in: The Economic Journal, vol. 108, no. 450, pp. 1547-1561.

Greene, W.H. (2002), Econometric Analysis, 5th ed., Upper Saddle River, NJ.

Gros, D./Thygesen, N. (1998), European Monetary Integration, 2nd ed., Harlow.

Gros, D./Steinherr, A. (1997), Openness and the Cost of Fixing Exchange Rates in a Mundell-Fleming World, CEPS Working Document no. 113, Brussels.

Grossman, G.M./Helpman, E. (1990), Trade, Innovation, and Growth, in: American Economic Review, vol. 80, no. 2, pp. 86-91.

Grubel, H./Lloyd, P.J. (1975), Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products, London.

Hamilton, C./Kniest, P. (1991), Trade Liberalisation, Structural Adjustment and Intra-Industry Trade: A Note, in: Weltwirtschaftliches Archiv, vol. 12, no. 2, pp. 356-367.

Hardouvelis, G.A. (1992), Monetary Policy Games, Inflationary Bias, and Openness, in: Journal of Economic Dynamics and Control, vol. 16, no. 1, pp. 147-164.

Harrigan, J. (2001), Measuring Product-Market Integration: Comment, in: Blomström, M./Goldberg, L.S. (eds.), Topics in Empirical International Economics: A Festschrift in Honor of Robert E. Lipsey, Chicago, IL, pp. 44-46.

Harrison, A. (1996), Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries, in: Journal of Development Economics, vol. 48, no. 2, pp. 419-447.

Harrison, W.J./Pearson, K.R (2000), An Introduction to GEMPACK, Monash University, GEMPACK Document No. 1, 5th ed., Clayton.

Hertel, T.W. (ed.) (1997), Global Trade Analysis: Modeling and Applications, Cambridge, MA.

Hertel, T.W./Tsigas, M.E. (1997), Structure of GTAP, in: Hertel, T.W. (ed.), Global Trade Analysis: Modeling and Applications, Cambridge, MA, pp. 13-73.

Hirsch, B./Addison, J. (1986), The Economic Analysis of Unions: New Approaches and Evidence, Boston, MA.

Holub, H.-W./Schnabl, H, (1985), Input-Output-Rechnung: Input-Output-Tabellen, 2nd ed., Munich.

Huff, K.M./Hanslow, K./Hertel, T.W./Tsigas, M.E. (1997), GTAP behavioral parameters, in: Hertel, T.W. (ed.), Global Trade Analysis: Modeling and Applications, Cambridge, MA, pp. 124-148.

International Monetary Fund (IMF), various issues, Exchange Arrangements and Exchange Restrictions, Washington, DC.

Isard, W. (1951), Interregional and Regional Input-Output Analysis: A Model of Space Economics, in: Revue of Economics, vol. 4, pp. 318-328.

Itakura, K./Hertel, T.W. (2000), A Note On Changes Since GTAP Book Model, West Lafayette, IN.

Itoh, H./Wang, L. (2004), Economic Effects of Information Technology Oriented Joint Ventures in China: A CGE Analysis, paper for the conference "International Conference on Policy Modeling (EcoMod2004)", Economic Modeling (EcoMod) Network and Centre d'études prospectives et d'informations internationales (CEPII), Paris, June 30-July 2.

Jarque, C.M./Bera, A.K. (1987), A Test for Normality of Observations and Regression Residuals, in: International Statistical Review, vol. 55, no 2, pp. 163-172.

Juhn, G./Mauro, P. (2002), Long-Run Determinants of Exchange Rate Regimes: A Simple Sensitivity Analysis, IMF Working Paper no. 02/104, Washington, DC.

Karras, G. (1999), Openness and the Effects of Monetary Policy, in: Journal of International Money and Finance, vol. 18, no. 1, pp. 13-26.

Karras, G. (2001), Openness to Trade and the Potency of Monetary Policy: How Strong is the Relationship?, in: Open Economies Review, vol. 12, no. 1, pp. 61-73.

Klyuev, V. (2001), A Model of Exchange Rate Regime Choice in the Transitional Economies of Central and Eastern Europe, IMF Working Paper no. 01/140, Washington, DC.

Knetter, M.M./Slaughter, M.J. (2001), Measuring Product-Market Integration, in: Blomström, M./Goldberg, L.S. (eds.), Topics in Empirical International Economics: A Festschrift in Honor of Robert E. Lipsey, Chicago, IL, pp. 15-44.

