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Comparative advantage of Vietnam's rice sector under different liberalisation scenarios

– A Policy Analysis Matrix (PAM) study

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Abstract

The rapidly changing global economic environment and domestic economic reforms in Vietnam have brought the issue of comparative advantage of the rice sector to the forefront. In recent years, Vietnam has had to compete in an increasingly competitive rice export market. This paper examines the fluctuations in the comparative advantage of Vietnamese rice production based on different scenarios of trade liberalisation and economic reform in Vietnam. To do this, a Policy Analysis Matrix (PAM) was used in conjunction with an econometric model.

The study involved simulation of a large number of scenarios of trade liberalisation and macroeconomic reform, using variations in a single factor and in a group of factors such as product price and input costs, i.e., the price of imported fertilisers, land, water and labour costs, etc. The empirical results show that in 1998 (the baseline scenario), the comparative advantage in rice was relatively high and that the use of domestic resources – i.e., land, labour and water – was efficient in economic terms. The estimated DRC elasticities in respect of the world rice price and the shadow exchange rate in 1998 showed a considerably improved comparative advantage. The estimated DRC elasticities for land rent, the social costs of labour, the import price of fertilisers and irrigation water charges were small in absolute values indicating small and negative impacts on comparative advantage with a rise in these prices. The results of sensitivity analyses revealed that the comparative advantage of rice is very sensitive to changes in its export price. In addition, the exchange rate and land rent are also important determinants of the rice sector's comparative advantage in Vietnam. Other empirical results show that Vietnam is still likely to retain its comparative advantage in rice production in the next decade; however, its comparative advantage might be seriously affected or even disappear entirely if Vietnam is exposed to a number of unfavourable economic conditions simultaneously.

The major recommendation of this paper is that production should be diversified, with appropriate agricultural policy support, within a broader framework of macroeconomic transformation and trade liberalisation.

Keywords: Comparative advantage, rice production, PAM, DRC, agricultural diversification, trade liberalisation, Vietnam.

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1 Introduction

During the 1980s, Vietnam found itself facing increasing economic and trade difficulties resulting from the collapse of the former Soviet Union and the socialist regimes of eastern Europe. Vietnam's former principal sources of aid and major trading partners were cut off simultaneously. In addition, the domestic economy was increasingly showing the signs of large-scale inefficiency, the legacy of central planning and heavy subsidisation of the economy pursued by the country for decades. Economic reform in Vietnam, which began in 1986, also called 'Doi Moi' (meaning renewal or renovation), was not an ordinary Government economic directive, but a fundamental policy reform with the main aim of shifting Vietnam from a centrally planned to a market-oriented economy. Like many other economic reforms, Doi Moi is a prolonged process, largely the result of adapting the system 'from below', a process during which much is learned through experience (DE VYLDER, 1996).

As part of the economic reforms, trade liberalisation has been pursued in terms of both domestic and international trade. The main features of domestic trade liberalisation are price reform, which leaves most prices to be determined by the market, and the removal of internal trade barriers that segment markets. Foreign trade reform was the key element of trade liberalisation during the last decade. Vietnam became a member of the ASEAN Free Trade Area (AFTA) in 1995, thereby experiencing a new kind of relationship in AFTA, based on interdependence and cooperation for mutual benefit.

The results of economic reform in Vietnam began to emerge a little later, from 1991 onwards. The economic growth rate reached 6% in 1991 and, for the first time, more than 8% (8.7%) in 1992 (EIU, 1996). Living standards improved significantly as market mechanisms came into play. The country's per capita GNP increased from US$ 170 in 1993 to US$ 240 in 1996 and US$ 370 in 1999 (WORLD BANK, 1990-2001). However, it is a fact that Vietnam is still a country at an early stage of development. Agriculture is a very important sector of the economy and provides the principal source of employment, accounting for about 70% of the total labour force over the period 1990-1998 (ANZDEC, 2000). In agriculture, the food crop

sector plays a substantial role, with rice being the principal crop. The share of rice in total food crop output has increased over time, reaching 91.5% in 1999 (NGUYEN & HEIDHUES, 2000).

In the new domestic and international context marked by macroeconomic reforms and trade liberalisation, the rice sector in Vietnam benefited from a more open market, but it also faced tougher competition. Although, in terms of its export volume, the share of Vietnamese rice in the world export market increased during the last ten years, the real competitiveness in terms of comparative advantage of Vietnamese rice sector in effect, is still an open question.

