Draft – Comments Welcome

The Effects of Rice Policy on Food Self-Sufficiency and on Income Distribution in Vietnam

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Abstract

Rice policy in Vietnam has traditionally been concerned with maintaining food self-sufficiency, while protecting the poor. In this paper we specify and estimate demand and supply curves for rice, using data from the Vietnam Living Standards Survey of 1998, and use the estimates to help forecast production and consumption through 2018. The results show that rice self-sufficiency is likely to continue for the foreseeable future; indeed, exports are expected to rise slightly.

Export taxes and subsidies are among the main tools of rice policy. A 10% tax on exports, by cutting the domestic price of rice, would trim production and boost consumption, reducing exports by over a quarter. Such a tax would help affluent households, and those living in remote areas, because they are net purchasers of rice. The very poor would be helped, while somewhat poor households would, on average, be hurt by an export tax on rice.

1. Introduction

Rice has a special place in the Vietnamese economy and in the popular imagination. It is the dominant staple crop in the country, accounting for 92% of grain production, 45% of agricultural output, and an estimated 7.5% of GDP (GSO 2004). Almost 43% of farmland is devoted to rice, and as recently as 1998, 65% of households cultivated at least some rice. In the same year, 17% of household spending was devoted to rice (including home consumption), a figure that ranged from 36% for the poorest fifth of the population (as measured by expenditure per capita) to 7% for those in the top quintile. Rice has a weighting of 20.15% in the consumer price index.

Rice is also an important export earner. Since 1996, Vietnam has exported at least 3 million tonnes of rice annually; over the decade 1993-2002 Vietnam was the world's second largest exporter of rice by volume, or fourth largest as measured by value (FAOSTAT 2004 data); the country accounted for 13.5% of the total volume of rice exports, exceeded only by Thailand (26.8%). By 1996 rice accounted for 11.1% of Vietnamese export earnings, although by 2003 this proportion had declined to 3.6%.

Given the importance of rice – as a source of food, of income, of export earnings – it is not surprising that issues related to rice have received considerable attention from the government of Vietnam. But rice policy has changed dramatically over the past two decades, and it continues to evolve. To cite just two recent examples:

- In April 2004, the Minister of Natural Resources and the Environment proposed that the land area devoted to rice cultivation be allowed to fall from the current 4.02m hectares to 3.8m hectares (EIU 2004b). This would represent a major shift in thinking, because currently it is difficult to obtain permission to convert rice land to other uses.
- In June 2004, the Ministry of Trade proposed a significant relaxation of the rules governing rice exports, in effect replacing a system where rice export contracts have to be licensed to one where they only have to be reported (Oryza, 3 June 2004). This would continue a decade-old trend towards liberalizing the rice export market.

Underlying the evolution of rice policy are two major concerns. The first is to ensure food security, which traditionally has been equated with rice self-sufficiency. As recently as 1988 Vietnam was a significant net importer of rice, and there is a live memory of the near-famine conditions in the north of

the country in 1987. The second overarching concern in rice policy is with poverty, and more specifically a worry that changes – especially market liberalization – in the rice market might hurt the county's poor.

In the light of these concerns, this paper addresses two sets of questions.

1. How serious are worries that, within a few years, Vietnam will again become a net rice importer? And what effect would policy changes – such as an export tax on rice, or a devaluation – have on this situation?
2. What effects would changes in rice policy, particularly changes that would alter the domestic price of rice (such as an export quota or export tax or subsidy), have on income distribution and poverty in Vietnam?

Before addressing these questions, it is first necessary to provide some further background, on the rice sector specifically, and on economic policy in general (section 2). This is followed by an analysis of the links between rice policy and self-sufficiency (section 3) and between rice policy and income distribution (section 4).

2. Vietnamese Rice Economy and Policy

In 2003, Vietnam produced 34.5 million tonnes of paddy, almost three times the level of 1976 (Figure 1 and Table 1). Over the same period, the area sown to rice rose by almost 50%, mainly due to the extension of double and triple cropping that was made possible by investments in irrigation. Yields doubled during this period, and in 2003 were about 4.6 tonnes of paddy per sown hectare, somewhat lower than in China (6.1 tonnes), similar to yields found in Indonesia (4.5 tonnes) and well above the yields in Thailand (2.5 tonnes), consistently the world's leading exporter of rice (FAOSTAT). Production in 2003 amounted to 300 kg. per capita, more than sufficient to satisfy domestic needs; a sixth of the crop was exported (Figure 2).

Although rice is grown in all the regions of Vietnam, the two most important "rice bowls" are the Red River Delta centered on Hanoi (19% of total output in 2003) and the Mekong Delta in the south (51% of output). In years of good harvest, the densely-populated and comparatively poor Red River Delta, which has the highest yields per hectare in the country, sometimes generates a net surplus, but almost all of the country's consistent export surplus comes from the Mekong Delta.

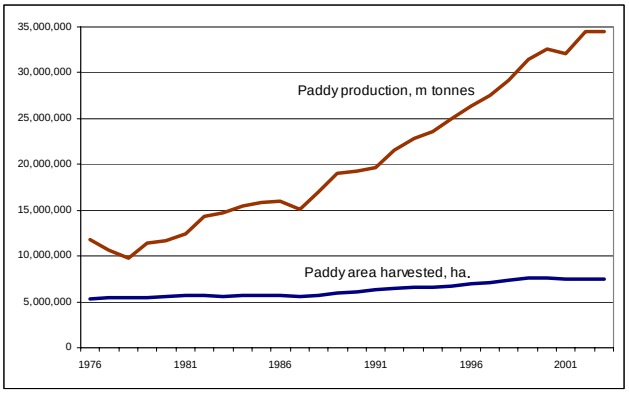


Figure 1. ***Paddy production and area harvested, 1996-2003***

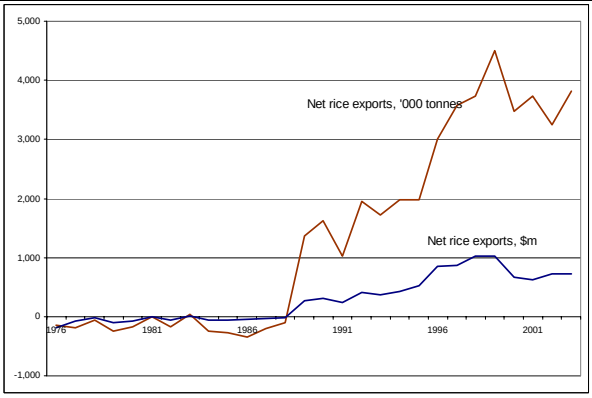


Figure 2. ***Rice exports, value and volume, 1996-2003***

Table 1
Harvested area, paddy output, and rice exports, 1988-2002

	Harvested area, '000 ha.	Production, '000 tonnes paddy	Yield, tonnes of paddy per ha.	% growth of area harvested	% growth of production	Net exports of rice, '000 tonnes
1976	5,297	11,827	2.23	1.3*	1.4*	-142
1981	5,652	12,415	2.20	0.2**	3.5**	-3
1988	5,741	17,000	2.96	2.46	12.56	-108
1989	5,911	18,996	3.21	2.97	11.74	1,365
1990	6,043	19,225	3.18	2.23	1.20	1,622
1991	6,303	19,622	3.11	4.30	2.06	1,027
1992	6,475	21,590	3.33	2.74	10.03	1,944
1993	6,559	22,837	3.48	1.30	5.77	1,721
1994	6,599	23,528	3.57	0.60	3.03	1,983
1995	6,766	24,964	3.69	2.53	6.10	1,977
1996	7,004	26,397	3.77	3.52	5.74	3,003
1997	7,100	27,524	3.88	1.37	4.27	3,575
1998	7,363	29,146	3.96	3.70	5.89	3,729
1999	7,654	31,394	4.10	3.95	7.71	4,503
2000	7,666	32,530	4.24	0.17	3.62	3,477
2001	7,493	32,108	4.29	-2.26	-1.28	3,726
2002	7,504	34,447	4.59	0.15	7.28	3,241
2003	7,449	34,519	4.63	-0.73	0.21	3,820