Kossov, K. (1970), The Theory of Aggregation in Input-Output Models, in: Carter, A.P./Brody, A. (eds.), Applications of Input-Output Analysis, Amsterdam, pp. 241-248.

Kotcherlakota, V./Sack-Rittenhouse, M. (2000), Index of Openness: Measurement and Analysis, in: Social Science Journal, vol. 37, no. 1, pp. 125-130.

Krugman, P.R. (1990), Policy Problems of a Monetary Union, in: De Grauwe, P., Papademos, L. (eds.), The European Monetary System in the 1990s, Centre for European Policy Studies and Bank of Greece, pp. 48-64.

Krugman, P. (1991), Geography and Trade, Cambridge, MA.

Krugman, P. (1993), Lessons of Massachusetts for EMU, in: Torres, F./Giavazzi, F. (eds.), Adjustment and Growth in the European Monetary Union, London, pp. 241-261.

Krugman, P.R./Obstfeld, M. (2003), International Economics: Theory and Policy, 6th ed., Reading, MA.

Kydland, F.E./Prescott, E.C. (1977), Rules Rather than Discretion: The Inconsistency of Optimum Plans, in: Journal of Political Economy, vol. 85, no. 3, pp. 473-491.

Lane, P.R. (1997), Inflation in Open Economies, in: Journal of International Economics, vol. 42, no. 2, pp. 327-247.

Lane, P.R. (2001), International Trade and Economic Convergence: The Credit Channel, in: Oxford Economic Papers, vol. 53, no. 2, pp. 221-240.

Leamer, E.E. (1988), Measures of Openness, in: Baldwin, R.E. (ed.), Trade Policy Issues and Empirical Analysis, Chicago, IL, pp. 147-200.

Leamer, E.E./Levinsohn, J. (1995), International Trade Theory: The Evidence, in: Grossman, G./Rogoff, K. (eds.), The Handbook of International Economics, vol. 3, North-Holland, pp. 1339-1394.

Lee, J.-W. (1993), International Trade, Distortions, and Long Run Economic Growth, in: IMF Staff Papers, vol. 40, no. 2, pp. 299-328.

Lee, J.-W. (1996), Government Interventions and Productivity Growth, in: Journal of Economic Growth, vol. 1, no. 4, pp. 391-414.

Leontief, W.W. (1936), Quantitative Input and Output Relations in the Economic System of the United States, in: Review of Economics and Statistics, vol. 18, no. 3, pp. 105-125.

Leontief, W.W. (1941), The Structure of American Economy: 1919-1929, 1st ed., Cambridge, MA.

Leontief, W.W. (1951), The Structure of American Economy: 1919-1939, 2nd ed., New York, NY.

Leontief, W.W. (1966), Input-Output Economics, New York, NY.

Levine, R./Renelt, D. (1992), A Sensitivity Analysis of Cross-Country Growth Regressions, in: American Economic Review, vol. 82, no. 4, pp. 942-963.

Levy-Yeyati, E./Sturzenegger, F. (2002), Exchange Rate Classification: Database, Universidad Torcuato Di Tella, Buenos Aires.

Levy-Yeyati, E./Sturzenegger, F. (2001), Exchange Rate Regimes and Economic Performance, mimeo., Universidad Torcuato Di Tella, Buenos Aires.

Lloyd, P.J. (1998), Globalisation, International Factor Movements and Market Adjustments, CREDIT Research Paper, no. 98/7, Nottingham.

Lloyd, P.J./MacLaren, D. (1998), Measures of Trade Openness Using CGE Analysis, University of Melbourne, Department of Economics Research Paper no. 659, Parkville.

Lutz, M.G. (2001), Globalisation, Convergence and the Case for Openness in Developing Countries: What Do We Learn From Open Economy Growth Theory and Empirics?, CSGR Working Paper no. 72/01, Coventry.

Lutz, M.G./Singer, H.W. (1994), The Link Between Increased Trade Openness and the Terms of Trade: An Empirical Investigation, in: World Development, vol. 22, no. 11, pp. 1697-1709.

Matusz, S. (1996), International Trade, the Division of Labor, and Unemployment, in: International Economic Review, vol. 37, no. 1, pp. 71-84.