In general, there is an effect on the production costs of agricultural products, as the prices of their inputs change due to import tax reductions introduced in accordance with Vietnam's AFTA commitments. In the case of rice, input costs such as fertiliser, fuel and pesticides will change as a result. On the other hand, it also means that domestic production of these products will no longer be protected. Trade liberalisation may induce some changes in factor markets as well. Land and labour in rural areas are likely to become more expensive in the future, although they are currently low compared to those of other countries in the region. Economic reform and trade liberalisation will certainly bring about changes in macroeconomic policies such as exchange and interest rate policies, etc. All of these changes working in different directions will affect the comparative advantage of rice production in Vietnam. This has been a concern in Vietnam for many years.

This paper is an attempt to answer the question to what extent and in which direction the comparative advantage of rice production will be affected given a change in each, or a number of, its determining factors. The paper starts in analysing the current level of comparative advantage of Vietnamese rice, and identifies the major factors determining it. In the next section, the methodology and data are described. Section three analyses the estimation procedure and scenarios examined, while the empirical results are summarised and discussed in section four. The paper ends with conclusions and policy recommendations, which show, among other things, the relevance of a diversified agriculture in Vietnam.

2 Methodology and data

2.1 The concept of comparative advantage, PAM model and the data

The comparative advantage concept used in this study is referred to comparative cost advantage in David Ricardo's theory which is presented in any economics textbook. In that sense, the comparative advantage of rice production in Vietnam is estimated implying a cost comparison to "the rest of the world".

The 'core' model used for simulations is a Policy Analysis Matrix (PAM). This can be described as a product of two accounting identities, one defining profit as the difference between revenues and costs, and the other measuring the effects of divergence (distorting policies and market failures) as the difference between observed parameters and parameters that would exist if distortions were removed (MONKE & PEARSON, 1989). The PAM results for a production system can help to determine simultaneously the economic efficiency of the system, the level of distortion on the input and output markets, and the extent to which resources are transferred among agents. The PAM can be considered as a simple static general equilibrium and policy-oriented simulation model (MONKE & PEARSON, 1989). The PAM has features of a general equilibrium model in that it takes into account the interdependencies between rice sector and other input sectors including factor markets for rice. It is static as it considers economic factors at a given point of time. The advantage of PAM is that it allows the disaggregation of the production activities and their costs. The cost components are examined directly and to a very detailed degree. It can be utilised to test a wide range of policy options which affect any stage of production chains. The PAM model applied for the rice sector in Vietnam is adapted from (MONKE & PEARSON, 1989) and can be presented as follows:

Table 1 Policy Analysis Matrix

	Revenue	Costs of		Profit
		Tradable inputs	Domestic factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effects of diver-gences	I	J	K	L

Note:

D= A-B-C , H= E-F-G

Output transfers: I= A-E, Tradable input transfers: J=B-F,

Domestic factor transfers: K= C-G Net transfers: L=D-H or L=I-J-K

The detailed formulae of the matrix components are[1]:

$$A = P_c T_c \qquad E = P_c(s) T_c \qquad (1)$$

$$B = \sum_{i=1}^{n} P_i Q_i \qquad C = \sum_{j=1}^{m} W_j L_j \qquad (2)$$

$$F = \sum_{i=1}^{n} P_i(s) Q_i \qquad G = \sum_{j=1}^{m} W_j(s) L_j \qquad (3)$$

[1] P_i, $P_i(s)$, W_j, $W_j(s)$, P_c and $P_c(s)$: are prices of input i, domestic factor j and product c measured in private and social prices respectively. T_c: quantity of product c produced per unit of observation (for example per hectare). Q_i, L_j: quantity of input i and domestic factor j used in producing the product output. n, m: respectively, number of tradable inputs and number of domestic factors used in the production system.

From the information provided by the PAM, a number of indicators of protection and comparative advantage can be derived. The formulas of these parameters can be presented as follows[2]:

$$NPC = \frac{A}{E} = \frac{P_c T_c}{P_c(s) T_c} = \frac{P_c}{P_c(s)} \tag{4}$$

$$NPI = \frac{B}{F} = \frac{\sum_{i=1}^{n} P_i Q_i}{\sum_{i=1}^{n} P_i(s) Q_i} \tag{5}$$

$$EPC = \frac{A - B}{E - F} = \frac{P_c T_c - \sum_{i=1}^{n} P_i Q_i}{P_c(s) T_c - \sum_{i=1}^{n} P_i(s) Q_i} \tag{6}$$

$$DRC_c = \frac{G}{E - F} = \frac{\sum_{j=1}^{m} W_j(s) L_j}{P_c(s) T_c - \sum_{i=1}^{n} P_i(s) Q_i} \tag{7}$$