Source: FAOSTAT data 2004 [accessed July 10, 2004]. GSO (2004) for recent production and area figures. EIU (2004a) for recent export figures.
Notes: * 1976-1981 annual average. ** 1981-1988 annual average

According to the Vietnam Living Standards Survey of 1998, 65% of all households were involved to at least some extent in rice cultivation. The typical household consumed 149 kg. of rice per person per year in 1998 (Table 2), with modest levels among the poorest fifth of the population (137 kg./capita) and the richest quintile (128 kg./capita) and higher consumption levels (157-163 kg./capita) in between. The low consumption level of poor households is evidence of inadequate nutrition; for rich households it is an indication that they are shifting to higher-quality foodstuffs.

Table 2
Breakdown of expenditure by type, 1998

	Breakdown of expenditure						Expend/HH	SE of
	Expenditure per capita quintile					All	'000 dong	Exp/HH
	Low	Lo-mid	Middle	Mid-upr	Upper	**HH**		
Rice consumption/cap, kg p.a.	137	160	163	157	128	**149**		
Rice as % of expenditure	36.0	28.0	22.3	15.6	6.8	**16.5**	2,615	38
Oth cereals & tubers as % exp.	2.8	1.8	1.8	1.8	1.4	**1.7**	272	12
Memo: Food as % of tot	65.4	59.8	54.6	48.5	35.2	**47.0**		
***Memo:* Expenditure per capita, '000 dong**	1,172	1,727	2,234	3,060	6,268	**2,893**		
% of hh active in agric.	79	80	72	59	24	**59**		

Source: Based on VLSS98. Sample size: 5,999
Note: Exchange rate in January 1998 was 12,290 dong/USD, so average expenditure per household was $1,287 p.a.
Memo: Income per capita was 3,217,000 dong per year.

In looking at rice production, it is conventional to divide the period since 1975 into three parts: the immediate post-unification period (1976-1981); a period of limited reforms (1981-1988); and a return to a household-based farm economy (1988-).

After unification in 1975, agriculture in the south of Vietnam was collectivized. The weakened incentives facing farmers, combined with limited supplies of modern inputs, led to stagnation in yields, so that all of the modest expansion in output between 1976 and 1981 was due to an increase in the area sown to rice. This expansion in cultivation did not keep up with population growth, and Vietnam imported moderate quantities of rice to supplement domestic production; Pingali and Xuan (1992) provide further details.

In 1981, in an effort to create stronger incentives for farmers, the government introduced a rudimentary contract system, not unlike the one that had come into operation in China after 1978; farmers were required to deliver a set amount of rice to the state at a fixed (low) price, but could dispose of additional amounts as they saw fit. Despite some initial success – Nghiem and Coelli (2002) argue that total factor productivity rose particularly quickly during this period – the contract system ran out of steam, as rising input prices, increased mandatory deliveries and continued controls on output prices squeezed farmer margins. In 1986, a year in which inflation rose to almost 500%, imports peaked at 351,000 tonnes after the crop increased by just 0.8%; in 1987, paddy output fell by 5.6%, and serious shortages emerged, particularly in northern Vietnam (Haughton 1999).

The dramatic reforms of 1988 – which under Decree 10 restored the household (rather than the commune) as the main production unit in agriculture, introduced 15-year use rights for rice land, and allowed the market to determine the domestic price of rice – had an immediate effect. Resolution 5 of 1993

strengthened these reforms by establishing 20-year land use rights, and land titling has now been largely completed in rice-growing areas. The effects of these changes on the rice economy were remarkable: paddy output rose by an average of 7.5% annually between 1988 and 1992, and by 4.8% annually for the subsequent decade. By 1989 Vietnam had begun to export large quantities of rice, peaking at a total of 4.5 million tonnes in 1999, but now consistently exceeding 3 million tonnes annually.

2.a Recent government policy

The broad goals of government rice and agricultural policy remain those of ensuring food security; reducing poverty; and fostering economic, social and political stabilization for industrialization and modernization. These goals find concrete expression in the government's decisions about investment, the provision of agricultural services, land use, and trade.

Typically about 5-6% of the government's budget has gone to investment in agriculture. More than half of this total has generally gone to maintain and expand the systems of irrigation, which mainly serve rice cultivation. There is an extensive network of agricultural extension, but the evidence from the Vietnam Living Standards Surveys of 1993 and 1998 indicated that fewer farmers were availing of these services; it is not clear whether this is because the quality or quantity of the services is falling, or whether farmers themselves are better able to get good information elsewhere. The government also provides very modest amounts of funding for agricultural research.

In the 1980s the government aimed to maximize the area cultivated in rice, but this policy has now been relaxed – in practice if not in theory. Between 2000 and 2003, the land area devoted to rice fell from 4.26 million to 4.02 million hectares; most of the switch was to shrimp farming, which in many areas is far more profitable than rice cultivation, even if it is also much riskier (Brennan 2002). It is difficult to obtain permission to shift rice land to other uses, particularly in the north of the country; this is the main reason for the remarkably high price of non-agricultural land in the Red River Delta, even in towns that are distant from Hanoi (Cung et al. 2004). As worries about Vietnam's ability to feed its population have receded, there are increasing calls for substantially relaxing the restrictions on land use, and this once-taboo subject is currently one of vigorous debate.

The government has traditionally viewed exports as a residual, a way of disposing of rice that is not needed at home. In the 1990s it set export quotas near the beginning of each year, after assessing the prospects for domestic demand and supply for the year ahead, and then often revised the quotas later in

the season. By 1993 a relatively large number of firms, all state-owned, were permitted to export rice. However a number of them were inexperienced and undercapitalized, and proved unable to fulfill some of the orders they received from foreign buyers, significantly damaging the country's reputation as a reliable supplier of rice. The government reacted by limiting the number of firms allowed to export, and allocated 70% of the export quota to VinaFood. In early 1994 a particularly large gap opened up between the farmgate price of rice and the cif price of rice exported though Ho Chi Minh City, partly as a result of the excess concentration among exporting firms. Goletti, Minot and Berry (1998, p.49) estimate that the implicit tax on exports, as reflected in the gap between domestic and export prices, averaged 24% over the period 1991-1996. They attribute the gap to export quotas and restrictions on the number of exporters. In a controversial recent paper, Ghosh and Whalley (2003) actually argue that the policy made sense, by raising revenue from a hard-to-tax sector of the economy and moderating the adjustment costs that would have been incurrent in response to changes in world prices.