McDougall, R.A./Dimaranan, B.V. (2002), Guide to the GTAP Data Base, in: Dimaranan, B.V./McDougall, R.A. (eds.), Global Trade, Assistance, and Production: The GTAP 5 Data Base, West Lafayette, IN, pp. 8-1 - 8-18.

McDougall, R./Tyres, R. (1997), Developing Country Expansion and Relative Wages in Industrial Countries, in: Hertel, T.W. (ed.), Global Trade Analysis: Modeling and Applications, Cambridge, MA, pp. 191-211.

McKinnon, R.I. (1963), Optimal Currency Areas, in: American Economic Review, vol. 53, no. 4, pp. 717-725.

Menon, J./Dixon, P.B. (1997), Intra-Industry versus Inter-Industry Trade: Relevance for Adjustment Costs, in: Weltwirtschaftliches Archiv, vol. 133, no. 1, pp. 164-169.

Morrison, C./Siegel, D. (2000), The Impacts of Technology, Trade and Outsourcing on Employment and Labour Composition, in: Scandinavian Journal of Economics, vol. 103, no. 2, pp. 241-264.

Mundell, R.A. (1961), A Theory of Optimum Currency Areas, in: American Economic Review, vol. 51, no. 4, pp. 657-665.

Mussa, M./Masson, P./Swoboda, A./Jadresic, E./Mauro, P./Berg, A. (2000), Exchange Rate Regimes in an Increasingly Integrated World Economy, IMF Occasional Paper no. 193, Washington, DC.

Mythili, G. (1995), A Note on Aggregation Error in Input-Output Analysis, in: Journal of Quantitative Economics, vol. 11, no. 2, pp. 149-156.

Nilsson, L. (1997), The Measurement of Intra-Industry Trade between Unequal Partners, in: Weltwirtschaftliches Archiv, vol. 133, no. 3, pp. 554-565.

Nowak-Lehmann Danzinger, F. (2000), Trade Policy and Its Impact on Economic Growth: Can Openness Speed Up Output Growth?, Ibero-Amerika-Institut für Wirtschaftsforschung Discussion Paper no. 75, Göttingen.

O'Rourke, K.H./Taylor, A.M./Williamson, J.G. (1996), Factor Price Convergence in the Late Nineteenth Century, in: International Economic Review, vol. 37, no. 3, pp. 499-530.

Organisation for Economic Cooperation and Development (OECD) (1992), Structural Change and Industrial Performance, Paris.

Organisation for Economic Co-operation and Development (OECD) (1998), Foreign Direct Investment and Economic Development: Lessons from Six Emerging Economies, Paris.

Papaioannou, M.G. (2003), Determinants of the Choice of Exchange Rate Regimes in Six Central American Countries: An Empirical Analysis, IMF Working Paper no. 03/59, Washington, DC.

Pasinetti, L.L. (1977), Lectures on the Theory of Production, New York, NY.

Paus, E.A./Robinson, M.D. (1999), Real Wage Performance under Greater Trade Openness: Lessons from Latin America and Asia, in: Journal of Developing Areas, vol. 33, no. 2, pp. 269-288.

Pöyhönen, P. (1963), A Tentative Model for the Volume of Trade between Countries, in: Weltwirtschaftliches Archiv, vol. 90, no. 1, 93-99.

Pearson, K.R. (1997), Implementing GTAP using the GEMPACK software, in: Hertel, T.W. (ed.), Global Trade Analysis: Modeling and Applications, Cambridge, MA, pp. 164-188.

Pearson, K.R./Horridge, M./Pratt, A.N. (2001), Hands-On Computing With RunGTAP and WinGEM: To Introduce GTAP and GEMPACK, Monash University, Clayton.

Pritchett, L. (1996), Measuring Outward Orientation in LDCs: Can It Be Done?, in: Journal of Development Economics, vol. 49, no. 2, pp. 307-355.

Rassekh, F. (1992), The Role of International Trade in the Convergence of Per Capita GDP in the OECD: 1950-1985, in: International Economic Journal, vol. 6, no. 4, pp. 1-15.

Razin, A./Rose, A.K. (1994), Business Cycle Volatility and Openness: An Exploratory Cross-Section Analysis, NBER Working Paper No. 4208, Cambridge, MA.