In this study, the PAM is applied to the case of rice production in An Giang province, which is located in the Mekong River Delta of Vietnam. An Giang province – the country's biggest rice producer, with an output of 2.1 million tonnes in 1999 (GSO, 2001) has been a stable supplier of rice exports and has always been one of the top two rice exporting provinces in

[2] NPC = Nominal Protection Coefficient, which shows the overall policy distortion in the product market; NPI = Nominal Protection Coefficient on tradable inputs, which shows the policy distortion of all tradable input markets as a whole; EPC = Effective Protection Coefficient, which measures the combined policy effects in both product and tradable input markets; DRC = Domestic Resource Cost Ratio, which reflects the opportunity cost of the domestic resources involved in the production of the commodity and measures the comparative advantage of the product.

Vietnam during the last decade. It is therefore a good representative for Vietnam in this respect.

The data used for this study come from different sources and include both micro- and macroeconomic data in the form of primary and secondary data. The micro-data were extracted from the results of a production cost survey carried out by the Government Pricing Committee of Vietnam in An Giang province. In this survey, 50 farm households were interviewed in Tan Chau and Chau Phu districts for the 1997/1998 winter-spring rice crop season. Another survey was undertaken by the author for a range of other information such as land rent, land category, local transportation costs, labour costs, etc., for the province in 1999. Data on the detailed costs of exporting rice and importing fertilisers were also collected from the Government Pricing Committee of Vietnam. In addition, macroeconomic data such as exchange rates, inflation, economic growth, rice indicators, trade volumes, export and import prices, export and import tariffs, tax reduction schedules, trade policies, water charges and other agricultural policies, etc., were gathered for the base year of 1998 and for the period 1999-2000. These data were collected from the Ministry of Agriculture and Rural Development of Vietnam, the Ministry of Trade, the General Statistical Office, the Government Pricing Committee, the State Bank, the local offices of the World Bank, UNDP and FAO in Vietnam. Other secondary data such as data on AFTA and its progress, information on the ASEAN countries, world rice output and exports, the world market share of rice etc. were obtained from websites of the ASEAN Secretariat, FAOSTAT, the World Bank, IMF and a number of publications.

2.2 Estimation procedure and scenarios: A PAM in conjunction with an econometric model

With the PAM the current comparative advantage of Vietnamese rice and the level of protection were estimated. **Firstly, the baseline scenario**, which was established for the case of 1997/1998 winter-spring rice production in An Giang province, was simulated with a standard PAM for an agricultural product. 1998 is an “average year” for the period 1995-2000 in terms both of rice production output and rice export volume in Vietnam. All the calculations in the PAM were conducted on a hectare basis and in Vietnamese currency, the Vietnamese dong (VND).

With farm budget data and relevant macroeconomic data, the PAM was estimated in the steps outlined by YAO & TINPRAPHA (1995): (1) classifying and decomposing input items into their corresponding tradable, non-tradable and transfer payments (tax or subsidy) components; (2) estimating social prices (or shadow prices) of all the input items and products (rice being one of them); (3) constructing commodity and system budget tables; and (4) constructing the PAM and deriving relevant policy parameters.

In step (1), material inputs such as imported fertilisers, seeds, pesticides and herbicides, fuel, pumping, land preparation and harvesting services, farm transportation and farm tools, and pure non-tradable inputs like land costs, labour costs, water charges and interest costs are decomposed into their corresponding tradable, non-tradable and transfer payments components. In step (2), the shadow exchange rate as the rate that affects all social values of tradable components is estimated. In this process, the UNIDO approach is followed, and the free trade exchange rate referred to in BRENT (1998) is used as the shadow exchange rate. A social conversion factor[3] is calculated and used to convert the official exchange rate to the corresponding shadow exchange rate. Having obtained the shadow exchange rate and carried out the cost decomposition of inputs and rice as output, the next step is to estimate their import parity and export parity prices in social values, as these served as the basis for formulating the commodity and system budget tables in step (3). Social values of pure domestic factors are treated differently, and are estimated according to the principles of opportunity costs. The proxy for the opportunity cost of using land is estimated by the actual payment that a farmer in the study area makes for using the land. This is the sum of the state rent for land (the so-called agricultural tax) and the private market rent for land. Taking into consideration the approach used by AHMED (1983) and YAO & TINPRAPHA (1995), the shadow price for labour is estimated using the weighted average of peak-season and off-season wage rates. In addition, the unemployment rate is also taken into account in calculating the shadow price of labour. Having estimated all social values, the PAM is then formulated, summarising both private and social values in the rice production process. Based on the estimated PAM, policy