A significant gap between the domestic and world prices of rice persisted until 1998, suggesting that the export quotas were binding (Nielsen 2003; Minot and Goletti 1998). Policy makers at the time wanted to be sure that there would be sufficient rice for domestic needs; they were also concerned that if they allowed the domestic price to rise, this would hurt poor farmers (Ryan 1999).

Since then the government has gradually loosened the rules, first allowing more state-owned exporters, and then permitting private firms to export rice directly. The government maintains some control over exports by requiring that all export contracts get official approval, although this requirement too is now under debate.

An important study undertaken by IFPRI (Minot and Goletti 1998; summarized in Ryan 1999), using data from the VLSS93, argued that a higher domestic rice price would not systematically hurt the poor (although it would hurt some poor and help others), but it would boost GDP. The report coincided with a shift in official thinking that was tilting towards great liberalization in rice trading. In effect by the late 1990s the rice export quotas became non-binding, and the gap between domestic and foreign prices largely disappeared (Figure 3); the export quotas were formally ended in 2001 (Nielsen 2003), to be replaced by export “targets.” Between January 1996 and December 2002, the correlation between the price of rice in Vietnam (as reported monthly by the GSO in compiling the consumer price index) and the world price (as measured by the export price in Bangkok) was 0.83, showing substantial integration with the world market during this period.

Although state-owned enterprises still dominate rice exports, in practice they farm out most of the work to small private companies (especially for the hard work of buying rice from farmers themselves) and they also have to compete with private exporters. State companies, by holding substantial stocks of rice that are effectively at the disposal of the government play an important role in ensuring food security. There is no export tax on rice, but one was introduced briefly in 1998 (?) when the export price was unusually high.

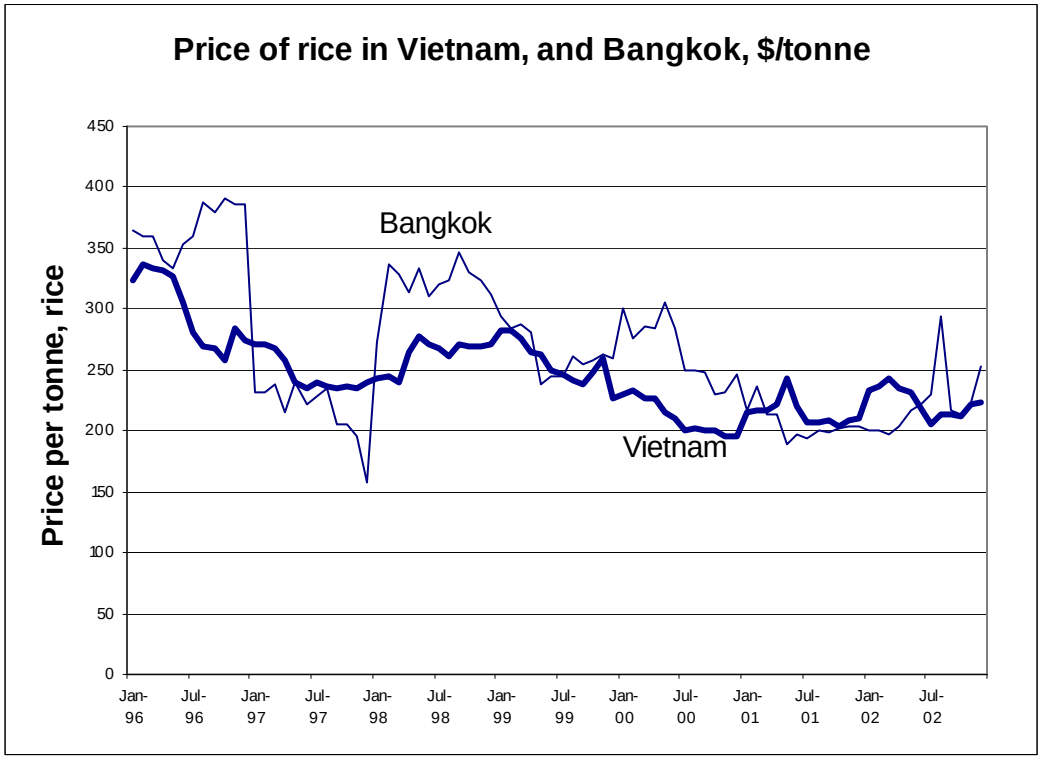


Figure 3. ***Rice prices in Vietnam and Bangkok, $/tonne, 1996-2002.***

By 2001 the change in thinking was complete; in that year the government sought to *maintain* the domestic price of rice in the face of falling world prices, while in earlier years it had resisted allowing the domestic price to rise to the world level. It set a floor price, and subsidized the interest rate for firms that held a million tonnes of rice stocks (in anticipation of a recovery in the price). Such a policy is hard to maintain in the long term, and is difficult to time correctly in the short run, particularly for a rice-exporting country.

Whither Rice Policy?

Rice exports peaked in 1999 at 4.5 million tonnes. This has led some to be concerned that Vietnam, in the foreseeable future, will cease to be a rice exporter and may even begin to import rice again. Pingali et al. (1997) conclude that "it is highly unlikely that rice output in Vietnam will grow to the extent of satisfying rising domestic demands while at the same time leading to an expansion of exports."

This leads naturally to the first question that we address: what can be expected to happen to rice output, consumption, and exports over the coming decade?

In order to answer this question we first need to specify and estimate demand and supply functions for rice (sections 3.a and 3.b). We do this using household-level data from the Vietnam Living Standards Survey of 1998. We are then in a position to forecast rice demand and supply, and hence exports, and so to forecast the evolution of rice self-sufficiency (section 3.c). Our main result is that we agree with Pingali et al. (1997) that output will not rise rapidly, but we also argue that rice demand for household use is expected to grow very slowly, so that substantial rice exports are likely for the foreseeable future.

The most important single instrument of rice policy is the tax (or subsidy) on rice exports, because this is the main practical way that the government may influence the domestic price of rice. This is not to deny the role played by investments in irrigation, or subsidies to inputs such as fertilizers, or the provision of information through agricultural extension and other means. But the profitability of rice cultivation is particularly sensitive to the price of rice that farmers receive from sales.

Which leads to the second question: what effect would a change in the tax (or subsidy) on rice exports have on production, consumption, and hence exports? We answer this question by simulating the effects of a tax on rice exports using the demand and supply model estimated in sections 3.a and 3.b. The results are presented and discussed in section 3.d, and show that a 10% tax on rice exports would reduce export shipments by over a quarter.

