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MSSD DISCUSSION PAPER NO. 14

**RICE MARKETS, AGRICULTURAL GROWTH,
AND POLICY OPTIONS IN VIETNAM**

by

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TABLE OF CONTENTS

TABLE OF CONTENTS	i
LIST OF TABLES	ii
LIST OF FIGURES	iii
ABSTRACT	iv
INTRODUCTION	1
BACKGROUND	3
MARKET STRUCTURE	8
High Level of Commercialization and Importance of the Private Sector	9
Underdevelopment and Regional Unbalance of Private Sector	10
Local Nature of Trade and Information	11
Credit Constraints	12
MARKET PERFORMANCE	13
Price Variability and Margins	13
Price Transmission and Market Integration	15
Marketing Costs, Profitability, and Investment	16
Restrictions on Domestic Trade	18
EXPORTS AND WORLD MARKETS	20
Rice Exports and Food Security	20
Quality of Exported Rice	21
Price Transmission and Price Comparisons	21
World Markets and Major Competitors	22
Constraints to Future Growth	23
MODELING THE RICE SYSTEM: VASEM	23
POLICY OPTIONS AND LONG-RUN PROSPECTS	25
Elimination of Rice Quota	25
Elimination of Barriers to Internal Trade	29
Long-run Prospects for Rice Exports	31
CONCLUSIONS	32
Conclusion #1: Future Growth of the Rice Sector Relies on Rice	

Exports	32
Conclusion #2. Viet Nam Has a Large Potential for Rice Exports	33
Conclusion #3. Fulfilling this Potential Depends on Development of Private Marketing	35
Conclusion #4. The Private Marketing Is Still Underdeveloped	37
Conclusion #5. Targeting and Income Growth Are the Best Ways to Address Food Security	38
Conclusion #6. Macroeconomic Policy Penalized Agriculture	38
POLICY RECOMMENDATIONS	39
Recommendation #1. Elimination of External and Internal Restrictions	40
Recommendation #2. Promotion of Rice Marketing	41
Recommendation #3. Remove Macroeconomic Bias Against Agriculture	42
Recommendation #4. Target the Poor and Food Insecure	42
Recommendation #5. Invest in Agricultural Research	43
APPENDIX 1: STRUCTURE OF THE MODEL	44
BIBLIOGRAPHY	40

LIST OF TABLES

Table 1: Agroecological Regions of Viet Nam	8
Table 2: Marketed Surplus by Season	9
Table 3: Marketing Channels for Farmers	10
Table 4: Size of Operation	11
Table 5: Credit Constraints	12
Table 6: Rice Storage	13
Table 7: Comparative Dynamic Indicators of Market Integration	16
Table 8: Unit Operating Costs	17
Table 9: Composition of Retail Price	18
Table 10: Restrictions of Movement of Goods	19
Table 11: Export Prices as a Share of Bangkok Prices	21
Table 12: Overall Effects of Removing Export Quota	26
Table 13: Regional Effects of Removing Export Quota	27
Table 14: Distributional Effects of Removing Export Quota	28
Table 15: Effects of Quota Removal on Extreme Poverty	29
Table 16: Regional Effects of Removing Internal Trade Restriction	30

LIST OF FIGURES

Figure 1: Per Capita Paddy Output	4
Figure 2: Viet Nam Agroecological Regions	7

Figure 3: Marketing Channels	8
Figure 4: Coefficient of Variation	14
Figure 5: Margin between North and South Wholesale Rice Prices	15
Figure 6: Real Prices of Paddy and Rice	15
Figure 7: Miller Total Investment	17
Figure 8: Price Differential North-South	19
Figure 9: Food Security Export	20

ABSTRACT

Viet Nam has undergone a profound transformation in recent years and, as a result of a series of macroeconomic and institutional reforms since 1986, it has made substantial progress toward becoming a market economy. As this transition continues, Viet Nam faces the challenge of formulating and implementing a growth strategy which is both economically and politically feasible. Critical to this growth strategy is the role of agriculture and, within agriculture, the development of an efficient rice marketing system. The emergence of Viet Nam as a major rice exporter has raised a number of important policy questions. First, will the country be able to continue its impressive growth? Second, how far has Viet Nam moved along the path toward a market economy? Third, what is the role of the government in the development of a rice market economy? Finally, what is the best way to promote food security? The paper addresses these issues and report the results of a study conducted by IFPRI for the Asian Development Bank in collaboration with the Ministry of Agriculture and Rural Development of the Government of Viet Nam. The study is based on extensive data collection from marketing agents (farmers, traders, millers, state owned enterprises, and exporters) conducted during 1995 and 1996.

RICE MARKETS, AGRICULTURAL GROWTH, AND POLICY OPTIONS IN VIETNAM

INTRODUCTION

The past 10 years have witnessed a remarkable success in Viet Nam agricultural production. As the country has moved from a central planning system to a market economy, the response of the agricultural sector has been impressive. Production of paddy has grown at over 5 percent per year during the past 10 years, outperforming the growth of population and transforming Viet Nam from a food importing country to a leading rice exporter. This transformation was largely the result of liberalization of agricultural markets. Resolution No. 10 in 1988 recognized the farm household as the central economic unit responsible for its production decisions. Resolution No. 5 in 1993 further moved in the direction of rural development and recognized the rights of land use.

To ensure similar success over the next 10 years is a major challenge. Among the main issues in food policy that Viet Nam needs to confront, this study focuses on rice policy and examines four main questions related to: a) the prospects for future growth; b) the steps along the path towards a market economy; c) the role of the government in a market economy; and d) the best ways to ensure food security.

The first question is: **Will the country be able to continue its impressive growth in rice production and exports?** If Viet Nam continued its current production growth during the next ten years while maintaining a restrictive export policy, it could induce poor prospects for the agricultural sector. Internal demand would be unlikely to absorb future growth in production.

As aggregate income grows, consumers will shift away from rice towards more costly foods and diversified diet. This is already the case in the richest parts of the country, such as HCMC and Hanoi. With an internal demand growing at 2 percent, and with a restrictive export policy, the effect on price of rice could be catastrophic. In a market economy, excess production would result in a fall of prices, leading in turn to lower farmer income.

Even with much lower productivity growth than in the past 10 years, Viet Nam has the potential for increased rice exports. In fact, Viet Nam could rival Thailand as the leading rice exporter if a more efficient and effective marketing system were developed. The major constraints in achieving this potential lie in the rice marketing system.

If it is true that the major constraints to future growth lie within the marketing system, the second question is: **How far has Viet Nam moved along the path**

toward a market economy in the rice subsector? Whereas the private sector is the main sector involved in agricultural production, the marketing sector is still characterized by a significant presence of the public sector. State owned enterprises (SOE) are the only participants in rice exports. SOE rice exports, however, would not be possible without the intermediation of private traders and millers. Despite the enormous gap in size and assets between private sector and SOE, the private sector is responsible for moving and distributing about 80 percent of the rice produced in Viet Nam.

The private sector marketing system is still largely underdeveloped. This underdevelopment is reflected not only in small size of transactions, storage, and asset basis, but also in the local nature of trade. Most of the private sector marketing agents are operating at relatively short distance from their residence in spite of the existence of regional rice deficit that could represent an opportunity for a sizable inter-regional trade. Price differences among regions are still wide and are above the transportation costs.

The comparison with other countries at similar level of development confirms the low integration of Viet Nam domestic markets. Domestic restrictions are partly responsible for this low level of integration. Barriers to entry into the rice export business, however, are the most limiting factor in the development of an efficient marketing system, as they prevent competition among marketing agents that would result in lower distribution costs and improved quality for domestic and international markets.

The commitment of the government to move further along the direction of a market economy raises the third question: **What is the role of government in the development of a rice market economy?** If the private sector develops, it will be mostly responsible for the decisions concerning production and distribution of rice. Given the crucial role of rice for growth of agriculture and for food security, the government needs to ensure that markets develop in a balanced manner, without adversely affecting the development of the rural economy and the food security of vulnerable groups.

An important function of the state is therefore to promote a stable macroeconomic environment leading to the promotion of private sector investment. Only if the private sector recognizes the commitment of the government to such stable environment, will it have the incentives to carry out the investments needed to improve the marketing system, thus saving precious resources in the state budget.

The private sector, however, will not have incentives to investing in public goods where the benefit of the investment cannot be appropriated. Examples of these public good investments are rural infrastructure, agricultural research, and extension of market and technology information.

Finally, the legal infrastructure to clarify property rights, enforce contracts, and establish transparent rules is as important as the physical infrastructure. This legal infrastructure reduces the risks and transaction costs of market operations, thus facilitating trade, storage, and processing activities.

However important, growth and efficiency cannot be pursued by neglecting the vulnerable groups of society. Key to food policy is to insure food security of the population. Then, the final question becomes: **What is the best way to provide food security?** To try to meet the needs of the poor by price policy (that is lowering the price of food) and by trade policy (restricting exports) is generally a self-defeating policy. Lower rice prices and lower exports result in slower agricultural growth, lower national income, and hurt the rural population where most of the poor are found.

By allowing the country to grow, the government may redistribute the gains from growth using more efficient and effective ways to meet the need of the poor and the food insecure. Targeted programs are the best examples of this type of redistribution.

This study addresses the four general issues mentioned above based on an analysis of the rice marketing system in Vietnam conducted by IFPRI (see IFPRI 1996). Section 2 provides a background to rice production and rice policy in Viet Nam. Section 3 describes the structure of rice markets. Section 4 presents the results on the performance of rice markets in Viet Nam. Section 5 describes the structure of rice exports in Vietnam in relation to world markets. Section 6 describes the multimarket spatial-equilibrium model (called VASEM) used to examine the effects of policy options and the long-run prospects for Vietnamese rice exports. In section 7, VASEM is used to simulate the effect of eliminating the rice export quota, the effect of removing barriers to internal trade, and the long-run prospects for rice exports. Section 8 summarizes the main results and section 9 presents the policy recommendations.

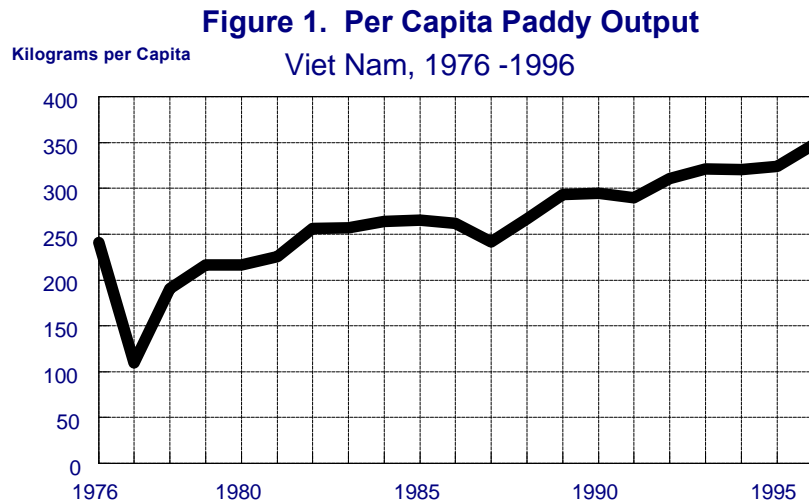
BACKGROUND

In the past fifteen years, Viet Nam has moved gradually away from centralized control of agricultural decisions and toward a more market-based system. In 1981, the government responded to declining per capita food production by issuing Instruction 100, which shifted from collective agriculture to a system of production contracts in which individual farmers took greater responsibility for fulfilling production quotas. Combined with higher procurement prices and better weather, these reforms resulted in several years of rising per capita food production.