Razin, A./Sadka, E./Coury, T. (2002), Trade Openness and Investment Instability, NBER Working Paper no. 8827, Cambridge, MA.

Redding, S. (1999), Dynamic Comparative Advantage and the Welfare Effects of Trade, in: Oxford Economic Papers, vol. 51, no. 1, pp. 15-39.

Rivera-Batiz, L.A./Romer, P.M. (1991), International Trade with Endogenous Technological Change, in: European Economic Review, vol. 35, no. 4, pp. 971-1001.

Roberts, M./Tybout, J. (1997), The Decision to Export in Columbia: An Empirical Model of Entry with Sunk Costs, in: American Economic Review, vol. 87, no. 4, pp. 545-564.

Rodriguez, F./Rodrik, D. (1999), Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence, NBER Working Paper no. 7081, Cambridge, MA.

Rodrik, D. (1994), Getting Interventions Right: How South Korea and Taiwan Grew Rich, NBER Working Paper no. 4964, Cambridge, MA.

Romer, D.H. (1993), Openness and Inflation: Theory and Evidence, in: Quarterly Journal of Economics, vol. 108, no. 4, pp. 869-903.

Romer, D.H. (1998), A New Assessment of Openness and Inflation: Reply, in: Quarterly Journal of Economics, vol. 113, no. 2, pp. 649-652.

Romer, P.M. (1990), Endogenous Technological Change, in: Journal of Political Economy Growth, vol. 98, no. 5, pp. 71-102.

Rose, A.K. (2000), One Money, One Market: Estimating the Effect of Common Currencies on Trade, in: Economic Policy: A European Forum, April, pp. 7-45.

Rose, A.K. (2004), Does the WTO Really Increase Trade?, in: American Economic Review, vol. 94, no. 1, pp. 98-114.

Ryans, J.K./Mitchell, L./Baker, J./Shanklin, W.L. (1987), Economic Development Programs Compared, in: Business, vol. January-March, pp. 47-51.

Sachs, J.D. (1996), Notes on the Life Cycle of State-Led Industrialization, in: Japan and the World Economy, vol. 8, no. 2, pp. 153-174.

Sachs, J.D./Warner, A. (1995), Economic Reform and the Process of Global Integration, in: Brookings Papers on Economic Activity, vol. 1, pp. 1-118.

Sala-i-Martin, X. (1997), I Just Run Two Million Regressions, in: American Economic Review, vol. 82, no. 2, pp. 178-183.

Schumann, J. (1968), Input-Output-Analyse, Berlin.

Shapiro, C./Stiglitz, J. (1984), Equilibrium Unemployment as a Worker Control Device, in: American Economic Review, vol. 74, no. 3, pp. 433-444.

Slaughter, M.J. (2001), International Trade and Per Capita Income Convergence: A Difference-In-Differences Analysis, in: Journal of International Economics, vol. 55, no. 1, pp. 203-228.

Slaughter, M.J./Swagel, P. (1997), The Effect of Globalization on Wages in the Advanced Economies, IMF Working Paper no. 97/43, Washington, DC.

Smets, F./Wouters, R. (2002), Openness, Imperfect Exchange Rate Pass-Through and Monetary Policy, NBB Working Paper no. 19, Brussels.

Söderbom, M./Teal, F. (2001), Trade and Human Capital as Determinants of Growth, CSAE Working Paper no. 2001.10, Oxford.

Spilimbergo, A. (2000), Growth and Trade: The North Can Lose, in: Journal of Economic Growth, vol. 5, no. 2, pp. 131-146.

Spilimbergo, A./Londoño, J.L./Szekély, M. (1999), Income Distribution, Factor Endowments, and Trade Openness, IADB Working Paper no. 356, Washington, DC.

Subramanian, A./Wei, S.-J. (2003), The WTO Promotes Trade, Strongly but Unevenly, NBER Working Paper no. 10024, Cambridge, MA.

Straffa, P. (1960), Production of Commodities by means of Commodities: Prelude to a Critique of Economic Theory, Cambridge, UK.

Tanasie, M. (2004), Central and Eastern European Countries and the Perspective of the EMU, paper for the conference "European Integration and World Economy", 3rd annual meeting, European Economics and Finance Society (EEFS) and University of Gdansk, Poland, May 13-16.

Temple, J. (2000), Growth Regressions and What the Textbooks Don't Tell You, in: Bulletin of Economic Research, vol. 52, no. 3, pp. 181-205.