Rice policy is not driven exclusively by concerns about self-sufficiency; it is also mindful of the effects on the distribution of income. So to complete the analysis of a tax on rice exports, we trace the distributional effects. In section 4 we develop an appropriate model and estimate the effects. We find that a 10% tax on rice exports would benefit those in the top and bottom quintiles of the *income*

distribution, hurting those in the middle; if instead one considers the distribution of *expenditure* (per capita) rather than income, such a tax would hurt all groups outside the most affluent quintile.

3. Will rice self sufficiency be maintained?

Will Vietnam continue to export rice in the foreseeable future, or will it begin to import rice again? To answer this question we need to (1) estimate a demand function for rice, (2) estimate a supply function for rice, and (3) use these estimated functions to help forecast consumption, production and exports in the years ahead. Having done this, we then ask what would be the effect of a 10% tax on rice exports, which we take as typical of the sort of major rice policy move that Vietnam might plausibly introduce.

3.a. Estimating the demand for rice

In this section we specify and estimate a number of rice demand equations for Vietnam. Before discussing possible specifications, it is useful to describe the data that are used in the estimates, which come from the Vietnam Living Standards Survey of 1998 (VLSS98).

The Data

In December 1997, interviewing began on a second nationwide Living Standards Survey, and the data collection was completed in November 1998. The main questionnaire runs to 115 pages. It was administered in the course of two visits, and collected information about all the individuals in the household. The questionnaire was based on the format used by the World Bank in other Living Standards Measurement Surveys, adapted to Vietnamese conditions and needs, and pre-tested locally. A separate community questionnaire, administered only in rural areas, collected basic data on such items as the availability of electricity, wage rates, and the distance to the nearest school. The survey was undertaken the General Statistical Office, with technical assistance from the World Bank and significant financial support form the UNDP and the Swedish International Development Agency (SIDA).

The household questionnaire collected detailed information on expenditures, based on recall over the previous year. It asked households about the quantity and value of ordinary rice and glutinous rice consumed, with separate information on home production and purchases; a distinction is also made between purchases for "normal expenses" and for the Tet (Lunar New Year) holiday season. Of the 5,999

households surveyed, only 5 did not report consuming any rice, and we excluded these observations in our estimations.

The VLSS98 used a stratified, systematic cluster sampling procedure, using the 1989 census as the relevant frame (see Haughton and Kinh 2003 for further details). Although somewhat complex, the sampling weights are known (see Bales 1999). For comparative purposes, we also draw on estimates based on a similar survey of 4,800 households that was undertaken in 1993 (VLSS93). The VLSS surveys were well designed and executed and the data are of better quality and more complete than any other household survey data in Vietnam (see GSO 2000).

Specifying Demand Curves

The precise form of the demand curve for rice is not known, so researchers have approached the problem pragmatically (Sadoulet and de Janvry 1995). Perhaps the most commonly used specification is the double log form, which may be written as

$$\ln q_i = a_i + \sum_j E_{ij} \ln(P_j / P_i) + \eta_i \ln(y / P) + \sum_k b_{ik} z_k \qquad (1)$$

where

q_i is the quantity of the good demanded (here rice),

E_{ij} is the elasticity of demand for good *i* with respect to the price of good *j*,

P_j is the price of good *j*,

P is the consumer price index,

y is expenditure (or income), so y / P is real expenditure (or income),

η_i is the expenditure (or income) elasticity of demand for the good, and

z_k is a vector of other variables, including household characteristics.

In this form, the equation is automatically homogeneous of degree zero in prices and expenditure, a restriction that is suggested by the theory of demand, but which does not appear to hold very well in practice (Deaton and Muellbauer 1980, chapter 3). This is probably because changes in expenditure and in prices influence the quantity demanded with lags of different length. Equation (1) also assumes that the elasticities are constant at all prices and expenditure levels. This may be true locally, but is not

plausible as a general proposition: many goods that are "luxuries" at low levels of income ($\eta_i > 1$) become "necessities" at higher income levels (i.e. $0 < \eta_i < 1$) or even inferior goods ($\eta_i < 0$).

Despite these limitations, we have estimated a number of equations of the form (1). In every case we have included a squared ln(y/P) term, which does not constrain the equation to being linear homogeneous, but adds realism; all of the squared coefficients were statistically highly significant (see Table 3), providing additional evidence that contemporaneous linear homogeneity does not hold up well in practice. We have also included, among the "other" (i.e. z_k) variables, dummy variables for the country's eight regions (the reference point being the Southeast Region, which includes Ho Chi Minh City); the age, educational level and gender of the head of household; and a set of dummy variables that pick up the demographic structure of the household.

The construction of the price variable merits some further discussion. For any given household, $y_i = P_i q_i$, so that given information on y_i and q_i (which are available from the VLSS98) it is possible to obtain a measure of the implicit price (or "unit value") $\hat{P}_i$. However it is not satisfactory to use $\hat{P}_i$ as an independent variable because of well-known problems (Deaton 1988): First, if there are errors in q_i, for any given y_i, then a high value of q_i will be associated with a low value of $\hat{P}_i$, and vice versa, thereby exaggerating the expected negative relationship between the two variables. Second, rice quality is unobservable, so one might observe variation in rice prices without any corresponding variation in the quantity demanded, again biasing towards zero the estimates of price elasticities.

Our solution is to use, as the independent variable, the average village price of ordinary rice (rather than the implicit price calculated for each household). We thus use

$$P_i = \frac{1}{m}\sum_{i=1}^{m} P_j,$$

where the price is summed over the *m* households in each village.[1]

[1] In each of the villages where households were surveyed, a separate price survey was undertaken that collected, among other things, information on the price of rice. We decided not to use this information for two reasons: such information was not collected for the urban wards, where 20% of the households were surveyed; and the price data were collected at the time the village was surveyed, and so are susceptible to seasonal variation.

Although the VLSS98 household survey questionnaire asked numerous questions about the size and sources of income, the measure of income is somewhat suspect. It does not take adequate account of changes in inventories, particularly of animals, and it tends to confound operating and investment expenses, so that a significant number of households appear, implausibly, to have negative incomes. These are common problems with household data. Our solution is to use expenditure rather than income as the relevant independent variable. One virtue of this approach is that expenditure probably comes closer to measuring "permanent" income than does current income.