In the late 1980s, stagnating agricultural production and weather-related shortages catalyzed more fundamental reform of the agricultural sector. In 1988, Resolution 10 legalized private ownership of farm implements and animals and

assigned cooperative land to individual farmers on long-term leases. The sale of agricultural surpluses and private trade in agricultural goods were legalized and promoted, thus expanding the scope of agricultural markets (see IFPRI, 1996: 31).

Rice production has responded dramatically to these reforms. Between 1988 and 1995, cultivated area expanded 3.1% per year. This growth has been largely due to increases in the cropping intensity, particularly in the Mekong River Delta. The increased cropping intensity is, in turn, the result of investment in irrigation and the adoption of new rice varieties with shorter maturation periods. Over the same period, rice yields grew 2.4% per year, primarily as a result of better water control and the adoption of higher-yielding varieties. The combined result is that rice production has grown 5.6% per year over the period 1988-1995 (Viet Nam, 1996b and IFPRI, 1996:111-112). Figure 1 shows the dramatic increase of paddy production per capita in the period after unification.



Source: Data from GSO.

Over the same period, apparent rice consumption (production minus net exports) has risen about 3.1 percent per year. This is greater than the 2.1 percent annual population growth over this period (Viet Nam, 1996a). From 1962 to 1988, Viet Nam was a net rice importer every year except in 1983. Since 1989, Viet Nam has exported rice every year, with the volume rising to 2.02 million tons in 1995¹ and about 3 million tons in 1996. This puts Viet Nam among the three largest rice exporters in the world together with Thailand and the United States.

The rice markets in Viet Nam are not, however, completely liberalized. First, the government imposes a rice export quota. Interviews with exporters suggest that

¹ Vietnamese observers believe that an additional 500 thousand tons was exported illegally to China. This agrees with estimates based on rough balance sheet calculations.

the quota is binding, a conclusion confirmed by persistent differentials between domestic and international rice prices. For example, in 1995 the export unit value of Vietnamese rice was US\$269 per ton, compared to the MRD wholesale price of US\$205 per ton. Vietnamese policy-makers defend the export quota as necessary to ensure adequate supplies of rice for Vietnamese consumers. Rice is the dominant staple, accounting for 66% of caloric intake (World Bank, 1995). In addition, it is argued that liberalizing exports would increase Viet Nam's exposure to volatile international rice markets. This volatility is related to the thinness of world rice markets: only 3 to 5% of world production is traded (IFPRI, 1996: 100).

Second, the government restricts rice movements within the country. The documentation and administrative procedures required to transport rice from the south to the north of Viet Nam are comparable to those required to export rice. One justification given by the government for the restrictions on south-north trade is that the main surplus region is the Mekong River Delta in the south, while the destination of much of the smuggled rice is China, on the northern border. Most of the south-north movement, however, is legitimate trade from the Mekong River Delta to the northern regions of Viet Nam which have a combined rice deficit of almost 900 thousand tons. Thus, legitimate internal trade is restricted, partly in order to control illegal exports. Movements of rice within the north and within the south are less tightly regulated but is still subject to roadblocks, tolls, and other restrictions from local authorities, according to IFPRI interviews with traders, millers, and state-owned enterprises (see IFPRI, 1996: 70).

The restrictions on internal trade are reflected in rice price differentials which exceed transportation costs. For example, in 1995 the average wholesale price of rice was US\$64 per ton higher in the north than in the south, yet data from the IFPRI survey of traders suggest that the cost of transporting rice from the south to the north is only US\$27 per ton (IFPRI, 1996: 188).

The third type of restriction is that state-owned enterprises have a monopoly on rice exports and on south-north trade. The monopoly on rice exports and long-distance internal rice trade is seen by policy makers as necessary to ensure legitimate internal trade while preventing smuggling. In addition, the profits generated by state-owned enterprises are an important source of revenue for the central government.

The International Food Policy Research Institute (IFPRI) carried out a series of surveys of farmers, traders, millers, and state-owned enterprises as part of a larger study of rice markets during 1995-1996. These data, combined with data from other sources, were used to derive conclusions related to the structure, performance of rice markets and export system. The information was further used to develop a spatial-equilibrium model of the markets for rice and three other staple foods in Viet Nam. The model is designed to provide regionally-disaggregated information to policy makers concerning the impact of alternative rice policies on

rice prices, production, consumption, exports, household welfare, and other variables of interest.

For the purpose of the analysis, Viet Nam is divided into seven agroecological regions (see Figure 2). The North Mountain and Midlands (NMM) region is a large, sparsely-populated mountainous area bordering China. The NMM has the largest rice deficit of the seven regions. The Red River Delta (RRD) is a fertile, irrigated region in the north with a high population density. RRD farmers produce a surplus large enough to supply Ha Noi, located in the RRD, and to cover part of the NMM deficit. The North Central Coast (NCC) is a rice deficit region with the lowest per capita income of the seven regions. The South Central Coast is also a deficit region, where agriculture is often disrupted by typhoons. The Central Highland (CH) is a sparsely populated, mountainous, rice-deficit region. Recently, the production of cash crops (particularly coffee) has grown rapidly in the CH. The Northeast South (NES) is an urbanized region that includes Viet Nam's largest city, Ho Chi Minh City. Although a rice deficit area, the NES is economically diversified and has the highest per capita income of the seven regions. The southern-most region is the Mekong River Delta (MRD), a fertile and mostly-irrigated area with rice surpluses of over 4 million tons. It is larger than the RRD and, being further south, has a longer growing season which allows a greater cropping intensity than is possible in the RRD. Table 1 summarizes some of the main characteristics of the seven regions.

FIG 2 - VIETNAM AGRO-ECOLOGICAL REGIONS

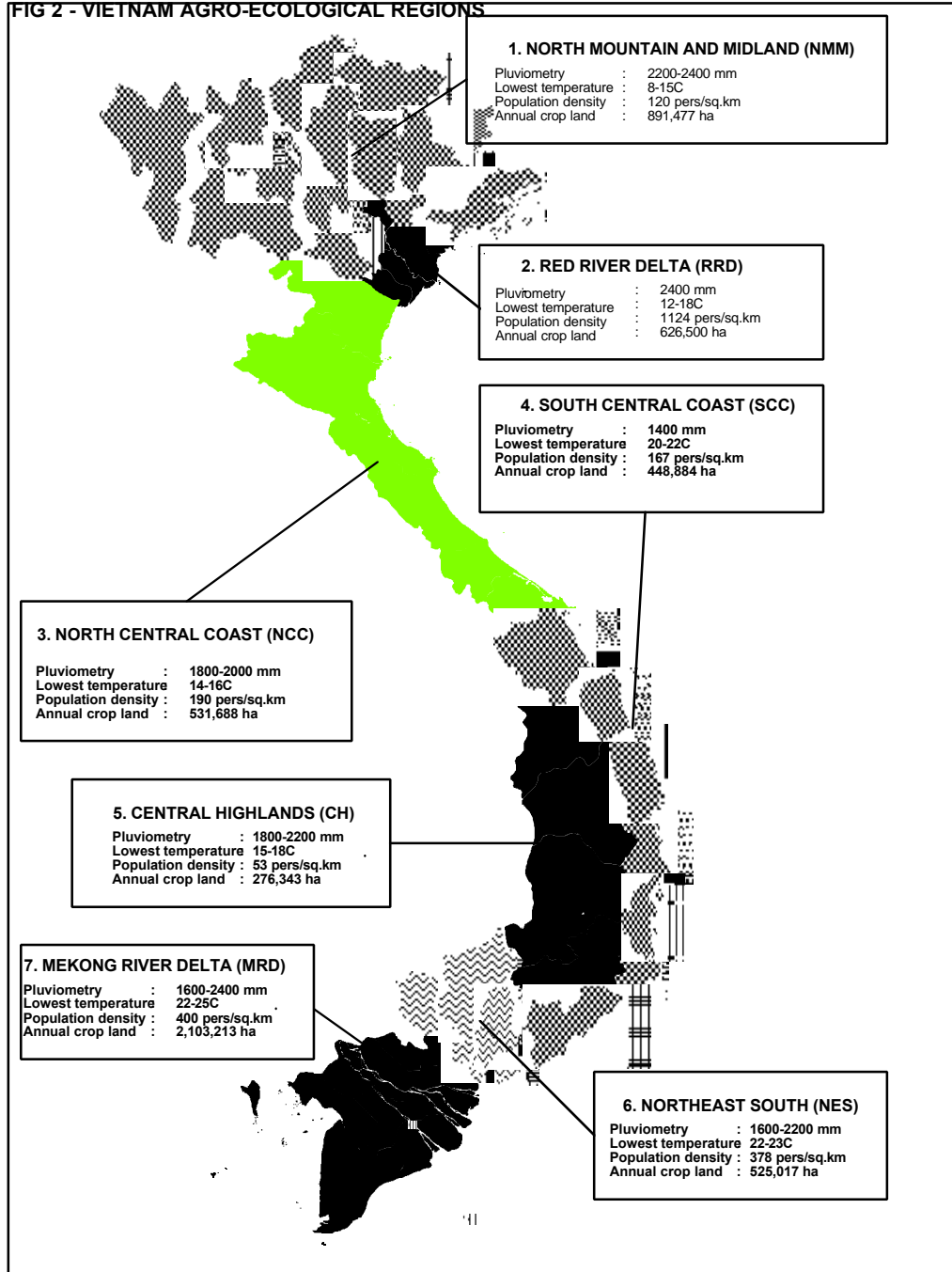


Table 1. Agroecological regions of Viet Nam

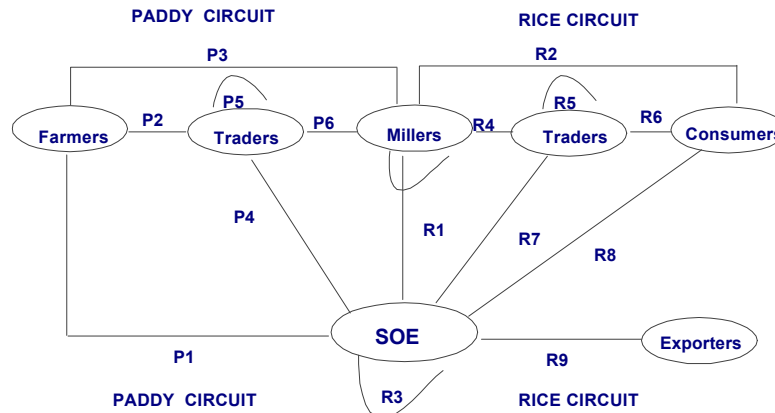
	North Mountains and Midlands	Red River Delta	North Central Coast	South Central Coast	Central Highlands	Northeast South	Mekong River Delta
Population (million)	12.4	14.1	9.7	7.6	3	8.9	15.9
Population density (person/km ²)	120	1124	190	167	53	378	401
Urbanization (%urban)	13	17	11	23	23	46	13
Paddy production (1000 tons)	2254	4623	2141	1749	429	935	12832
Paddy yield (tons/ha)	2.79	4.44	3.14	3.38	2.48	2.66	4.02
Rice consumption (kg/capita)	156	170	153	145	162	131	160
Rice surplus (1000 tons)	-759	173	-291	-159	-247	-654	4468
Per capita expenditures ('1000' 1992 Dong/person/year)	963	1102	871	1267	1481	1840	1469

Source: Data from GSO

MARKET STRUCTURE

Central to the rice marketing system of Viet Nam is the complex web of relationships among its key participants, namely farmers, traders, millers, and SOE. The links between these agents can be described by an analysis of *marketing channels*. The overall purpose of these channels is to transport and store the paddy produced by farmers, to transform it into rice, and to distribute it to consumers, both for domestic consumption and exports (see figure 3).