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[3] $$SCF = OER / FTER = \frac{e.X + \eta.M}{e.X(1 - t_x) + \eta.M(1 + t_m)}$$

Where: SCF: social conversion factor; OER: official exchange rate; FTER is the free trade exchange rate; X & M are total export and import values respectively (in F.O.B and C.I.F prices respectively); e is the average export demand elasticity; η is the average import supply elasticity; t_x and t_m are the average export and import tax respectively.
Source: BRENT (1998)

parameters like NPC, NPI, EPC and DRC are derived for the baseline scenario. The resulted figure for DRC reveals the comparative advantage of Vietnamese rice at the time of investigation. The concrete results of the baseline scenario will be discussed in section 3 of this paper.

In order to see the changes in the comparative advantage of Vietnamese rice production under different scenarios of transformation and trade liberalisation, sensitivity analyses are conducted, both by varying individual and a combined group of factors. The general procedure used for these sensitivity analyses can be seen in Figure 1.

The sensitivity analyses at the first level are carried out by changing individually world rice price, shadow exchange rate, price of imported fertilisers, social cost of labour, irrigation water charge, and the market rent for land. Different variation scenarios are conducted for each of the determining factors, resulting in corresponding changes in comparative advantage. The elasticities of comparative advantage of Vietnamese rice in respect of input and output factors are also estimated. The results are discussed further in section 3 of this paper.

The second level of the sensitivity analysis procedure is described in Figure 2. At this level, selected assumptions need to be made as it is confusing to examine changes in all determining factors for comparative advantage simultaneously.

Figure 1 Impact of trade liberalisation and transformation on comparative advantage of rice production in Vietnam