Terra, C.T. (1998), Openness and Inflation: A New Assessment, in: Quarterly Journal of Economics, vol. 113, no. 2, pp. 641-648.

Theil, H. (1957), Linear Aggregation in Input-Output Analysis, in: Econometrica, vol. 1, pp. 111-122.

Thom, R./McDowell, M. (1999), Measuring Marginal Intra-Industry Trade, in: Weltwirtschaftliches Archiv, vol. 135, no. 1, pp. 48-61.

Tinbergen, J. (1962), Shaping the World Economy: Suggestions for an International Economic Policy, New York, NY.

Turnovsky, S.J. (1981), Monetary Policy and Foreign Price Disturbances under Flexible Exchange Rates, in: Journal of Money, Credit, and Banking, vol. 13, no. 2, pp. 156-176.

United Nations Centre on Transnational Corporations (UNCTC) (1991), Do Government Policies Towards Foreign Direct Investments Matter?, New York.

Vamvakidis, A. (2002), How Robust is the Growth-Openness Connection?: Historical Evidence, in: Journal of Economic Growth, vol. 7, no. 1, pp. 57-80.

Wacziarg, R. (2000), Measuring the Dynamic Gains from Trade, GSB Research Paper no. 1654, Stanford, CA.

Wang, L. (2003a), How Do Impact Levels of International Trade on Economic Variables Influence the Measurement of the Importance of International Trade?: The Net Economic Openness Model, paper for the conference "European Integration: Real and Financial Aspects", 2nd annual meeting, European Economics and Finance Society (EEFS) and University of Bologna, Bologna, May 14-16.

Wang, L. (2003b), How Important is International Trade for a Country Really?: A Value-Added Based Approach to Measure Economic Openness, paper for the conference "VIII Conference on International Economics", Spanish Chapter of the International Economics and Finance Society (AEEFI) and University of Castilla-La Mancha (UCLM), Ciudad Real, June 25-27.

Wang, L. (2003c), How to Improve Performance of the Cost-Benefit Analysis of Monetary Integration?: An Application of the Value-Added Based Economic Integration Model, paper for the conference "Regional Cooperation and Economic Integration: European and East Asian Experiences", 4th international conference, Inha University and University of Le Havre, Incheon, October 8-9.

Wang, L. (2004a), Economic Integration Models and Monetary Integration Analysis: A Reassessment of MERCOSUR, paper for the conference "Second Annual Conference", Euro-Latin Study Network on Integration and Trade (ELSNIT), Inter-American Development Bank (IDB), Florence, October 29-30.

Wang, L. (2004b), Integration of the CEECs in the EU and their Participation in the EMU: A VEO and AGE Analysis, paper for the conference "Input-Output and General Equilibrium: Data, Modeling, and Policy Analysis", Economic Modeling (EcoMod) Network and International Input-Output Association (IIAO), Brussels, September 2-4.

Wang, L. (2004c), IT-Joint Ventures and Economic Development in China: An Applied General Equilibrium Analysis, Diskussionsbeiträge aus dem Institut für Volkswirtschaftslehre der Universität Hohenheim, Discussion Paper no. 233, Stuttgart.

Wei, S.-J. (1996), Intra-National Versus International Trade: How Stubborn are Nations in Global Integration?, NBER Working Paper no. 5531, Cambridge, MA.

Wei, S.-J. (2000), Natural Openness and Good Government, NBER Working Paper no. 7765, Cambridge, MA.

Weil, G. (1983), Exchange-Rate Regime Selection in Theory and Practice, in: Monograph Series in Finance and Economics, no. 2.

Weinhold, D./Rauch, J.E. (1999), Openness, Specialization, and Productivity Growth in Less Developed Countries, in: Canadian Journal of Economics, vol. 32, no. 4, pp. 1009-1027.

Wolf, H. (1993), Trade Orientation: Measurement and Consequences, in: Estudios de Economía, vol. 20, no. 20, pp. 52-72.

Wood, A. (1997), Openness and Wage Inequality in Developing Countries: the Latin American Challenge to East Asian Conventional Wisdom, in: World Bank Economic Review, vol. 11, no.1, pp. 33-57.

World Bank (1987), World Development Report, Washington, DC.

World Bank (2004), World Development Indicators, Washington, DC.