Figure 3. Marketing Channels



Four main conclusions emerge from the analysis of the structure of marketing channels and the operations of marketing agents, namely: a) the high level of commercialization and the involvement of the private sector not only at the

production stage but also at the marketing stage; b) the underdevelopment and regional unbalance of the private sector, in spite of its importance in the distribution system; c) the local nature of trade and information; and d) the credit constraints limiting procurement activities, storage, and investment.

High Level of Commercialization and Importance of the Private Sector

Rice marketing in Viet Nam is highly commercialized. Paddy sales by farmers as a proportion of production, the so called *marketed surplus*, is over 60 percent in all seasons in the two main producing regions, the RRD and the MRD (see table 2). The MRD is more commercialized than the RRD with a peak of marketed surplus of 95 percent occurring during the rainy season. Other regions are less commercialized, particularly the NMM and the CH. Their production is mostly for home consumption. The average marketed surplus in NMM, for example, is as low as 16 percent of total production during the main Winter-Spring crop.

Table 2: Marketed Surplus by Season
Sales as Percent of Production

	NMM	RRD	NCC	SCC	CH	NES	MRD	Viet Nam
Winter-Spring	16	65	35	34	44	72	77	70
Summer-Autumn	.	.	32	41	47	49	64	60
Rainy	8	58	.	.	.	29	95	48
All Year	12	62	37	37	45	55	72	64

Source: IFPRI survey 1995-96

Paddy marketing is dominated by private traders, who procure about 96 percent of total marketed surplus from farmers (see table 3). Millers and SOE also buy from farmers, but their importance relative to traders is marginal. This is true across different regions and across different seasons. The weak link between SOE and farmers suggests that producer price stabilization, considered by many SOE an important function of their operations, is not the result of paddy procurement. With only 2 percent of paddy procured from farmers, the extent of SOE stabilization is quite limited. The linkage between demand management by SOE and prices received by farmers takes place through induced demand for rice by SOE. The price signals are sent to farmers through the private sector.

Table 3. Marketing Channels for Farmers
Shares of Farmers Sales

	Millers	Traders	Others
Winter- Spring	1.2	96.9	1.9
Summer- Autumn	1.1	96.9	2
Rainy	8.2	90.7	1.1
All Year	1.6	96.5	1.9

Source: IFPRI Survey 1995-96

Traders are the main customers of farmers and they are also the main suppliers of SOE in the MRD. The difference between rice marketing in the north and south is the composition of customers. In both regions, assemblers are the main suppliers of wholesalers and millers. Whereas in RRD, the system of rice is directed mainly to domestic consumers, in the MRD, the distribution system is oriented heavily towards SOE. Moreover, while in the RRD, consumers are the main customers of SOE, in the MRD SOE's rice sales are destined mainly to exports or other SOE (see IFPRI 1996, chapter 4, section 5).

Underdevelopment and Regional Unbalance of Private Sector

In spite of its key role in the rice marketing system of Viet Nam, the private sector is still underdeveloped and shows a distinct pattern between north and south. The trading sector is largely characterized by small transactions and small assets. In spite of the existence of some large traders and millers in the south, the average transactions are still quite small when compared to those of SOE. The latter have an average monthly rice sale of over 4,000 tons compared to about 33 tons for traders and 171 tons for millers (see table 4).

Table 4. Size of Operation

		Rice Sales (mt/month)	Assets (000 USD)
Viet Nam	Traders	32.7	3
	Millers	171	31
	SOE	4,017	1,594
MRD	Polisher	800	218
	SOE	5,054	1,395

Source: IFPRI Survey 1995-96

The MRD and the NES have a much more developed marketing system than in the rest of the country. Wholesalers in the MRD, for example, sell 91 tons of rice per month on average, while the average is only 32 tons in the RRD. Medium-sized millers sell about 1.75 tons of rice per month in the RRD and about 38 tons in the MRD. Moreover, there are more large millers and polishers in the MRD and NES than in the RRD. Even these large millers, however, are small relative to SOE. In the MRD, for example, the largest millers and polishers have average monthly sales of rice amounting to 1,163 tons, while the SOE sell about 5,054 in the same region (see IFPRI 1996, chapter 4, section 4).

Similar considerations apply for the asset basis of various marketing agents. SOE assets amount to an average of \$1,594 thousand, while traders assets are \$2.9 thousand, and millers \$31 thousand. Wholesalers assets in the RRD are \$2.1 thousand, while they are \$3.8 thousand in the MRD; medium size millers assets in the RRD are \$0.8 thousand, while they are \$18.3 thousand in the MRD (see table 3 and IFPRI 1996, chapter 4, section 3).

Local Nature of Trade and Information

Even though Viet Nam has an aggregate surplus of rice that can be exported, many regions have rice deficit. It is then necessary to transport rice from surplus regions of MRD and RRD to the deficit regions. Domestic trade flows by private sector and shipment of rice by SOE are the main mechanisms of redistributing domestic production within the country. It is estimated that over 2.1 million metric tons need to be transported across regions in order to ensure food security (see IFPRI 1996, chapter 11, section 2). About half of this amount is moved by SOE, leaving the private sector involved in very small amount of long distance trade. Over 90 percent of total paddy procurement and rice sales take place within a radius of 100 km of the marketing agents residence. The private sector is rarely

involved in rice trade transactions at more than 400 km distance (see IFPRI 1996, chapter 4, section 6).

This local nature of marketing is also reflected in the limited information of marketing agents of rice markets situation outside of their immediate surroundings. Most agents indicate personal contacts as the main source of information for prices and regulations affecting their business. Even though half of wholesalers own a telephone, access to broader and more formal market information is very limited (see IFPRI 1996, chapter 4, section 8).

Credit Constraints

All marketing agents, both from private sector and SOE, agree in being credit constrained. The extent of this constraint is reported to be very high: credit requirements vary between 3 and 10 times the actual credit available to market agents. The interest rate that private marketing agents were prepared to pay for access to additional credit is close to market rate, whereas SOE willingness to pay for additional credit is below market rate (see table 5, and IFPRI 1996, chapter 4, section 9).

Table 5. Credit Constraints

	Current Credit (USD)	Interest Rate (%)	Required Credit (USD)
Wholesaler			
RRD	2,102	2.57	6,556
NES	1,810	5.04	262,202
MRD	4,014	4.43	18,143
Medium Miller			
RRD	571	2.17	3,810
NES	2,133	2.5	14,206
MRD	4,873	2.56	25,360
State Owned Enterprise			
RRD	141,231	1.27	89,524
NES	3,454,382	1.53	9,206,349
MRD	5,769,893	1.75	14,147,186

Source: IFPRI Survey 1995-96

The credit constraints assessment by marketing agents is reflected partly in the very short-term storage behavior. Holding stock of rice for more than two weeks is rare among private sector agents and only large millers and polishers can afford to do that, with average holding period of 16 days for large millers in the MRD. The average holding period for traders is less than a week. SOE can afford to store rice for longer periods, with an average holding period of about 4 weeks for SOE in the MRD (see table 6, and IFPRI 1996, chapter 5, section 4).

Table 6. Rice Storage

	Capacity (mt)	Rice Stock (mt)	Holding Period (day)
Retailer	5.6	1.7	5.8
Wholesaler	117.3	22.3	5.9
Assembler	6.1	0.2	1.3
Small Miller	17.9	1.9	2.3
Polisher	1,930.9	480.3	15.6
SOE	21,734.3	2,978.5	23.2

Source: IFPRI Survey 1995-96

MARKET PERFORMANCE

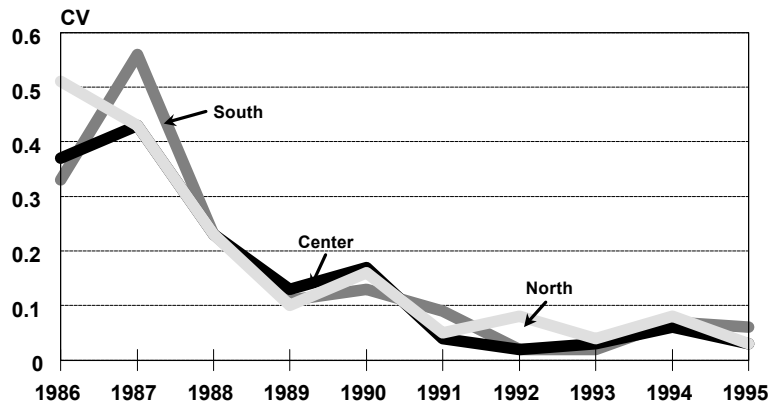
In a market economy, prices are the main incentives for agricultural production and marketing. The study of their behavior is therefore critical to the understanding of the market system performance. Prices affect revenues and costs and therefore profits of various marketing agents. Price signals are transmitted over time and over space and affect the allocation of resources. If the transmission of price signals is imperfect, then the performance of the marketing system will suffer.

The reforms initiated in the latter part of the 1980s have radically changed the rice marketing system of Viet Nam, promoting the development of a market economy and a private sector. Market performance has improved during this period, yet several problems remain in order to develop an efficient and effective marketing system. Four main aspects of market performance deserve consideration: a) price variability and margins; b) price transmission across spatially separated markets and market integration; c) marketing costs, profitability, and investment response; and d) restrictions to domestic trade.

Price Variability and Margins

Macroeconomic stabilization in the early 1990's has percolated down to the rice sector. Rice price inflation declined from about 650 percent in 1987 to about 20 percent in 1995 (see IFPRI 1996, chapter 5, section 2). Macroeconomic stabilization has also implied a much lower intra-year price variation: the coefficient of variation of monthly rice prices was 0.05 in the period 1991-95 compared to 0.27 in the period 1986-1990 (see figure 4). Macroeconomic policies, however, have contributed to declining real prices of paddy and rice in the period 1989-1995.

Figure 4. Coefficient of Variation of Paddy Prices

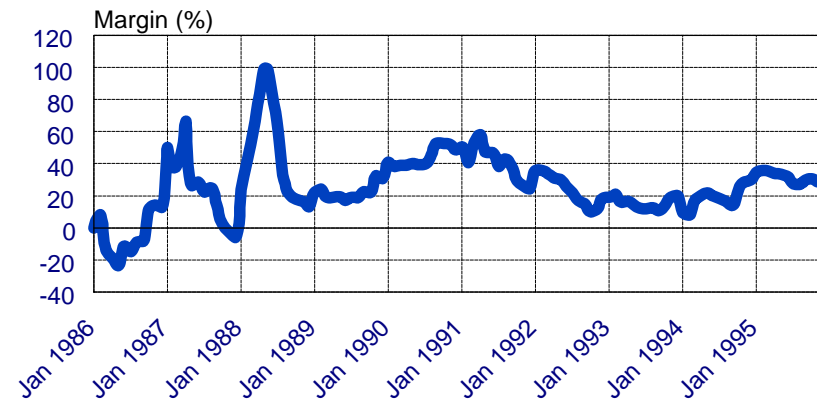


Source: Data from GSO.