Table 3
Price and Expenditure Elasticities Based on Double-Log Specification

	Overall		Rural		Urban	
	All	No cult	All	No cult	All	No cult
Price elasticities, all hh	**-0.424**	**-0.341**	**-0.435**	**-0.255**	**-0.475**	**-0.389**
p value	0.000	0.000	0.000	0.046	0.000	0.000
Expend. Elasticity at mean, all hh	**0.093**	**0.029**	**0.146**	**0.087**	**-0.023**	**-0.011**
Sample size	5,994	2,229	4,268	886	1,726	1,343
Adjusted R squared	0.640	0.534	0.647	0.512	0.518	0.518
Memo						
Coeff. Of hhexpend	2.891	2.615	3.383	2.731	1.949	2.129
p value	0.000	0.000	0.000	0.000	0.000	0.000
Coeff. Of hhexpend squared	-0.150	-0.134	-0.176	-0.141	-0.101	-0.109
p value	0.000	0.000	0.000	0.000	0.000	0.000
Mean log of hh expend	9.359	9.652	9.177	9.365	9.808	9.841

	Expenditure per capita quintiles									
	Low	Lo-mid	Mid	Mid-hi	High	Low	Lo-mid	Mid	Mid-hi	High
	All households in sample					Non-cultivators of rice in sample only				
Price elasticities, all hh	**-0.553**	-1.831	**-0.301**	**-0.367**	**-0.425**	-0.631	-0.343	**-0.330**	**-0.276**	**-0.232**
p value	0.000	0.302	0.000	0.000	0.000	0.150	0.270	0.030	0.005	0.055
Expend. Elasticity at mean, all hh	**0.478**	**0.175**	**0.241**	**0.150**	**0.018**	**0.481**	1.204	**0.158**	**0.246**	**0.015**
Sample size	919	998	1,165	1,319	1,593	137	212	317	501	1,062
Adjusted R squared	0.643	0.627	0.725	0.749	0.529	0.334	0.473	0.669	0.724	0.492
Memo										
Coeff. Of hhexpend	2.877	4.370	5.635	6.572	2.962	6.576	-1.773	6.129	5.669	3.057
p value	0.000	0.000	0.000	0.000	0.000	0.038	0.543	0.000	0.000	0.000
Coeff. Of hhexpend squared	-0.138	-0.233	-0.294	-0.341	-0.147	-0.346	0.164	-0.323	-0.286	-0.151
p value	0.000	0.000	0.000	0.000	0.000	0.069	0.357	0.000	0.000	0.000
Mean log of hh expend	8.707	9.016	9.186	9.424	10.022	8.805	9.066	9.231	9.497	10.077

Notes: Based on VLSS98 data. Each column shows the estimates from a separate regression of the form shown in equation (1). Statistically significant elasticities (at the 10% level or better) are shown in bold face.

The key estimated elasticities are shown in Table 3, where we present separate estimates for urban and rural areas, and for households in each of the five quintiles (as determined by real expenditure per capita). We also provide separate estimates for households that do, and do not, cultivate rice. A higher price of rice affects rice farmers both as consumers and as producers of rice; thus estimates that include such

households do not provide pure demand elasticities, because income is not held constant when the price of rice changes. On the other hand, these hybrid elasticities are useful for policy simulations.

The most striking result is that the expenditure elasticity, which stands at 0.09 at the mean level of household expenditure, is low; Benjamin and Brandt (2002, Table 4), pooling data from the VLSS93 and VLSS98, found rice expenditure elasticities that varied from 0.41 (in the urban south) to 0.64 (in the rural north).

As expected, our estimated expenditure elasticities are substantially higher among poor households than rich; more interestingly, they are negative (on average) in urban areas. The implication is that even the rapid growth in income and expenditure levels in Vietnam – about 6% per capita in 2003, for instance – is raising the demand for rice for household use by only about half a percent per year (or one and a half percent when population growth is factored in). The expenditure elasticity for households that do not cultivate rice is just 0.03.

The price elasticity appears to be between –0.4 and –0.5, in line with expectations. However, it does appear to vary by income group (especially for households that do not grow rice, and where there is a pure Marshallian price elasticity), falling in absolute terms as expenditure levels rise, as one would expect.

This "curvature" in price elasticities prompted Peter Timmer (1981) to use a more flexible form of the demand equation, which allows the major elasticities to differ and does not impose homogeneity. The version of the double logarithmic quadratic form estimated by Guerts et al. (1997), in the spirit of the Timmer equation, may be written as

$$\ln y_i = a_i + b_i \ln P_i + c_i \ln y + d_i (\ln y)^2 + e_i (\ln P_i \times \ln y) + f_i \ln P + \sum_k g_{ik} z_k , \qquad (2)$$

where y_i is expenditure of good *i* (i.e. $y_i = P_i q_i$). Guerts et al. applied this equation to the demand for a number of food products in Costa Rica, using cross-section data from a large household survey. The main weakness of this form is that it does not yield cross-elasticities, a defensible simplification in our case, where the focus is on the demand for rice, the overwhelmingly dominant staple food in the country.

The results of estimating equation (2) are reported in Table 4. The signs and magnitudes of the regression coefficients are plausible, and the fit of the equation is acceptable. A selection of elasticities appears in Table 5; the national estimates are based on the figures in Table 4; the elasticities for rural and urban

households are based on separate regressions for these two groups (not shown here); and the elasticities for 1993 are based on an equation with the same specification as in Table 4, but using data from VLSS93 (reported in Appendix 1). Since the equation allows elasticities to vary by expenditure level, we report price and expenditure elasticities for the mean national level of expenditure, and also, where appropriate, for the mean levels of expenditure in urban and rural areas.

Table 4
Estimation Results of Rice Demand Equation, 1998

	Coefficient	p-value	Mean
Dependent variable:			
Ln(value of rice consumed by household)			2,177
Independent variables:			
Ln(price of rice in village)	-0.876	0.097	3.312
Ln(household expenditure)	2.623	0.000	14,679
Ln(household expenditure) squared	-0.143	0.000	
Ln(price of rice)×Ln(household expenditure)	0.152	0.007	
Urban (yes = 1)	-0.346	0.000	0.288
Age of household head in years	-0.002	0.000	48.015
Gender of household head (male=1)	0.040	0.001	0.729
Number of household members who are aged:			
< 1	0.032	0.079	0.066
1 through 3	0.071	0.000	0.218
4 through 6	0.126	0.000	0.290
7 through 12	0.162	0.000	0.689
13 through 19	0.191	0.000	0.835
Male, 20 through 39	0.206	0.000	0.671
Female, 20 through 39	0.187	0.000	0.705
Male, 40 through 59	0.184	0.000	0.378
Female, 40 through 59	0.214	0.000	0.447
Male, 60 and over	0.202	0.000	0.202
Female, 60 and over	0.162	0.000	0.274
Regional dummy variables:			
Region 1 (Red River Delta)	0.127	0.000	0.196
Region 2 (Northern Highlands)	0.225	0.000	0.122
Region 3 (Northwest Mountains)	0.263	0.000	0.021
Region 4 (North Central Coast)	0.105	0.000	0.118
Region 5 (Central Coast)	0.048	0.007	0.105
Region 6 (Central Highlands)	0.106	0.000	0.046
Region 8 (Mekong Delta)	0.052	0.001	0.186
Intercept	-5.828	0.000	

Notes: Adjusted R^2=0.630. Number of observations 5994. Means refer to underlying variables, prior to taking logs.

Source: Based on Vietnam Living Standards Survey 1997-98.