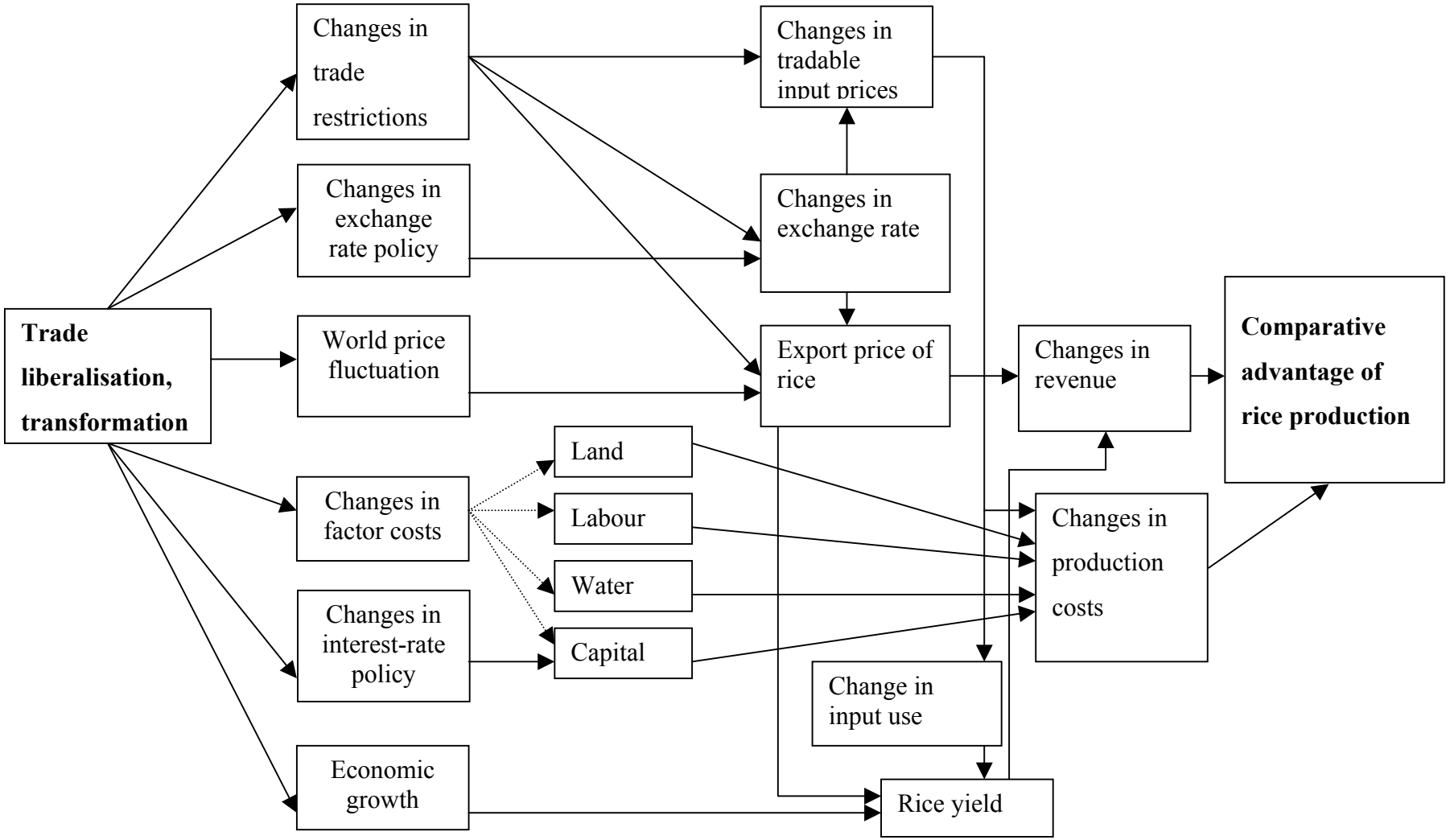
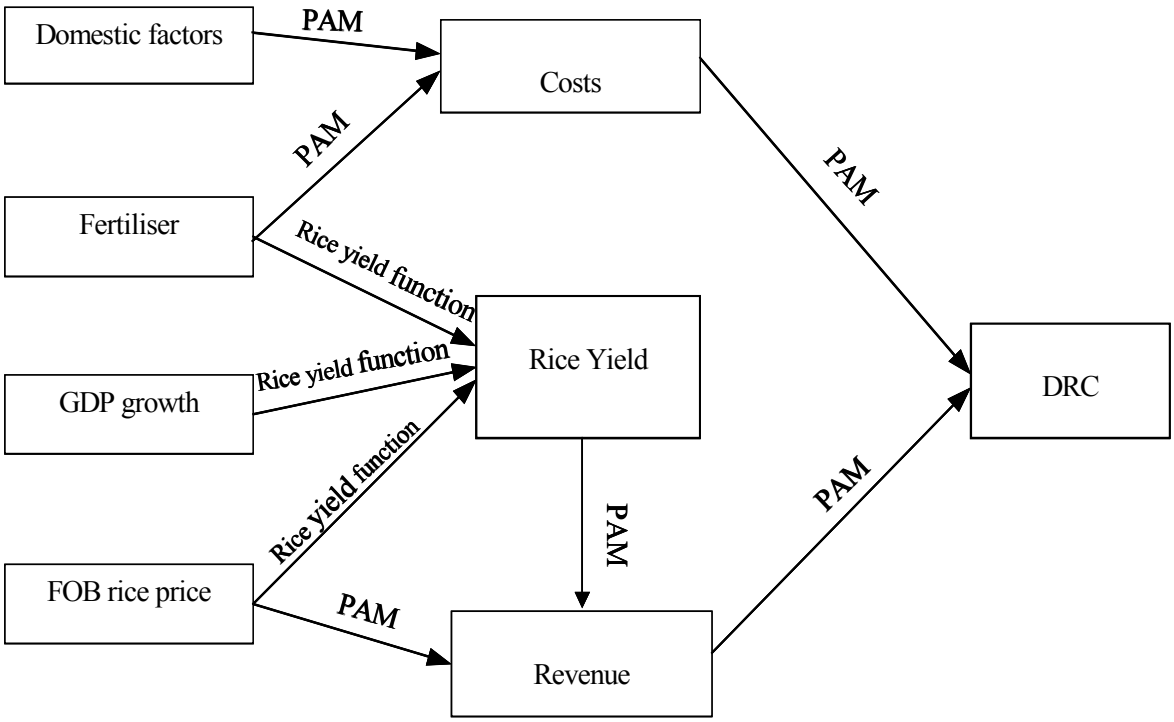


Figure 2 Procedure for examining combined effects on the comparative advantage of Vietnamese rice



As may be seen in Figure 2, the changes in imported fertiliser costs and in the export rice price not only result in a change in costs and revenues respectively; they also affect rice yield. This change in the rice yield, in turn, leads to a further change in revenues. The overall impact of these changes in social costs and revenues on the comparative advantage of rice can then be seen in the resultant DRCs, which are a measure of comparative advantage.

The underlying macroeconomic assumption in these simulations is that the economy of Vietnam continues to grow at the same rate as in 1998-2000, i.e., at around 5% annually. It is also assumed that the trade liberalisation schedule will continue to be implemented. During the transformation and trade liberalisation process, it is assumed that costs of domestic resources increase rather than decrease, due to their increasing scarcity. Imported fertiliser prices have fluctuated frequently during the last ten years and therefore changes in these are considered and simulated in both directions. Specifically, the costs of tradable input items in rice production are assumed to fluctuate at the same rate as imported fertiliser prices in this study. Sharing the view of WAILES et al. (2000) concerning the world rice price for the coming years, the simulations assume that rice price will decrease slightly by the year 2010.