Seasonality is not very pronounced in the aggregate. In the period 1991-95, the range between seasonal peak and trough is about 9.8 percent. The seasonal variation is slightly higher in the north than in south (10.9 versus 8.5 percent). The aggregate picture, however, hides a considerable variation at district level, where it is possible to see seasonal variation of up to 27 percent (see IFPRI 1996, chapter 5, section 2). Seasonality of price is a reflection of seasonality of production. In Viet Nam paddy is harvested somewhere each month of the year. March is the month with the largest harvest (about 22 percent of the total), and the four months from May to August contribute an additional 46 percent of total production. The deficit during the lean months (September to January) totals 2.46 million tons (see IFPRI 1996, chapter 11, section 3).

Paddy prices are about 15 percent above the country average in the north and about 12 percent below country average in the south. These regional differences do not show any relevant trend over time (see figure 5). There is no indication of either convergence or divergence of regional prices towards a common level (see IFPRI 1996, chapter 5, section 2).

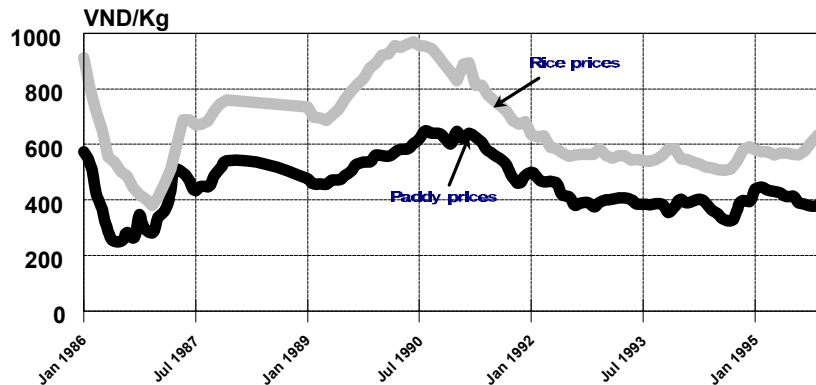
Figure 5. Margin between North and South Wholesale Rice Prices



Source: Data from GSO

Rice prices are about 70 percent above paddy prices. As in the case of regional prices, there is no indication of either long term convergence or divergence between paddy and rice prices (see IFPRI 1996, chapter 5, section 2). On the other hand, the prices of rice and paddy have declined in real terms since 1990 (see figure 6).

Figure 6. Real Prices of Paddy and Rice



Source: Data from GSO.

Price Transmission and Market Integration

Over the period 1991-1995, the number of segmented market links has decreased from 34 to 20 percent of total links. This improvement reflects better price transmission between markets in Viet Nam. However, still only 54 percent of price shocks are transmitted across markets, indicating a system of spatially

separated markets that is still characterized by a very low degree of integration. On average, the adjustment of prices is very slow: it takes about 5 months for price shocks originating in one market to be transmitted to another market (see IFPRI 1996, chapter 5, section 3).

The comparison with other developing countries highlights the poor performance of Viet Nam both because of its poor infrastructure and the presence of trade restrictions (see table 7). In spite of the active participation of the private sector, the local nature of domestic trade makes it difficult to eliminate price differentials across spatially separated markets (see IFPRI 1996, chapter 4, section 6).

**Table 7. Comparative Dynamics
Indicators of Market Integration**

	Egypt Wheat	Bangladesh Rice	Malawi Maize	Pakistan Wheat	Viet Nam Rice
Long Term Multiplier	0.35	0.73	0.49	0.47	0.54
Speed of Adjustment	3.53	2.6	5.7	3.39	5.15

Source: Computations based on GSO Data and Goletti 1994

Marketing Costs, Profitability, and Investment

The private sector has lower marketing costs than SOEs. Unit costs of SOEs in the MRD are \$44/ton whereas they are \$6.55/ton for large millers. Even after taking into account the higher taxes paid by SOEs, SOE costs are about five times higher (see table 8). The main components of these higher costs for SOEs are higher labor and transportation costs (see IFPRI 1996, chapter 5, section 4).

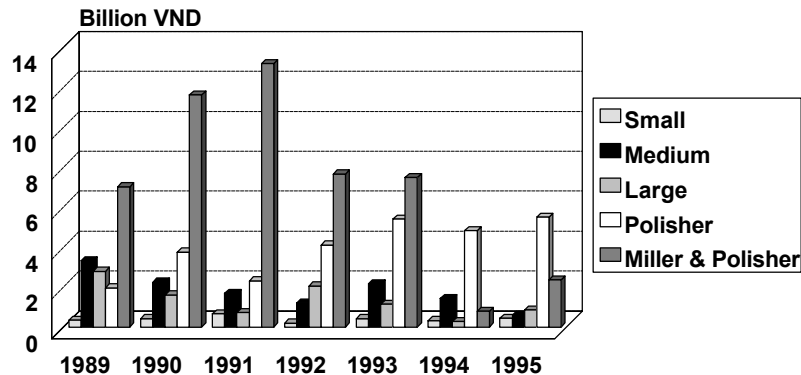
Table 8. Unit Operating Costs
USD/Ton

	Wholesalers	Medium Millers	Large Millers & Polishers	SOE
RRD	7.85	3.26	8.24	55.26
MRD	11.67	6.29	7.29	42.99

Source: IFPRI Survey 1995-96

Market reforms have promoted marketing activities and improved the profitability of various marketing agents as witnessed by the surge in investment of the private sector at the beginning of the 1990s. Millers responded earlier with investment in new machinery, particularly in the NES and MRD (see figure 7). Traders have also responded, but with a lag of two years, reaching their peak in 1994-1995 (see IFPRI 1996, chapter 5, section 5).

Figure 7. Miller Total Investment
MRD



Source: IFPRI Survey 1995-1996.

The greater development of the marketing system in the south does not penalize either farmers or consumers. In spite of higher share of retail price going to marketing agents in the MRD than in the RRD (29 percent versus 17 percent), both farmers and consumers are better off in the MRD than in the RRD. Farmers get higher profits, both in absolute terms (\$148/ton versus \$91/ton) and as a share

of retail price (49 percent versus 29 percent). Consumers are better off because of lower price of rice (see table 9, and IFPRI 1996, chapter 5, section 4).

Table 9. Composition of Retail Price

		RRD (USD/ton)	RRD (% retail price)	MRD (USD/ton)	MRD (% retail price)
Farmers	Unit Cost	206	65	120	40
	Unit Profit	57	18	93	31
	Farmgate Price	263	83	213	71
Marketing Agents	Unit Cost	19	6	33	11
	Unit Profit	34	11	55	18
	Marketing Margin	53	17	88	29
Retail Price		316	100	301	100

Source: IFPRI Survey 1995-96

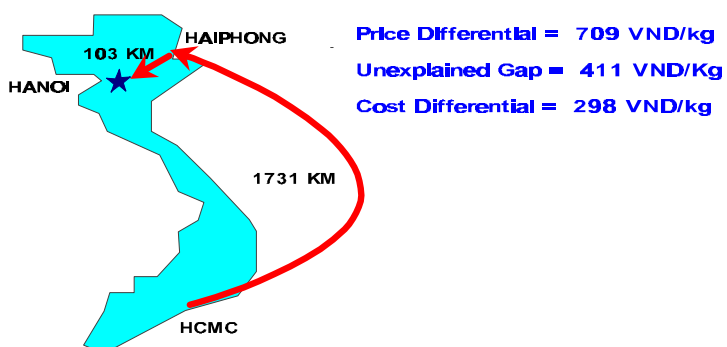
Restrictions on Domestic Trade

Restrictions on inter-provincial movements of rice are perceived by the private sector and SOEs as seriously limiting the flow of rice from south to north (see table 10). Regulations set up in the past to curb rice smuggling are still in effect and make trade from south to north so difficult that they are similar to the procedures needed to trade with another country. Only 42 percent of the gap between prices in the north and the south is explained by the cost of transportation and marketing. The remaining 58 percent is the result of various constraints, notably the restrictions on the inter-regional movement of rice (see figure 8, and IFPRI 1996, chapter 5, section 6).

Table 10. Restrictions on the Movement of goods

Region	Marketing Agent	Percentage Reporting	First Type of Restriction	Second Type of Restriction
NMM	Retailer	3	Police	Inter-Province
	Wholesaler	83	Police	Inter-Province
	Assembler	6	Police	
	SOE	100	Police	Inter-Province
RRD	Retailer	0		
	Wholesaler	12	Tolls	Inter-Province
	Assembler	0		
	SOE	60	Police	Inter-Province
NCC	Wholesaler	100	Tolls	Inter-District
	Assembler	6	Police	
SCC	Wholesaler	7	Other	
	SOE	100		
CH	Wholesaler	15	Other	Inter-Province
NES	Wholesaler	8	Inter-Province	Other
	SOE	17	Inter-District	Inter-Province
MRD	Retailer	1	Police	Inter-Province
	Wholesaler	31	Inter-Province	Police
	Assembler	51	Inter-District	Inter-Province
	SOE	71	Inter-Province	MOT
Viet Nam	Retailer	1	Police	Inter-Province
	Wholesaler	23	Inter-Province	Police
	Assembler	17	Inter-District	Inter-Province
	SOE	57	Inter-Province	Police

Source: IFPRI Survey 1995-96.

Figure 8. Price Differential North-South

Source: IFPRI Survey, 1995-1996.

EXPORTS AND WORLD MARKETS

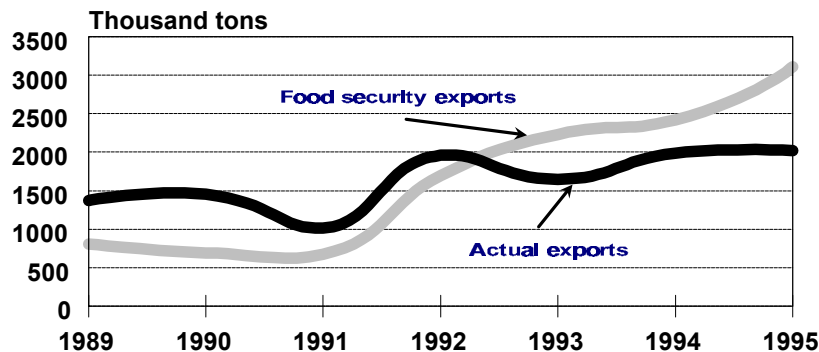
Rice exports from Viet Nam are often cited as the success story of agricultural policy reforms. After many years of being a net importer of food, in 1989 Viet Nam exported 1.4 million tons. After eight years, the position of Viet Nam among major rice exporters seems consolidated, with an average of more than two million tons of rice exports over the past five years.

International markets are in continuous flux. In the past couple of years India has emerged as a new leading exporter, and it may well continue to be so in the years to come. Rice importers are characterized by high turnover and the world rice markets is well known for its instability. It is important therefore to understand the features of past growth of exports from Viet Nam and to relate them to international markets in order to identify the constraints to future growth. Five main sets of issues deserve particular attention, namely: a) the relation between export growth and food security; b) the quality of exported rice; c) price transmission and price comparisons; d) world markets and major competitors; and e) constraints to future growth.