The demand for rice appears to have become slightly more price elastic than it was in 1993, perhaps because a wider range of alternative foodstuffs is now available. Expenditure elasticities have "flattened" – there is now less difference in these elasticities between poor and rich households. Most striking

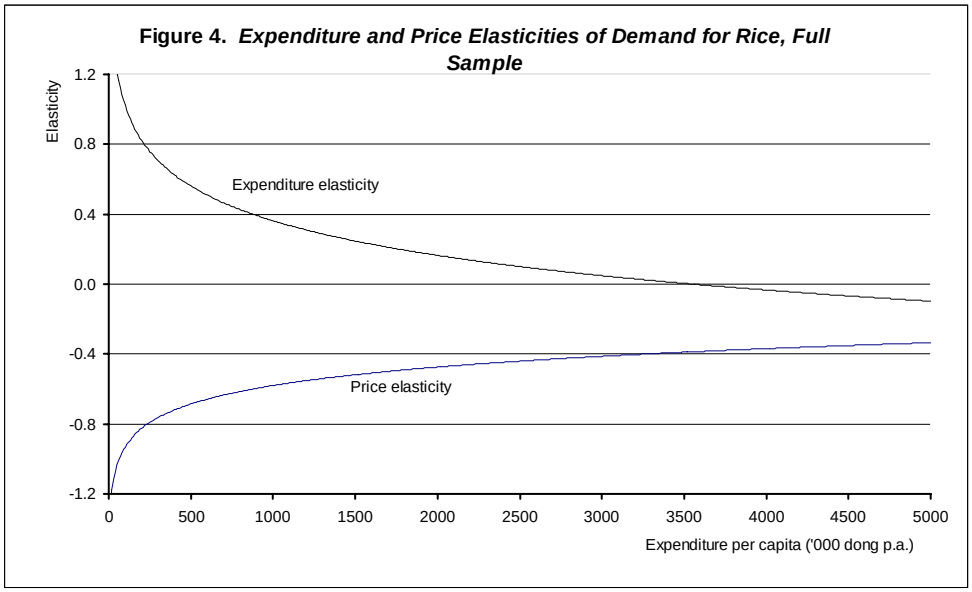
perhaps is the relatively low expenditure elasticity even among rural households that are on average considered to be poor.

Table 5
Price and Expenditure Elasticities of Demand for Rice

	Own-price elasticity of demand		Expenditure elasticity of demand	
	Computed at national mean level of expenditure	Computed at subgroup mean level of expenditure	Computed at national mean level of expenditure	Computed at subgroup mean level of expenditure
For 1998				
National	-0.452		0.123	
National, non-cultivators only	-0.405		0.079	
Urban	-0.579	-0.532	0.114	0.037
Rural	-0.404	-0.452	0.098	0.159
For 1993				
National	-0.347		0.159	
Urban	-0.451	-0.316	-0.409	-0.432
Rural	-0.196	-0.306	0.272	0.190

Source: Based on data from VLSS93 and VLSS98. The elasticities for 1998 are derived from Table 4. For 1998 the geometric mean levels of expenditure per household (in millions of VND) were 14.7 overall, 18.2 in urban areas, and 9.7 in rural areas. These numbers are based on the full sample of households. The 1993 elasticities are based on applying the same econometric specification to VLSS93 data.

An elegant way to show how price and expenditure elasticities vary is with the help of Figure 4. The horizontal axis shows expenditure per capita (in January 1998 prices), while the expenditure and price elasticities appear on the vertical axis. The expenditure elasticity falls to 0 at an annual per capita income of VND3.56 million ($290), or only slightly higher than the average of VND2.9 million found in the VLSS98 sample. Average incomes by 2004 were closer to VND4.5million (in January 1998 prices). The pattern is robust; similar patterns emerged when separate equations were estimated for rural and for urban areas, and for households that did not cultivate rice; the relevant graphs are shown in Appendix 2.



3.b. The Supply of Rice[2]

We now turn to the supply of rice, specifying and estimating a production function in order to obtain the necessary elasticities. In line with standard practice (Haughton 1986), we estimate a modified version of the Cobb-Douglas production function, of the form

$$\ln Q = \ln A + \sum_i \alpha_i \ln X_i + \sum_j \beta_j Z_j \qquad (3)$$

where the X_i are the "traditional" input variables such as the area sown and the amount of labor used in cultivation, and the Z_i are variables that pick up other influences on output, such as the intensity of agricultural extension activities, or the educational level of farmers.

Some farmers do not use inputs such as fertilizer or pesticides, and in these cases $\ln X_i$ is undefined. To solve this problem we enter these inputs twice; first as dummy variables counted among the Z_i, which are set equal to 1 if the quantity used is positive, and to 0 otherwise; and again in log form, except that $\ln X_i$ is set equal to *0* when $X_i = 0$. For examples of a similar approach applied to Vietnam see World Bank (1995) and Wiens (1998).

[2] The approach taken here is similar to that of Lien et al. (1999), whose core estimates were done by the authors of the current paper using data from VLSS93.

Equation (3) is estimated using data from the VLSS98. The survey did not measure the amount of labor time devoted to cultivating each individual crop. However, assuming farmers are efficient profit maximizers, then one may use the unskilled wage rate instead of the quantity of labor (see Sadoulet and de Janvry 1995). The wage rate used in the estimations comes from the community questionnaire that was undertaken in each of the 120 (rural) villages surveyed as part of the VLSS98. Some of the results are reported in Table 6, with the full set of estimates shown in Appendix 3; they are based on a sample that consists of all rural households that cultivate rice. The results shown in Appendix 3 include all the relevant variables, whether or not they are statistically significant, in order to make it clear which variables do *not* influence rice output. When the non-significant variables are dropped, the remaining coefficients barely change in size or significance.

The equation fits well and the coefficients are plausible. Not surprisingly, the most important determinant of rice output is the area of land cultivated. Starting at the mean level of output, an extra hectare of land would raise paddy output by 1.6 tonnes, holding other inputs (such as fertilizer) constant. An additional kilo of urea would raise paddy output by just 1.2 kilos, again holding other inputs unchanged, a comparatively low marginal product of urea.

Our main interest is in the effect of a change in the price of rice on the quantity supplied. It can be shown that the own-price elasticity of supply is given by minus the elasticity of output with respect to the wage rate.[3] We estimate the latter at –0.070 (Table 6), which implies a price elasticity of 0.07. This is at the low end of findings elsewhere: Binswanger (1989) reports that in 13 of the 18 countries he surveyed, the supply elasticities were between 0.1 and 0.2. However, the finding of low price elasticity of supply is not

[3] Let rice output (Q) depend on the quantity of land (K) and labor (L) used in producing it, with the production function taking the following form:

$$Q = AK^{\alpha} L^{1-\alpha}.$$

Assume further that farmers aim to maximize their profits, which are given by

$$\Pi = PQ - rK - wL,$$

where r is the rental on land, w is the wage rate, P is the price of output (rice in this case) and Π measures farm profits. Some manipulation gives the profit-maximizing condition

$$\frac{wL}{PQ} = 1 - \alpha$$

which may be rearranged and substituted into the production function in order to eliminate L. Further manipulation gives

$$Q = A^{\frac{1}{\alpha}} K (1-\alpha)^{\frac{1-\alpha}{\alpha}} w^{\frac{\alpha-1}{\alpha}} P^{\frac{1-\alpha}{\alpha}},$$

from which one can see that the elasticity of output with respect to the price of rice (that is, $\partial \ln Q / \partial \ln P$) = $(1-\alpha)/\alpha$. This is just the negative of the elasticity of output with respect to the wage rate (that is, $\partial \ln Q / \partial \ln w$), which is estimated in Table 6, where it takes on the value of -0.070.

unreasonable in the Vietnamese context, where it is difficult to get permission to convert rice land to other uses.