The 'core' estimation procedure at the second level of sensitivity analysis includes an estimation of a rice yield function. The estimated function results are used as 'inputs' for the PAM. The independent variables for the function were chosen on the basis of the work of KAKO et al. (1999), KAVCIC et al. (1999) and HUANG & CHEN (1999), although the independent variable sets are not the same. In this study, the rice yield function is assumed to be a function of rice price, input prices and technological change. The functional form used is a Cobb-Douglas model in its logarithmic transformation formulation. With regard to rice price, the export rice price was chosen rather than the domestic rice price, as the former has an influence on the latter, but not vice-versa. To take into account the time for the export rice price to affect rice yield the export rice price lagged by one year is used in the model. In Vietnam in general, and in An Giang province in particular, the most important input in rice production is imported urea. The price of imported urea is therefore employed as another endogenous variable in the yield function. As a proxy for technology change, GDP growth rate is utilised in the estimation[4].

3 Results and their implications

3.1 Baseline scenario

Following the estimation procedure presented above, the main results of the baseline scenario are shown in Table 2. As may be seen in the table, both private and social profit are positive, showing that rice production is profitable for producers as well as for Vietnam as a whole. The private profit is greater than social profit, implying that for the society rice is not as profitable as the private value might suggest. The difference of around VND 2.06 million (US$ 136 as of February 2002) per hectare is substantial. Specifically, the non-tradable input transfer or domestic resource transfer is negative, which means that the cost to society of using

[4] The rice yield function for An Giang province is specified as:

$$\ln(Y_t) = A + \beta_1 \ln(P_{urea,t}) + \beta_2 \ln(P_{rice,t-1}) + \beta_3 \ln(GDP\_G_t) + u_t$$

Where: Y: is rice yield of An Giang's winter-spring crop in tonnes per hectare; P_{urea}: price of imported urea in An Giang province in VND/kg; P_{rice}: export rice price, F.O.B Ho Chi Minh City in US$/tonne and transformed into VND/kg at the prevailing exchange rates; GDP_G: GDP growth of Vietnam in percentage per year; u: error term

domestic resources exceeds its private value. The social value of non-tradable inputs (domestic resources) in this case is almost double than their private value.

Table 2 A PAM for rice in An Giang province and derived policy parameters, in VND

	Total revenue	Tradable inputs	Domestic resources	Profit
Private prices	12,952,959	2,243,378	3,869,551	6,840,030
Social prices	14,096,798	2,417,380	6,899,527	4,779,890
Divergence	-1,143,839	-174,002	-3,029,976	2,060,140
NPC = 0.919 ; NPI = 0.928 ; EPC = 0.917 ; **DRC = 0.591**				

Source: Computed results

With regard to protection levels, a nominal protection coefficient (NPC) of 0.919 showed that rice farmers were taxed in real terms by 8.1% on the rice they produced in 1998. The nominal protection coefficient on tradable inputs (NPI) of 0.928 indicates that farmers implicitly received a subsidy equivalent to 7.2% on their input use. Put differently, rice farmers paid less than the real costs for the country as a whole in terms of tradable inputs. The effective protection coefficient (EPC) of 0.917 implies that the overall impact of the government policies in both the rice and input markets results in a net disincentive of 8.3% for rice farmers in Vietnam. EPC is not the simple arithmetic sum of NPC and NPI as the denominators of these indicators are different. The value of "domestic resources" in social prices is much larger than that in private prices meaning that the society as a whole even bear a larger cost than the farmers in terms of the real cost of "domestic resources". It means that although the rice farmers were somehow "taxed" by the combined government policies as EPC figure suggested, their production costs in private prices were under-estimated (or their profit was over-estimated) from the viewpoint of society's interest. DRC of 0.591 (< 1) shows that, from the national point of view, it is desirable to produce rice and expand its production because the social net value added is greater than the social costs of its domestic production factors. The low DRC in this case reveals that Vietnam has a relatively high level of comparative advantage in producing rice at the time of investigation.