Rice Exports and Food Security

Rice exports in the period between 1989 and 1995 have averaged at 11 percent of total production and grown at a rapid rate of 8.4 percent annually. The export growth has not compromised food security of the country as measured by the rice calories per capita per day. Food availability considerations only would have probably reduced the exports in the initial years of this period, whereas they would have allowed more exports in recent years (see figure 9). An additional million tons of exports in 1995 would have been consistent with food security, yet would have generated an additional USD300 million (see IFPRI 1996, chapter 11, section 2).

Figure 9. Food Security Export



Source: GSO and authors' calculations.

Quality of Exported Rice

The quality of rice exports from Viet Nam has increased dramatically over the years. Whereas Viet Nam had a reputation in the early 1990s for being an exporter of cheap and low quality rice, it has more recently gained a reputation for better quality rice, at least for rice with a broken percentage of 10 percent or less. In 1995, more than 55 percent of total rice exported was of 10 percent broken quality or better. The focus on broken percentage has neglected other aspects of quality that are important to international markets, such as homogeneity of the grain, variety improvement, fragrance, length, etc.

Price Transmission and Price Comparisons

The prices of Vietnamese export rice are becoming closer to Bangkok prices (see table 11). In 1990, export prices of 5 percent broken were 40 percent below the 5 percent broken Bangkok prices, whereas in 1995 they were just 11 percent below. This has been the result of improved milling technology and acquired experience in international markets.

Table 11. Export Prices as a Share of Bangkok Prices

	Export Price (USD/ton)	Bangkok 5% Broken (USD/ton)	Export Price as Percentage of Bangkok Price
1989	194	300	65
1990	170	271	63
1991	226	293	77
1992	207	268	77
1993	203	236	86
1994	218	270	81
1995	266	320	83

Source: Data from Ministry of Trade and USDA

Even though the trend of domestic prices follows the trend of border prices, changes in border prices is only partially transmitted. About 20 percent of the changes in international prices are transmitted to domestic prices. This is the result of policy intervention in the form of quota on exports, and of infrastructural and institutional bottlenecks.

The impact of an export quota is very similar to that of an export tax: both policies reduce exports, lower the domestic price of the good, benefit consumers, and penalize producers. The impact can be measured by estimating the *implicit tax rate*, defined as the export tax that would have the same effect on domestic prices

as the quota. We can get a measure of implicit tax rate in 1995 comparing the domestic wholesale price in the export region with the average export price. Taking into consideration the transport costs, the implicit tax associated with the export quota is 24 percent (see IFPRI 1986, chapter 12, section 3).

World Markets and Major Competitors

The international rice trade is characterized by thinness, volatility, and risk. Less than 5 percent of total milled production is traded, price variability is higher than for other cereals, and the turnover of major importers and exporters is very high.

World rice production has been growing at a rate higher than the world population during the past 30 years, mostly due to growing yields, particularly in Asia, associated with the Green Revolution. In the 1990s, however, yield growth, though still positive, has been considerably lower than in previous decades, and total production has grown less than world population (see IFPRI 1996, chapter 7, section 2).

During the 1980s several countries in Asia strictly adhered to a policy of rice self-sufficiency, but the situation has changed radically during the 1990's, making the international rice market very dynamic. Indonesia and China started to rely upon rice imports to meet their rice requirements. Japan and Korea committed themselves during GATT negotiation to import rice. Viet Nam has imposed a steady presence among the leading exporters together with Thailand and the USA. India may be the next rising star among the rice exporters.

The world market has become more competitive and price sensitive. Thailand and Viet Nam could both compete in the high and low quality rice, whereas the USA is largely oriented to high quality. Only the USA, Australia, and China can provide medium japonica rice, in demand by Japan and Korea.

East and Southeast Asia are the major markets for Viet Nam's rice, with Malaysia the most regular among the major buyers of Vietnamese rice. During 1995, China was a major market for Vietnamese rice. New markets, especially those in Latin America and in the Middle East deserve more attention of Vietnamese exporters in the future.

As the cost of production is largely favorable to Viet Nam, it is important to complement comparative advantage with competitive advantage based on a marketing strategy that promotes Viet Nam rice in several countries, particularly those rice importers characterized by moderate-high and stable growth.

Constraints to Future Growth

Credit constraints affect the performance of rice exporters very seriously; SOEs declared that their credit requirements are about three times the current average loans of \$3.45 and \$5.77 million in the NES and MRD, respectively. SOEs pay monthly interest rates varying between 1.53 and 1.75 percent, which is subsidized relative to a market rate of about 2.3 percent.

Transportation cost to ship rice exports is very high in Viet Nam, relatively to other Southeast Asian ports. A shipment of 10,000 tons out of Saigon could easily cost about \$40,000 in various dues, while the same shipment would cost about \$20,000 in Thailand. The premium that Bangkok rice prices have on Viet Nam prices are partly a reflection of this higher transportation cost.

Foreign buyers' major concern about Vietnamese rice exports is the lack of a consistent policy. Past experiences with repudiation of contracts have given Vietnamese rice exporters a bad reputation. The government has an important role to play to ensure the enforcement of international contracts.

MODELING THE RICE SYSTEM: VASEM

The emergence of Viet Nam as a major rice exporter has raised a number of important policy issues. One of the most important issues is how to balance the need for an adequate supply of rice for its population with the need for foreign currency generated by rice exports. In order to keep the domestic rice price low and ensure sufficient domestic supplies, the government has imposed a quota on rice exports. However, little is known about the effect of the rice export quota on prices, incomes, and production, and how a relaxation of the quota would affect rice markets.

Another important policy issue concerns regional disparities within the country and the effect of internal rice trade on these disparities. The Mekong River Delta (MRD) is a surplus region while the north, particularly the North Mountain and Midland (NMM) region, is a deficit area. To control rice exports, the government tightly regulates the shipment of rice from the south to the north. In addition, national and local authorities have, on occasion, restricted the movement of rice between provinces and even between districts in the interest of food security. To evaluate this policy, it is necessary to understand the regional dimension of rice marketing policy and, in particular, how barriers to internal trade affect rice markets.

The third issue concerns the long-run prospects for Viet Nam as a rice exporter, given its land constraints, its rapidly rising income, and its population growth. Some analysts argue that Viet Nam may not be able to sustain the current levels of exports in the face of expanding internal demand and the difficulty of

maintaining the area expansion and yield improvement of the past decade (Valdecañas, 1996). A critical issue for Viet Nam is what combination of policies will allow it to continue expanding rice exports in spite of these constraints.

The main objective of policy analysis is to provide information to the government regarding important rice marketing issues facing the country. We start with the three rice marketing issues discussed above: export quotas, restrictions on internal trade, and the long-term prospects for exports. For each issue, we identify several alternative rice marketing policies that could be carried out. Each policy option is simulated using the Viet Nam Spatial-Equilibrium Agricultural Model (VASEM) and the results are examined. In particular, we are interested in the effect of each policy on food security, income, and export revenue. To evaluate the policy alternatives, it is not enough to look at national income or national food consumption. We must also examine the effect of each policy on food consumption among different groups in the population: rich and poor households, urban and rural households, and households in different regions.

The VASEM is a multi-market spatial-equilibrium model (the model is described in Appendix 1; for a more detailed description of the model see IFPRI 1996, chapter 12). It is a multi-market model in that it simulates the markets for several related commodities: rice, maize, potatoes and sweet potatoes, and cassava. It is a spatial-equilibrium model in that it takes into account regional differences in production and consumption patterns, as well as the costs of transporting goods from one region to another. The model simulates the food markets in seven regions: the North Mountain and Midlands (NMM), Red River Delta (RRD), North Central Coast (NCC), South Central Coast (SCC), Central Highlands (CH), Northeast South (NES), and Mekong River Delta (MRD).

The model uses a set of equations to represent supply, demand, international trade, and internal flows among the regions of Viet Nam. We provide the initial assumptions by setting the values of the exogenous variables. The exogenous variables include international prices, the export quota, taxes, transportation costs, non-farm income, and marketing margins. The output of the model is the values of the endogenous variables that represent the market equilibrium associated with those assumptions. The endogenous variables include food production, food consumption, income, prices, exports, imports, and inter-regional flows for the four commodities.

One set of assumptions, called the base scenario, is chosen to represent a recent year for which data are available. The base scenario for the VASEM is designed to represent 1995. "Experiments" are carried out by changing the assumptions to represent a different situation or a new policy, running the model, and comparing the resulting equilibrium with the base scenario. These experiments can be used to simulate different policies, such as raising the rice export tax or adjusting the export quota. The experiments can also be used to simulate events

beyond the control of the government, such as an increase in international rice prices or a decline in rice production.

It is important to recognize that these simulations are not predictions because they do not take into account many other factors that affect markets, such as changes in weather, international markets, infrastructure, and policies in other countries. Instead, the simulations give us an idea of what would happen if a particular policy were adopted and all other factors remained the same.

POLICY OPTIONS AND LONG-RUN PROSPECTS

Elimination of Rice Quota

As shown in Table 12, the model indicates that eliminating the rice quota would raise domestic rice prices 20% on average, increase exports from 2.5 to 5.7 million tons, and increase national income 5.8 percent, or US\$795 million per year.

Rice consumption falls by 14% due to the higher prices. Sensitivity analysis suggests that the increase in exports and the fall in rice consumption may be overestimated if the price elasticity of demand for rice is less than the elasticities used in these simulations (see IFPRI 1996, Chapter 12, section 7). The results of sensitivity analysis, however, show that if the domestic price elasticity of demand for rice were just -0.3, exports would rise to 4.6 million tons and rice consumption declines only by 4 percent instead of 14 percent. We get similar results if we assume that the demand for Vietnamese rice exports is not perfectly elastic.

Table 12. Overall Effects of Removing Export Quota

	Amount	Change with respect to 1995 baseline	Percent Change
Rice price (D/kg)	3319	548	19.8
Paddy price (D/kg)	2027	578	39.9
Paddy production (1000 t)	27789	2867	11.5
Rice production (1000 t)	15443	1593	11.5
Rice consumption (1000 t)	9769	-1549	-13.7
Rice export (1000 t)	5674	3142	124.1
Value export (US\$ m)	1526	845	124.1
Farm income per capita (1000 D/yr)	762	166	27.8
Income per capita (1000 D/yr)	2175	140	6.9
Total household income (US\$ m/yr)	14446	932	6.9
Total income (US\$ m/yr)	14491	795	5.8
CPI (base=100)	104	4	4
Staple calories (kcal/day)	1372	-206	-13

Source: Simulation based on VASEM

Economic theory also suggests that export quotas have effects similar to export taxes. The model indicates that the 1995 effective rice export quota of 2.5 million tons is equivalent to a 24 percent tax on rice exports.

Table 13 demonstrates that the impact of the quota removal has a strong regional dimension: rice prices rise 30% in the south, 16-27% in the central regions, and 12-13% in the northern regions. There are two reasons for this pattern. First, rice prices were initially higher in the north so that a given absolute increase in the rice price is smaller percentage change. Second, the absolute increase is smaller outside the south because some of the central and northern regions become self-sufficient in rice. Once this happens, regional prices become “disconnected” from MRD and world prices, and less than the entire MRD price increase is transmitted to these regions.