Wages are rising in Vietnam, and as they continue to do so, rice output will fall. The estimation results indicate that if the wage rate rises by the equivalent of 1 kg of paddy rice per day, or about 10%, then the quantity of rice will fall by 14 kg per household (about 0.7%). This effect has been important elsewhere: in Taiwan the output of rice peaked in 1975 and by 1995 had fallen by about 40%, in part because farmers were attracted away from farming by higher wages (Lee 1996).

Table 6
Selected Estimation Results for Rice Production Function, 1998

	Coefficient	p-value	Mean**
Dependent variable:			
Ln('000 kg of rice/household/year)			2,035
Selected independent variables (see Appendix 3 for full list)			
Ln(area sown to rice, in square m/hh/year)	0.728	0.00	7,951
Proportion of rice area irrigated	0.099	0.00	0.82
Ln(male daily field preparation wage, '000 dong)	-0.070	0.00	19.37
Urea: (=1 if used, else = 0)	-0.104	0.04	0.93
Ln(kg of urea used)*	0.082	0.00	140
Phosphates: (=1 if used, else = 0)	-0.040	0.31	0.63
Ln(kg of phosphates used)*	0.025	0.00	89

Notes: Adjusted R^2=0.88. Number of observations = 3,484. * Ln(0) set equal to 0 in these cases.

** Means of underlying variables, prior to taking logs.

Source: Vietnam Living Standards Survey 1998. See Appendix 3 for full results.

3.c. Policy Simulations and Forecasts

The results of the previous two sections provide the information that is needed in order to forecast the future path of rice production, consumption and exports. It also allows us to simulate the effects of a number of policy options.

(i) Forecasting rice output, consumption and exports

As discussed above, it is sometimes argued that if rapid economic growth continues in Vietnam, its exports of rice will wither within a decade. The logic of the argument is that higher wage rates will deter farmers from cultivating rice, thereby reducing supply; meanwhile higher incomes will prompt households to consume more food, including rice. The net effect, so the argument goes, would be to squeeze exports.

Table 7
Assumptions Underlying Projections of Supply and Demand

	Actual 1998	Projected 2008	Projected 2018	Projected Growth, % p.a.
Supply curve				
Agricultural wage, VND '000 per day	19.4			5.0
% of communes with electricity	70.0	90	100	
# of months road is impassable	0.035	0.02	0.01	
Distance to nearest road, km	0.33	0.25	0.1	
Pesticide use, VND '000	206	230	250	
Urea use, kg	140	150	160	
Phosphate use, kg	89	100	110	
Potassium use, kg	24	26	28	
NPK use, kg	59	65	70	
Other fertilizer use, kg	28	33	38	
Age of head of household, years	47	50	54	
Education of household head, years	7	7	7.4	
% of rice land irrigated	81.7	0.1	0.2	
Rice land area, square meters	7951			0.5
All other variables: no change				
Demand curve				
Expenditure, VND '000 per hh p.a.	14,679			5.0

To forecast the production of rice, we first make projections of the changes in the values of each independent variable in the production function for 2008 and 2018. The relevant assumptions are set out in Table 7, where we assume modest growth in inputs of fertilizer and pesticides, an increase in the proportion of land irrigated, a slow (0.5% p.a.) rise in the area cultivated in rice, and a 5% annual increase in the agricultural wage. These values are then used in the production function to project rice output for each rice-producing household in the sample. Based on this procedure, total rice production is expected to grow by 0.08% annually through 2008 and 0.03% annually thereafter (Table 8). The annual growth rate in output would be closer to 0.5% annually if the wage rate were to remain constant.

These projections are certainly underestimates, because they do not capture the growth of total factor productivity. Using data from VLSS93 and VLSS98, Benjamin & Brandt (2002, p.23) were able to explain "nearly 60%" of the growth in rice output between 1993 and 1998 by conventional factors – irrigation, fertilizer, etc. – but the remaining two fifths of output growth escaped their model (and in some versions of their model the unexplained residual was even larger). The "unexplained" growth is not inexplicable: it is due to improvements in management, in water control, in the seeds used, and in myriad other changes that we are unable to observer, or at least quantify. Our model is no exception: it too underestimates the likely growth in rice output.

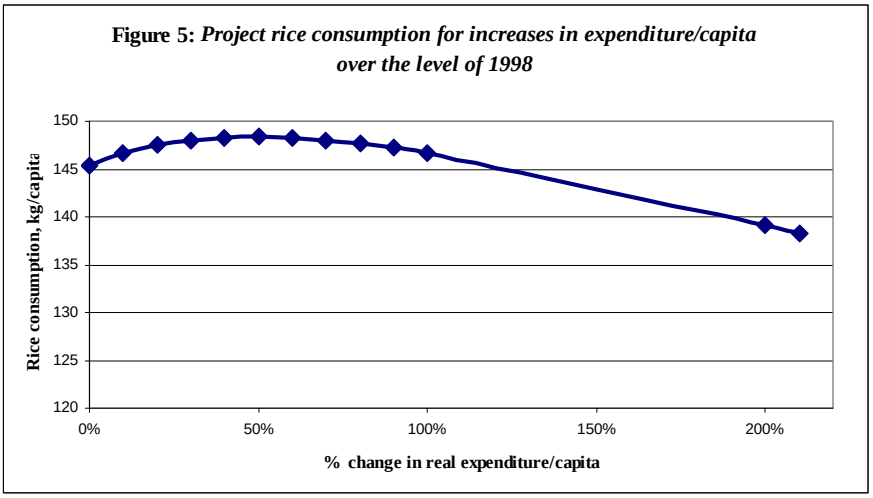
We account for productivity growth by assuming that about half of the increase in paddy yields is not accounted for in our model. A regression of the log of paddy output per hectare against time yields the following:

Ln(paddy per hectare)	=	-63.7	+ 0.0325 Year
		p=0.00	p=0.00

The equation is based on annual data from 1976 though 2003, and generates an R squared of 0.95. It shows an annual rise in productivity (as measured by output per hectare) of 3.3% annually. Our working assumption is that the growth in rice output that is not explained by our supply equation will amount to 1.6% annually through 2008 and, conservatively, will fall to 0.8% annually thereafter (see Table 8). Che, Kompas and Vousden (2001) estimated the recent increases in total factor productivity to be large, rising from 0.6% annually in 1976-80 to 3.8% in 1981-87 and 3.6% in 1988-94.

To forecast the demand for rice, we first assume that the real expenditure of every household will rise by 5% annually – distributionally neutral growth. Given this assumption, we use the demand equation to forecast rice demand for every household, comparing the result with the forecast in the absence of any expenditure increase. We project demand per household to rise by 0.19% annually through 2008 and to *fall* by 0.43% annually thereafter. This is because Vietnam is nearing the maximum level of per capita rice consumption; a 50% rise in per capita expenditure would raise forecast rice consumption to 148 kg/capita, after which it would decline, falling to 139 kg/capita once per capita expenditure expands by 200% (see Figure 5); if all goes well, this could happen within two decades.