3.2 Change in individual determining factors

Table 3 summarises the results of the first level of sensitivity analysis, showing the impact of changes in individual factors. The results show the degree of comparative advantage deterioration according to various decreases in export rice price. If the world rice price decreases by 35%, the country becomes neutral in terms of comparative advantage in rice. Similarly, the fluctuation in the shadow exchange rate (SER) affects rice comparative advantage in Vietnam. As the prevailing market exchange rate in Vietnam is already approaching the shadow exchange rate, it is unrealistic to simulate the scenario with a substantial change in the shadow rate of exchange. A 10% increase in the SER, for example, results in an improvement in the DRC from 0.591 to 0.539. A 5% decrease in the SER yields a DRC of 0.621, meaning a lower comparative advantage of rice in Vietnam.

The impact of changes in other single factors, namely imported fertiliser prices, social labour costs, and the market rent for land, are presented in c), d), e), respectively, of Table 3. As trade liberalisation progresses, the costs of these factors are expected to rise, resulting in a deterioration in rice comparative advantage. This is because in the conditions of trade liberalisation, rural labour cost in Vietnam will become more expensive due to urbanisation process and economic integration. Based on the results presented in Table 3, Vietnam could lose its comparative advantage in rice if, for example, the market rent for land increased by 135%. As land becomes increasingly scarce, this is not an unrealistic situation. The DRC's elasticities in respect of changes in individual determining factors are presented in Table 3(f), showing the relative importance of the different factors for the comparative advantage of Vietnamese rice.

Table 3 Individual impact of determining factors on the comparative advantage of rice in Vietnam

a) Change in the export rice price

$\Delta P_{fob\ rice}$	+5%	+20%	-5%	-20%	-35%
DRC	0.558	0.479	0.627	0.771	1.000

b) Change in the shadow exchange rate

Δ_{SER}	+5%	+10%	-5%	-7.8% (SCF=1)
DRC	0.564	0.539	0.621	0.635

c) Change in the imported fertiliser prices

$\Delta_{c.i.f\ f}$	+10%	+40%	-10%	-40%
DRC	0.5955	0.6091	0.5868	0.5742

d) Change in the social labour cost

Δ_{Ws}	+20%	+50%	+100%
DRC	0.607	0.631	0.672

e) Change in the market rent for land

$\Delta_{l\ rent}$	+10%	+50%	+135%
DRC	0.622	0.745	1.007

f) DRC's elasticities with respect to determining factors

Factors	$P_{fob\ rice}$	SER	CIF_F	Ws	L_rent
$e_{DRC,i}$	-0.640	-0.948	0.076	0.139	0.521

Note: ΔP_{fob_rice}: Change in the export rice price, F.O.B Ho Chi Minh City; Δ_{SER}: Change in the shadow exchange rate, in VND/US$; $\Delta_{c.i.f\_f}$: Change in imported fertiliser prices, C.I.F Ho Chi Minh City; Δ_{Ws}: Change in the social labour cost; Δ_{l_rent}: Change in the market rent for land; Baseline's DRC = 0.591

Source: Extract from PAM simulation results

3.3 Change in a number of determining factors simultaneously

Following the estimation procedure presented in Figure 2, a more realistic picture of comparative advantage of Vietnamese rice may be obtained from the 'combined effects' (Table 5). If the determining factors change simultaneously there are much larger fluctuations in rice comparative advantage.

First of all, the rice yield function for An Giang province was estimated. Its estimated results including the yield elasticities with respect to various independent variables were presented in Table 4.

Table 4 Results of regression analysis for rice yield function

Variables	Unstandardized Coefficients (B)	Standard Error	Standardized Coefficients (Beta)	T-statistics	Significance
Constant term (A)	1.316	.044		37.053	.000
Ln (P_{urea})	-0.03656	.054	-.156	-.672	.527
Ln (GDP_G)	1.733**	.611	.651	2.838	.030
Ln (P_{rice})	0.08818***	.025	.684	3.550	.012

R-Square = 0.785, Adjusted R-Square = 0.678;

Standard Error of the Estimate = $2.4874*10^{-2}$, DW=2.395

Note: * = Significant at 5%, *** = Significant at 1%

The regression results indicate that all three factors contribute to the change in the rice yield in An Giang province. All signs of the coefficients are expected. The coefficient for urea fertiliser price is negative as the yield is expected to increase with a reduction in the fertiliser price. Technological progress and the world rice price are expected to have a positive relation with the yield and their regression coefficients also show that fact. The coefficient of export rice price variable is significant at 1%, indicating that it has significant influence on the rice yield. However, the direct magnitude of the impact is not very high. The coefficient of GDP growth which represents technology change is also significant at 5%, showing that the technology change affects the rice yield significantly. The technology elasticity of the yield is relatively high, indicating that technology plays a substantial role in the rice yield increase in Vietnam. With a small fertiliser price elasticity of the yield, the imported urea price has also an influence on the rice yield but the impact is not very significant. This may reflect the fact that in Vietnam in general and in An Giang in particular, chemical fertilisers have already been used extensively. Therefore a further increase in fertiliser use may not result in a significant increase in the rice yield. The absolute value of rice export price elasticity of the yield is greater than that of imported urea price showing larger impact of this factor on the yield.