Table 13. Regional Effects of Removing Export Quota

Region	Change in Rice Price (%)	Change in Rice Production (%)	Change in Rice Consumption (%)
North Mountains and Midlands	12.4	6.7	-6.6
Red River Delta	13.4	7.5	-7.3
North Central Coast	15.9	8.6	-8.6
South Central Coast	17.8	7.8	-12.8
Central Highlands	26.6	11	-18.9
North East South	29.6	13.9	-24.8
Mekong River Delta	30.2	14.7	-22.4

Source: Simulation based on VASEM

It is not surprising that “interior” regions are partially insulated from international prices and trade policy. What is less intuitive is that “interior” regions should be defined according to the commodity flows rather than geography. For example, the Red River Delta is a surplus region with a major port, yet its prices are partially insulated from world prices and trade policy because it does not export and because it is some distance from the exporting region (the MRD).

Table 14 indicates that the *average* effect of eliminating the rice export quota is to boost real income by about 4.9% on average. The increase is highest among farmers in the MRD (12.8%), but other beneficiaries include the rural poor (5.5%) and the rural non-poor (6.1%). Three groups that lose (on average) from the elimination of the rice export quota are the urban poor (-0.4%), rural non-farm households (-1.7%), and poor households in the Central Highlands (-1.0%).

Table 14. Distributional Effects of Removing Export Quota

	Percent Change in Welfare
National average	4.9
Urban sector	1.3
Urban poor	-0.4
Urban non-poor	1.6
Rural	5.7
Rural poor	5.5
Rural non-poor	6.1
Rural farmers	6.5
Rural non-farm	-1.7

Source: Simulation based on VASEM

Overall, only 33% of Vietnamese households are net sellers of rice and fully 60% are net buyers (see IFPRI 1986, chapter 11). Thus, eliminating the rice export quota would have direct benefits for only one third of the households, but the multiplier effect of increased rice revenue creates benefits for most groups. In terms of extreme poverty, defined by the number of people who are below the threshold income set at the 10th percentile of the original income distribution, table 15 indicates that the poverty rate increases slightly in the urban areas, while decreasing slightly in the rural areas. Because the rural areas represent about 80% of the population, the overall effect is to lower the poverty rate slightly. Given the errors inherent in this type of calculation, we conclude that the price changes associated to the removal of export quota have little effect on the total number of people living in extreme poverty.

Table 15. Effects of Quota Removal on Extreme Poverty

(% of households below threshold)

	With Quota	Without Quota
Urban areas	3.2%	3.3%
Rural areas	11.7%	11.5%
Viet Nam	10.0%	9.9%

Source: Simulation based on VASEM and VLSS data

It is worth noting that the three groups that lose (on average) are relatively small, each accounting for less than 4% of the population². Thus, one option would be to replace the export quota with an export tax and use some or all of the tax revenue to fund assistance programs targeted at vulnerable households and rice deficit regions (see IFPRI, 1996, chapter 12, section 3).

Elimination of Barriers to Internal Trade

The model was also used to simulate the impact of eliminating restrictions on internal rice movements (the rice export quota is maintained in this scenario). As noted above, the price equations force the differences between prices in different regions to be no greater than the sum of actual cost of transportation and an implicit tax associated with restrictions on internal trade. The actual costs of transportation were calculated from data provided by traders and state-owned enterprises regarding recent rice shipments. The implicit tax associated with restrictions was inferred from the gap between observed price differences and the cost of transportation. To simulate the effect of eliminating restrictions on internal trade, we remove the implicit tax terms in the price equation so that regional price differentials are constrained to be less than or equal to the actual cost of transportation.

The model indicates that eliminating internal trade restrictions would cause the consumer rice price to fall 2% on average and paddy prices to rise 0.5% on average (see IFPRI 1996, chapter 12, section 4). These averages, however, hide

² Since only 20% of the population lives in urban areas and households are generally better off in urban areas than rural, under this definition only 3% of the population is classified as urban poor.

significant regional differences. As shown in Table 16, rice prices rise 6-7% in the south and fall 8% in the north³. Inter-regional rice shipments increase from 2.1 to 2.4 million tons, as more rice is shipped from south to north. The lower prices in the north convert the RRD from a rice-surplus region to a rice-deficit region. The export quota continues to be binding so there is no change in the level of exports⁴.

Table 16. Regional Effects of Removing Internal Trade Restrictions

Region	Change in Rice Price (%)	Change in Rice Production (%)	Change in Rice Consumption (%)
North Mountains and Midlands	-10.5	-6.1	8.3
Red River Delta	-8	-5	6.3
North Central Coast	-4.8	-2.8	3.5
South Central Coast	5.2	2.6	-4.4
Central Highlands	2.3	0.9	-1.9
North East South	6.8	3.1	-7
Mekong River Delta	6.9	3.8	-6.1

Source: Simulation based on VASEM

The distributional effects are not surprising. MRD farmers in the south and urban households in the north gain, while consumers in the south and farmers in the RRD lose. Nonetheless, the welfare effects for all of these groups are relatively small: the effect on real income is less than 2.5% for all groups considered.

³ Note that the export quota differs from an “equivalent” export tax in this case. With an export tax, rice prices in the exporting region (the MRD) would be fixed at the world price minus the tax, so prices in the north would fall by the full amount of the reduction in the north-south price differential. Under a binding export quota, in contrast, MRD prices are not tied to world prices. An increase in internal (northern) demand for rice raises prices in the south at the same time that the increased supply in the north lowers prices there. The implicit export tax associated with the quota declines.

⁴ Again, the result would be different under an export tax or under free trade. In either of these two cases, the removal of internal trade restrictions diverts some of the MRD surplus to the north, thus reducing exports by several hundred thousand tons.

Per capita farm income rises by 1.9%, while overall income per capita grows by 0.4%. In absolute terms, this represents a US\$99 million gain in income for Vietnamese households. To put this figure in perspective, these gains are more than 40% larger than the benefits *within staple food markets* of cutting domestic transportation costs in half (see IFPRI, 1996, chapter 12, section 4). Naturally, these two figures are not directly comparable because better roads generate benefits in non-food markets as well. Nonetheless, in terms of improving food markets, there seems little point in investments to improve the road network until after essentially costless steps to eliminate legal and administrative obstacles are undertaken.

Long-run Prospects for Rice Exports

The model was also used to examine the interaction between policy, income growth, and technological change in the rice sector over the period 1995-2005. A base scenario for 2005 was adopted assuming 2 percent annual population growth, 8 percent annual non-farm income growth, and 2 percent annual growth in agricultural productivity. The productivity growth is represented by shifts in the supply curves so they do not necessarily imply 2 percent growth in the quantity of agricultural output (see IFPRI, 1996, chapter 12, section 5).

The results suggest that income growth, by itself, will not threaten the continued rice export expansion. Although per capita income growth has been very high in recent years (7-10%), per capita rice consumption may rise initially, but it should begin to fall as Vietnamese consumers diversify their diets⁵. This view agrees with the assessment of the USDA (1995) that “per capita consumption rates in Indonesia and Viet Nam, being among the highest in the world, have little upward potential.”

A second conclusion is that a 2 percentage point difference in rice productivity growth can result in a US\$ 600 million difference in total annual income by 2005 (IFPRI, 1996, chapter 12, section 5). This figure represents the gains accruing to consumers due to lower retail prices and the gains of farmers due to increased output and lower costs of production (though these gains are offset by lower prices)⁶. This result does not necessarily imply that the gains from agricultural

⁵ This conclusion assumes that the relationship between income and rice consumption over time follows the cross-sectional patterns observed in the Viet Nam Living Standards Survey.

⁶ This estimate does not, however, include any losses in the form of reduced tolls or other revenue accruing to government authorities that regulate internal trade.

research outweigh the benefits, but it does suggest that the benefits of improving rice productivity are “large”.

Third, the overall gain in income from eliminating the rice export quota is roughly equal to the gains from a 2 percentage point increase in rice productivity over ten years (IFPRI, 1996, chapter 12, section 5). To be more specific, total income in 2005 would be roughly the same with the 1996 export quota of 2.8 million tons and 4% growth in rice productivity as it would with no quota and a 2% growth rate in rice productivity. In this case, the export quota essentially negates the positive benefits of the 2 percentage points of additional rice productivity growth.

CONCLUSIONS

As rice is the main sector in agriculture and as rice is the main crop grown by the majority of the population of Viet Nam, the development of the rice marketing of Viet Nam has important repercussions not only for the rural economy but also for the entire economy of Viet Nam. Six main conclusions emerge from the previous analysis of rice markets in Viet Nam. The conclusions can be expressed as follows: 1) future growth of the rice sector relies on rice exports; 2) Viet Nam has a large potential for rice exports; 3) the big potential relies upon the development of private marketing; 4) the private marketing is still underdeveloped; 5) targeting is the best way to address food security; and 6) macroeconomic bias against agriculture should be removed. The following sections expand further on each of these conclusions.

Conclusion #1: Future Growth of the Rice Sector Relies on Rice Exports

In addition to increases in productivity, future growth of the rice sector depends on the dramatic increase of rice exports. As the domestic market cannot absorb increases in production, the price of rice will decline unless external demand provides an outlet for increased production. If exports are not allowed to expand, farmers will not have the incentive to increase rice production, in spite of sectoral policies that promote agricultural productivity.

In a market economy, relative prices are the principal determinant of the allocation and use of scarce resources. They influence what goods and services will be produced, how they will be produced, and how they will be distributed among the population. Past rice policies have focused on measures aimed at increasing productivity such as irrigation investment, extension of yield improving varieties, modern plant nutrition and plant protection inputs, and mechanization. In the future, price incentives will be increasingly important, as farmers guide their planting decisions based on profitability.

The agricultural sector model VASEM confirms the previous considerations. In spite of rapid advances in agricultural productivity over ten years, farmers would be worse off than they were in 1995. The increase in rice production (34 percent) is offset by declining rice prices (12 percent) and rising farm population (22 percent).

The export quota, by holding down food prices, effectively transfers the benefits of agricultural productivity improvements from farmers to consumers. Rice consumption rises 39 percent, faster than the 22 percent increase in population. Although higher incomes would reduce per capita rice consumption at constant prices, the lower prices induce an increase in per capita demand. The welfare effect on the poor is, however, quite disappointing as both poor and non-poor households in rural areas lose.

Conclusion #2. Viet Nam Has a Large Potential for Rice Exports

Viet Nam has considerable rice export potential which is seriously limited by a series of constraints related to: a) the policy of setting a rice export quota; b) infrastructural bottlenecks aggravated by high shipping fees; c) poor quality of rice exports; and d) lack of transparency and credibility.

a. Rice export quotas are a serious constraint to growth

To a certain extent, rice quotas insulate the domestic economy from the vagaries of international trade. By reducing the transmission of international prices to domestic prices, the quota system provides a form of price stabilization. The export quota protects farmers from the effects of international price changes, but only by holding income below what it would be even with low international prices. This stabilization, however, is achieved at a considerable cost for the national economy. The agricultural spatial equilibrium model shows that the elimination of quota leads to an increase in rice production resulting in a dramatic increase in the surplus available for export, amounting to over 4 million tons. The rural poor and farmers are the main beneficiaries of this policy. Farmer income from staple food production rises 28 percent and net welfare benefit of the poor (taking into consideration both sales and purchases of food) increases by 5 percent. The growth of agriculture has multiplier effects on the rest of the economy, so that total income of the country rises by \$800 million. The negative effects on some regions, such as the CH and the NES could then be compensated by redistribution of the net gains in national income.

b. Infrastructural bottlenecks aggravated by high shipping dues

Poor port infrastructure and congestion at Saigon port - the port out of which 70 percent of total rice exports is shipped - are responsible for high cost of transportation of rice destined to export. The additional port of Can Tho in the middle of the Mekong Delta, the main surplus region of the country, is rapidly expanding its activities, but is still seriously constrained by insufficient investment to improve navigation of vessels with capacity above 5000 tons. Poor infrastructure, however, is not the only problem. High shipping dues in Viet Nam combined with the delays in loading operations and the slow movement along the channels linking Saigon Port to the South China Sea help to explain a higher discount of Viet Nam rice in international markets. Although these are charges paid by the foreign buyers (since most exports of rice are on a FOB basis), these fees are undoubtedly built into the FOB price offered by these buyers. This explains the fact that FOB prices of Vietnamese rice are 13-15 percent lower than those from major competitors such as Thailand.

c. Poor quality of rice exports

Quality improvement in Viet Nam rice exports has for too long been identified with the single criterion of broken percentage. The country has made remarkable progress since 1989 when less than 5 percent of total exports was 10 percent broken or less. Quality, however, depends on other factors, such as moisture content, length of grain, fragrance, homogeneity, color, absence of foreign matter, etc. Quality improvement depends not only on processing, but on drying technology, on variety improvement, and on storage conditions. The process of ensuring consistent quality in Viet Nam is complicated by the absence of large processing and storage facilities capable of consistently supplying shipments of 10,000 tons or more. The current practice is to load vessels with rice supplied by many - often 20 or more - warehouses that assemble rice processed by an even greater number of mills. It is not surprising that the only consistency in quality that can be obtained in this process is by focusing on broken percentage.

d. Lack of transparency and credibility

The development of an efficient marketing system depends on a set of institutions that make rules known and credible, so as to avoid the transaction cost associated with searching, negotiating, writing and enforcing of contracts. Foreign buyers have often complained of the arbitrariness of rice policy in Viet Nam leading to breach of contracts, disputes concerning payments and interpretations of contracts, negotiation practices that are very complicated and time consuming, and a general business atmosphere much more complicated than in neighboring countries. These complaints are part of the explanation of a discount of Viet Nam rice in international markets.

Even Vietnamese marketing agents suffer from the lack of transparency and credibility in rice policy. SOEs have found themselves in the position of repudiating contracts with foreign buyers due to sudden changes in policy. The quota allocation system is itself a source of various conflicts among SOE that are not completely resolved on the basis of clearly set guidelines. The allocation of quota and the determination of the amounts is not always based on efficiency criteria.

Conclusion #3. Fulfilling this Potential Depends on Development of Private Marketing

Export growth depends on the development of an efficient and effective marketing system able to meet the needs of domestic and international markets at low cost. The development of such a system relies heavily on the participation of the private sector. The private sector has responded very strongly to market reform; yet, its potential contribution to the rice sector and to national income is still largely underdeveloped.

a. The private sector plays a major role

While the private sector contribution to industrial GDP is only 31 percent, the private sector contributes 97 percent to agricultural GDP. The role of the private sector in the rice system is not limited to production, but also includes marketing. About 98 percent of paddy is procured by private marketing agents, including traders and millers. The presence of SOEs in the marketing system is relevant in the marketing channels leading to rice exports, while their role in the domestic distribution of rice is rather limited. With over 20 percent value added in domestic rice consumption, the private marketing agents contribute over \$700 million to the sector. The rice export activities of SOEs would be inconceivable without the complex web of suppliers and intermediaries from the private marketing system of the southern regions of MRD and NES.

b. The private sector has responded very strongly to market reforms

The private sector has responded very strongly to the incentives provided by the market oriented policies during the past 10 years. The impressive growth of production and the investment behavior of key marketing agents are the best examples of this response in the rice marketing system. Paddy production growth of 5.1 percent per year over the past 10 years has been achieved through farmers' expansion of cultivated area and the adoption of yield improving technologies. Investment by marketing agents peaked in the first part of the 1990s, with millers investing in new equipment, especially polishers for processing rice destined for export, and traders investing in transportation equipment and storage facilities to meet the requirements of an expanding domestic trade.

c. Yet, the private sector potential contribution is still largely underexploited.

The marketing system is characterized by a multitude of small marketing agents involved both in trading and milling. The average size of purchases and sales is small, even in the more developed rice system of the MRD. With the exception of a few large millers, polishers, and traders in the south, the marketing agents have a very low asset base and most of their transactions are conducted at the local level. About 90 percent of trade flows take place within a distance of 100 km from the residence of marketing agent, and only a marginal volume of transactions is inter-regional.

Market integration has slightly improved over the past ten years. The number of segmented markets, however, is still high, and the extent of price transmission is rather limited, with only 54 percent of price signals being transmitted on average among spatially separated markets. Even in comparison to other economies at similar level of development, this is considered a low level of integration. The low level of market integration in Viet Nam is the result of several factors related to internal trade restrictions and low level of infrastructural development.

Significant postharvest losses of 13-16 percent of total production occur as the result of inadequate drying and storage facilities and processing technology with low milling conversion factors of 65 percent.

The low level of rice stocks held by the private sector and the relative short stock holding periods (about two weeks for the largest millers in the MRD) are a further indication of the low level of development of the private sector. The limited stocks represent a serious constraint to meet the shipment requirements for world market often implying vessel sizes of over 10,000 tons.

Conclusion #4. The Private Marketing Is Still Underdeveloped

Several factors reduce the efficiency of rice markets in Viet Nam, thus reducing the purchasing power of households. The main ones refer to a) policy restrictions on rice flows across regions; b) barriers to entry in the export sector; c) limited access to credit for marketing; and d) limited access to information.

a. Policy restrictions on rice flows across regions

Restrictions on inter-provincial movements of rice seriously limit the flow of rice from south to north. These restrictions are equivalent to implicit taxes on rice movements. The differential between north and south rice prices was about 700 Dong/kg in 1995. Only 42 percent of the price gap is explained by cost of transportation and marketing. The remaining 58 percent is the result of various

constraints unrelated to infrastructure. The elimination of these implicit taxes on domestic trade would raise national income by almost \$100 million per year.

b. Barriers to entry in the export sector

Private sector is still not allowed to participate in rice exports, even though it is the key force responsible for producing and distributing rice in the country. The current system allowing only SOE to be involved in rice export could not function without the complex web of relations with suppliers and intermediaries from the private sector. The development of private large mills and polishers and large trading companies capable of meeting the requirements of international markets is therefore made rather difficult. This is the case in spite of a highly efficient private sector, with unit marketing costs between one fifth and one third of those of SOE.

c. Limited access to credit for marketing

Both the private sector and SOEs are seriously limited in their access to credit necessary to conduct procurement operations, to finance storage activities, and to fund productive investment. Credit requirements at peak are estimated to be five times the actual credit obtained by SOE and ten times the credit available to private sector. Storage is typically of a very short-term duration and even for larger marketing agents the average period of holding stock is about two weeks. Even though some investment in processing and transportation equipment has taken place during the past six years, further investment is needed to improve the current capital stock and complement physical stock (machinery, buildings, transportation means) with human capital formed through training in marketing, quality control, and financial management.

The existence of these needs does not imply that the government should make all these investments itself. The government, however, has an important role to play in facilitating access to credit, in providing a predictable environment for rice marketing, and in allowing the key participants, both from the private sector and SOEs, to make their own investments in storage, processing, and transportation.

d. Limited access to information

Most information related to prices, regulations, and market conditions are communicated through personal contacts. There are no official channels of communication of market relevant information among the private sector such as those provided by trade associations and chambers of commerce in other countries. Even for rice exports, a flexible marketing system capable of meeting the challenge of dynamic and continuously changing international markets has not yet developed. The country is not pursuing an aggressive marketing strategy aimed at increasing its market share in world markets, thereby endangering its current position among leading exporters and risking to be overtaken by its more dynamic

competitors. The absence of private sector intermediaries who search for potential buyers and who negotiate between buyers and sellers in the world market is also an indication of a marketing system that is still very far from fully developed.

Conclusion #5. Targeting and Income Growth Are the Best Ways to Address Food Security

Targeting and income growth are the most effective ways to address food security. Price policy and internal and external trade restrictions are not an effective way to meet food needs of the poor in so far as they lower the growth of the economy and are not targeted to the food insecure.

Most of the scenarios studied under various policy options show that low food prices are benefitting consumers at the expenses of farmers, the rural poor, and national income. The assumption that the poor are necessarily penalized by high rice prices is not warranted by the analysis of household surveys showing that 37 percent of the poor are net sellers. It can be shown that it is possible to implement food or cash redistribution mechanisms to compensate the food insecure (see IFPRI 1996, chapter 12, section 3).

Conclusion #6. Macroeconomic Policy Penalized Agriculture

The positive impact of sectoral policies to promote agricultural growth may be diminished or even reversed by macroeconomic policies that reduce farmers incentives through inflationary policy and appreciation of the real exchange rate.

Macroeconomic stabilization in the early 1990s has had a positive effect in reducing inflation and has contributed to lowering the price variability of rice markets during the 1980s. Macroeconomic policies, however, have not been able to improve the rice farmers incentives during the 1990s. Real prices of paddy have declined by over 30 percent since 1989; moreover, the competitiveness of rice prices has also declined relatively to fertilizer, the main material input (see IFPRI 1996, chapter 9).

The most significant determinant of the observed decline was the large appreciation of the real exchange rate, which reduced the relative profitability of all tradable goods, including rice. The real exchange rate decreased at a rate of 12.5 percent annually from 1989 to 1995, more than offsetting the combined impact of the favorable changes in foreign prices and sectoral policies promoting rice production. The real exchange rate appreciation was sustained by increased current-account deficits and capital inflows during 1993-95.

The large devaluations of the years 1990 to 1992 did not result in a real exchange rate depreciation because of rapid domestic inflation, averaging 52 percent annually. The inflation was fueled by expansionary monetary policy, which in turn was caused by the large fiscal deficits that averaged 9 percent of GDP during 1990-92. Subsequently, more prudent monetary and fiscal policies were adopted, as reflected in the sharp reduction of the inflation rate to an average of 16.2 percent during 1993-95. The latter subperiod was, however, characterized by a relatively stable nominal exchange rate, so that the real exchange rate further appreciated at an average annual rate of 14.5 percent.

If sustained over time, real exchange rate appreciation may nullify the gains of productivity obtained through technological change in agriculture. The agricultural sector spatial equilibrium model shows that under a scenario of a growth of production of 2 percent annually over 10 years period and just 2.6 percent annual appreciation of the real exchange rate, farmers are not only unable to benefit from technological change but, in fact, their income per capita is reduced by 9 percent (see IFPRI 1996, chapter 12, section 5).

POLICY RECOMMENDATIONS

Viet Nam could rival Thailand as the largest exporter in the world by year 2005 provided that rice exports are not too heavily taxed, that quotas are not too restrictive, and that the exchange rate depreciates at a pace close to that of inflation. In order to exploit this large potential, the obstacles that prevent the development of an efficient and effective marketing system have to be removed. The conclusions presented in the previous section suggest a set of policy recommendations to improve the rice marketing system of Viet Nam while contributing to higher national income, higher farmers income, and food security. The recommendations are organized into five groups: 1) elimination of external and internal restrictions; 2) promotion of rice marketing measures; 3) macroeconomic stability; 4) targeting and food security; 5) agricultural research.