In most scenarios reflecting economic fluctuations, Vietnam still maintains its comparative advantage in rice production. However, it can also be seen how quickly comparative advan-

tage deteriorates, or indeed disappears, when Vietnam is faced with unfavourable economic conditions. Based on the projection results of the Arkansas Global Rice Model developed in WAILES et al. (2000), the world rice price is expected to decrease slightly by the year 2010 and this is assumed to happen in the coming years. Therefore, in the simulations, only the scenarios with a world rice price decrease (in comparison to the time of investigation) are carried out. With a 20% reduction in the export rice price, a 10% increase in the imported fertiliser price and a 10% increase in the costs of domestic resources, the DRC is already 0.814. Meanwhile, a 30% decrease in the export rice price, combined with 10% and 30% increases in the import price of fertilisers and total costs of domestic resources respectively, results in a DRC of 1.109. The situation is similar when there is a 30% and 10% decrease in the export rice price and import price of fertilisers respectively, combined with a 40% increase in the total costs of domestic resources; this results in a DRC of 1.097. In these two cases, Vietnamese rice has a comparative disadvantage.

Table 5 Fluctuations in DRC due to simultaneous changes in factors

Change in imported fertiliser prices	F.O.B rice price change	Change in the total costs of domestic resources			
		+10%	+20%	+30%	+40%
$\Delta_{c.i.f\_f}$ = +10%	No change	0.607	0.648	0.689	0.729
	ΔP_{fob_rice} = -10%	0.696	0.743	0.790	0.837
	ΔP_{fob_rice} = -20%	0.814	0.869	0.923	0.978
	ΔP_{fob_rice} = -30%	0.978	1.044	1.109	1.175
$\Delta_{c.i.f\_f}$ = -10%	No change	0.580	0.619	0.658	0.697
	ΔP_{fob_rice} = -10%	0.662	0.706	0.751	0.795
	ΔP_{fob_rice} = -20%	0.768	0.819	0.871	0.923
	ΔP_{fob_rice} = -30%	0.913	0.974	1.036	1.097

Note: Assuming 5% GDP growth in all scenarios; DRC of baseline scenario is 0.591

Source: Model results

4 Conclusions and policy implications

Transformation and trade liberalisation provide a fairer 'playing field' but they also mean a new economic environment with genuinely tougher competition for economic agents. The rice sector in Vietnam, which is a crucial economic sector in terms of both production value and employment, is also facing these challenges with stronger competition in export markets. The comparative advantage of rice production in Vietnam, and its fluctuations, therefore, are of particular concern to policy-making. Utilising a PAM and a multivariate regression model, this paper analyses the changes in the comparative advantage of Vietnamese rice production based on different economic scenarios in the context of transformation and trade liberalisation.

The results indicate that Vietnam currently has a relatively high comparative advantage in producing rice with a Domestic Resource Cost Ratio (DRC) of 0.591, and the use of domestic resources is efficient in economic terms. Other findings are that the world rice price, the shadow exchange rate, the market rent for land, the social costs of labour and the import price of fertilisers are major determinants of the Vietnamese rice sector's comparative advantage with their respective DRC elasticities of -0.64, -0.948, 0.521, 0.139 and 0.076. At the same time, the results suggest that macroeconomic reforms and trade liberalisation for the whole country seem to have a greater impact on the rice sector's comparative advantage than equivalent reforms within the agricultural sector itself. In terms of dynamics, Vietnam is likely to retain its comparative advantage in the rice sector in the next ten years in most of the scenarios considered likely or possible. However, there are also possibilities that Vietnam might lose its comparative advantage in rice in certain unfavourable economic situations, such as in the event of a simultaneous increase in the cost of domestic factors and import fertiliser prices, combined with a reduction in the world rice price.

The study concludes that there is a need for more diversified agricultural development in order to reduce the negative impacts and risks of trade liberalisation. Specifically, as agricultural land is becoming scarce and opportunity costs increase, other production alternatives requiring less land, such as cash crops and livestock, need to be considered in areas where rice yields are low. Finally, rice farmers and exporting agents should be better informed about the world rice market, including both the demand and the supply sides, in order to minimise negative effects of rice price shocks and related revenue losses.

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