Recommendation #1. Elimination of External and Internal Restrictions

The rice export quota system should be progressively dismantled

Having shown the benefit to the country, the farmers, and the poor of increasing rice exports, the issue is how to dismantle the current system gradually over time in order to avoid destabilization of the markets. Different options are available.

a. Progressively increase the quota until it is not binding

If the current quota of 2.8 million tons is increased by 7 percent per year over a period of 10 years, given the base assumptions on productivity and population growth, it would result in a quota of 5.7 million tons in 2005. Farmers and the poor would benefit from this situation as opposed to the base scenario with lower quota that penalized the farmers, the poor, and the national economy.

b. Substitute current quotas with export taxes

We have seen that the quota system in 1995 was equivalent to an implicit tax on exports of 24 percent amounting to a rent of \$128 million. SOEs were the real beneficiaries of the system, while farmers, the rural poor, and national income were the losers. This quota system could be converted to a more transparent system of taxation, maybe set at a level of 10-20 percent in the short term and to zero in the longer term. Not only does this increase national income, but it reduces the incentives for smuggling and the need for restrictions on internal trade. Part of this export tax could be used for targeted food programs, investment in agricultural research, or promotion of marketing.

The private sector should be given access to rice exports

The elimination of barriers to entry of the private sector in the rice export business would contribute to the development of a strong private sector capable of competing internationally. The competition with SOEs would lower the cost of marketing of the latter and improve the efficiency of the system. Even after taking into account the higher taxes paid by SOEs with respect to the private sector, SOE unit marketing and operating costs are five times higher. Moreover, the development of the private sector would free the government from making some of the investment needed to improve the marketing system. We have seen that the private sector has already responded positively to the market policies promoted during the past 7 years. This response could be further accelerated if the long-distance trade, both domestic and international, were opened up to the private sector.

Internal policy restrictions on rice movement should be dismantled and internal trade freely allowed

The cost of the current restrictions of south-north trade is paid by consumers in the north who have to pay higher prices for rice and farmers in the south who receive lower prices for paddy. We have seen that the value of this change in policy is \$62 million per year and that increases farmers income by 1.9 percent and staple calories by 0.8 percent. The interesting aspect of this policy is that by removing restrictions on internal trade it generates benefits for the Vietnamese economy that are more than 65 percent larger than the benefits of cutting

transportation costs in half. Furthermore, the elimination of restrictions on internal trade is a policy that could be implemented at virtually no cost, while improvement in transportation infrastructure is a costly and time-consuming process. This is not to suggest that investment in infrastructure is not useful. But there is little point in improving infrastructure unless legal and administrative restrictions on trade have been lifted.

Recommendation #2. Promotion of Rice Marketing

a. Rice export should be promoted with a set of measures to improve rice quality, reduce shipping costs, and improve the reputation of Viet Nam exporters among foreign buyers.

Key among these measures are the institution of quality standards and quality control systems, improved port infrastructure both in HCMC and in Can Tho and lower port fees, and enforcement of contracts and commitments of Vietnamese exporters with foreign buyers.

b. Provide access to credit to marketing agents to facilitate procurement operations, storage activities, and investment in processing and transportation.

Credit should not be subsidized, but given on the basis of sound banking principles.

c. Provide access to information concerning prices, food production, international markets, and marketing system to a variety of marketing agents, both in the private and public sector.

Central to this policy is the extension of marketing information through publications, bulletins, electronic mail, fax, and training activities in Viet Nam and abroad.

d. Stability and credibility of policy are critical to its success.

A firm commitment to the promotion of private sector development in rice markets will be accompanied by a growth of private investment to improve the marketing system that complements the public investment in the past.

Recommendation #3. Remove Macroeconomic Bias Against Agriculture

Macroeconomic policies should be monitored in order to avoid penalizing farmers with real exchange rate appreciation that will reduce exports and farmers incentives.

Policy decisions made outside the Ministry of Agriculture have had an indirect but predominant price effect. Not only producers of rice, but also those of other

tradable goods (agricultural and nonagricultural) will benefit if the fiscal and monetary authorities succeed in further reducing the difference between domestic and foreign inflation rates.

Recommendation #4. Target the Poor and Food Insecure

Food security stocks and distribution targeted to food insecure households

The benefit to the poor of policies that promote agricultural growth are higher than those achieved by keeping rice prices low and restricting domestic or external trade. The analysis of household budgets indicates that the biggest losers from higher rice prices are the urban poor and the rural non-farmers, but these groups are relatively small. The urban poor include only 3 percent of the population, while rural non-farmers are 9 percent of the population, but only one third of them are poor.

Food or cash distribution programs have been repeatedly shown in a number of countries to be more efficient (that is lower cost) and more effective at reaching the poor than price or trade policy restrictions. Examples of these programs are self-targeted programs such as rice-for-work public works projects and low-quality rice distribution. Part of the benefits from increased exports such as those arising from implicit or explicit export tax revenues should be used to finance these programs.

Recommendation #5. Invest in Agricultural Research

Part of the export tax revenues should be earmarked for agricultural research investments described in the following paragraphs.

Investment in agricultural research targeted to improve yield

It has been shown that a 2 percent point difference in food productivity growth results in a US\$600 million difference in income after 10 years. Agricultural productivity alone, however, will not benefit the economy or farmers if the right incentives are not provided. A tight quota, for example, will discourage production and negate the benefits of this productivity growth.

Investment in agricultural research targeted at improving quality

Agricultural research has been for too long focuses on yield improving technology. Without diminishing the importance of yield improving technology, complementary research should address the issue of variety improvement that contribute to higher quality of rice.

Investment in post-harvest technology

Existing post-harvest technology is still expensive and not affordable by the majority of farmers and marketing agents. While improved incentives will contribute to private investment in postharvest technology, public investment should focus on promoting new cost-effective postharvest technology, particularly in loss-reducing drying and storage methods.

APPENDIX 1: STRUCTURE OF THE MODEL

The following is a list of the nine types of endogenous variables, along with the number of variables in each category.

BS_{cr}	Budget share for commodity c in region r	28
S_{cr}	Supply of commodity c in region r	28
PS_{cr}	Producer price for commodity c in region r	28
PD_{cr}	Consumer price for commodity c in region r	28
M_{cr}	Imports of commodity c into region r	28
X_{cr}	Export of commodity c from region r	28
$TQ_{crr'}$	Quantities of commodity c transported from region r to region r'	196
Y_r	Nominal income of household in region r	7
P_r	Consumer price index	7
IXT_c	Implicit export tax associated with quota	4

Demand: The budget share for commodity c in region r (BS) is a function of the log of consumer prices of the four commodities (PD) and the log of real income, where real income is nominal income (Y) deflated by Stone's price index (P).

$$BS_{cr} = \alpha_{cr}^D + \sum_{c'=1}^4 \beta_{cc'/r}^D \ln(PD_{c'/r}) + \theta_{cr} \ln\left(\frac{Y_r}{P_r}\right) \quad (1)$$

Supply: The supply of commodity c in region r (S) is determined by the producer prices of all four commodities in region r (PS).

$$\ln(S_{cr}) = \alpha_{cr}^S + \sum_{c'=1}^4 \beta_{cc'/r}^S \ln(PS_{c'/r}) \quad (2)$$

Price index: The Stone's price index in each region r (P) is a geometric weighted average of the four consumer prices (PD), where the weights are the budget shares (BS) of the respective commodities.

$$\ln(P_r) = \sum_{c=1}^4 (BS_{cr} \ln(PD_{cr})) \quad (3)$$

Supply balance The supply of each commodity in each region (S) must be greater than or equal to the sum of the shipments from that region r to other regions in the country (TQ) and exports from the region (X). Note that the shipments (TQ) include

the movement of the commodities from producers in each region to consumers in the same region.

$$S_{cr} \geq \sum_{r'=1}^7 TQ_{crr'} + X_{cr} \quad (4)$$

Demand balance Similarly, the sum of the shipments of commodity c into region r (TQ) plus the imports of commodity c into region r is greater than the quantity demanded of commodity c in region r.

$$\sum_{r'=1}^7 TQ_{cr'r} + M_{cr} \geq BS_{cr} Y_r / PD_{cr} \quad (5)$$

Income The income of each region (Y) is defined as the sum of nonfarm income (NFY) and farm income. Farm income is the sum of net revenue from each of the four crops, where net revenue is assumed to be a constant proportion (YR) of the value of production⁷. Nonfarm income is exogenous in the base scenario (NFY₀), but a multiplier is used to reflect the indirect effect of growth in farm income over the base value (FY₀) on non-farm income. The multiplier of 0.65 implies that a 1 unit expansion in farm income results in a 0.65 unit increase in nonfarm income.

$$Y_r = NFY_r + 0.65 \left(\sum_{c=1}^4 YR_c (S_{cr} PD_{cr}) - FY_0 \right) + \sum_{c=1}^4 YR_c (S_{cr} PD_{cr}) \quad (6)$$

Internal price relations The consumer price for a commodity in region r (PD) is greater than or equal to the sum of the producer price in region r*, the transportation costs from region r* to region r (TP), the implicit tax between r* and r (ITX), and the product-specific cost of processing and marketing (MKT).

$$PS_{cr} + TP_{rr'} + ITX_{rr'} + MKT_c \geq PD_{cr'} \quad (7)$$

⁷ Production is valued at consumer prices (PD) for two reasons. First, total expenditure, as calculated in the VLSS, values home production at consumer prices. Since 60 percent of rice production is in the form of home production, it is more consistent to calculate income at consumer prices than producer prices. Second, the majority of households (and even a majority of farmers) in Viet Nam are net buyers of rice. For these households, the opportunity cost of an additional unit of production is the consumer price of rice.

Import-domestic price relations The consumer price of commodity c in region r (PD) is no larger than the CIF import price (PM) plus transportation costs to region r (TP), plus the implicit tax associated with this transportation (ITX), plus the implicit tax associated with import quotas (IMT), if any.

$$PM_c + TP_{world\ r} + ITX_{world\ r} \geq PD_{cr} \quad (8)$$

Export-domestic price relations The producer price of commodity c in region r (PS) plus transportation costs from region r to the border (TP) plus the implicit tax associated with this transportation (ITX) plus the implicit tax associated with export quotas (IXT), if any, must be greater than or equal to the export (FOB) price on world markets.

$$PS_{cr} + TP_{r\ world} + ITX_{rworld} + IXT_c \geq PX_c$$

Export quota The exports of commodity c (X) cannot exceeding the export quota ($XQUOTA$) for that commodity. This equation is used to impose the rice export quota.

$$XQUOTA_c \geq \sum_{r=1}^7 X_{cr} \quad (10)$$

The model consists of 10 blocks: four equations and six inequalities. The software used (GAMS/MCP) constructs the equations corresponding to the Kuhn-Tucker conditions for each inequality. The programmer needs only identify the Lagrange multiplier that corresponds to each inequality. The multiplier for the supply and demand equations (1 and 2) are the producer prices (PS) and consumer prices (PD), respectively. The multiplier for the domestic price equation (7) is TQ , the shipments between regions. The multiplier for the import and export price equations (8 and 9) are imports (M) and exports (X), respectively. Finally, the multipliers for the export quota equations (10) is the implicit export tax (IXT), respectively.

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