Figure 5: ***Project rice consumption for increases in expenditure/capita over the level of 1998***



Although rice consumption *per capita* will begin to decline within about five years, total rice demand will continue to rise. This is because the number of households will rise over time, in line with projected population growth, so that even after 2008 the total demand for rice will increase, albeit at a modest rate of 0.67% per year.

The net result, set out in Table 8, is that Vietnamese exports of rice are forecast to rise slightly over the coming decade and a half, so the country will remain self-sufficient in rice for many years. Exports would rise even more if wages and expenditure increase less quickly than assumed here. These results should not be surprising; Thailand continues to be the world's major exporter of rice, despite the rapid rise in wages there over the past two decades.

Table 8
Forecasts of rice production, demand and exports

	Baseline	Actual	Forecast	
	1998	**2003**	**2008**	**2018**
Supply				
Rice production*, '000 tonnes	20,402	24,163		
Forecast % growth p.a. based on model			0.08%	0.03%
Assumed "unexplained" productivity growth p.a. **			1.60%	0.80%
Gives forecast production, '000 tonnes			***26,259***	***28,528***
Demand				
Domestic rice consumption, '000 tonnes***	16,673	20,343		
Forecast % growth p.a. based on model****			0.19%	-0.43%
Forecast % growth p.a. based on population			1.18%	1.10%
Gives forecast consumption, '000 tonnes			***21,778***	***23,271***
Exports				
Rice exports, '000 tonnes	3,729	3,820	***4,481***	***5,257***
Memo items:				
Forecast rise in production for whole sample, using model, tonnes	6,940		6,993	7,015
% growth p.a.			0.08%	0.03%
Forecast production with constant real wage, % growth p.a.			0.42%	0.48%
Forecast production with no change in age of head, % growth p.a.			0.11%	0.20%
Total paddy production, '000 tonnes	29,146	34,519		

Source for actual data: Table 1. * Assumes milling rate of 70%. ** Half of historical growth in productivity through 2008, a quarter thereafter. *** Production less exports. ***Assumes non-household demand for rice rises in line with household demand. Source for population projections: GSO 2001. Growth rates in final column are annualized for 2008-2018.

(ii) Simulating the effect of an export tax

We have argued that the most important single policy instrument of rice policy is a tax or subsidy on exports, because this would create a differential between the world price (which is essentially given) and the domestic price of rice.

To explore the effects of such a policy, suppose that the government were to impose a 10% tax on rice exports. Although this particular exercise is arbitrary, its results point to the direction and magnitude of other potential changes (such as a subsidy, or a smaller tax). The tax would push the domestic price down by 10% relative to the world price. This in turn would reduce the quantity supplied by 0.7% (= 10% times the own-price elasticity of supply of 0.07) while boosting the quantity demanded by 4.12%, based on applying the regression estimates in Table 4 to all households. The net effect would be to reduce exports by over a quarter, as the figures in Table 9 show.

Table 9
Simulating the effect of an export tax on rice that reduces the price domestically by10%

	Baseline 1998	Actual 2003	Simulated 2003 with export tax
Supply			
Rice production*, '000 tonnes	20,402	24,163	
% change in supply			-0.70%
Gives simulated production, '000 tonnes			***23,994***
Demand			
Domestic rice consumption, '000 tonnes**	16,673	20,343	
% change in demand			4.12%
Gives simulated consumption, '000 tonnes			***21,181***
Exports			
Rice exports, '000 tonnes	3,729	3,820	***2,813***
Therefore % change in exports			***-26%***

Source for actual data: Table 1. * Assumes milling rate of 70%. ** Production less exports.

4. The Effect of a Rice Export Tax on Income Distribution

Rice policy is not motivated purely by a desire to maximize export earnings or assure self-sufficiency in food grains. It is also tempered by a concern for the effects of policy changes on the poor. In this section we measure and present the distributional effects of a 10% tax on rice exports, complementing the analysis of section 3.c.(ii), which looked at the trade implications of such a measure. For the purposes of this exercise we assume that the tax revenue is not returned to households.

A tax on exports would lower the domestic price of rice. This would benefit households that make net purchases of rice, hurting those that are net sellers. By making a number of simplifying assumptions, it is possible to measure these effects (see Haughton and Kinh 2003 for a similar approach). Assume that individuals maximize utility, U(**x**), which is a function of the goods and services consumed, subject to a

budget constraint $\mathbf{P.x} \leq I(\mathbf{P},\mathbf{Z})$, where **x** is a vector of quantities of goods and services, **P** a vector of associated prices, **Z** is a vector of influences on income that are not sensitive to the prices of goods and services (e.g. remittances, education), and *I* represents income. Note that a change in the price of a good works on both sides of the budget constraint, altering the cost of living and also revenue.

To operationalize this framework, one needs to choose an appropriate utility function. Perhaps the simplest form is

$$U = \mathbf{P_0.x}$$

where the $\mathbf{P_0}$ may be thought of as weights (which happen to be the initial market prices) that allow one to aggregate goods and services; any monotonic transformation of this utility function would also yield the same result. Assuming that the budget constraint is binding, then for any given household,

$$dln(U) = (\mathbf{P_0.dx})/(\mathbf{P_0.x}) = dln(I) - dln(P),$$

where P is the "price of expenditure," effectively a price index for the household. In words, the proportionate change in utility may be measured by the proportionate change in nominal income (dln(I)) deflated by the proportionate change in the price of expenditure (dln(P)) faced by the individual. For instance, if a change in prices causes income to fall by 2% and the price of expenditure to fall by 3%, then utility ("real income") will rise by about 1%. This provides a practical way to measure the effects of changes in prices, provided one has household-level data on income (disaggregated by source, including rice-related income) and expenditure (disaggregated by the main goods and services, including rice). If the price of rice changes, one first tracks the effect on income, to get dln(I); then one measures the effect of the same price change on the price of expenditure, to get dln(P); it is then straightforward to determine the net effect on welfare.

The results of following this procedure for a 10% reduction in the price of rice (including paddy), using data from the VLSS98, are set out in Table 10. There would be a net reduction in welfare, since the exercise involves a tax on exports and does not make any assumption about how the revenue would be spent.

Perhaps surprisingly, the distributional effects of the change depend on whether one breaks down the population by income per capita or expenditure per capita. The tax on rice exports would hit poor households – as measured by income per capita – the hardest, and would actually help those in the top quintile, who are mainly net purchasers of rice. On the other hand, if distribution is measured by expenditure per capita, the drop in the price of rice would help those in the poorest and richest quintiles, while hurting those in the middle.

Table 10
Correlates of Changes in Real Income Due to a 10% Export Tax

	Income/cap, baseline	Income/cap after 40% devaluation	Absolute change in income/cap	% change in income/cap	Sample size (weighted)	p-value of test of significance absolute difference
	000 dong/yr	*000 dong/yr*		(%)	(%)	
Total	**3,217**	**3,211**	**(6)**	**-0.193**	**5999**	
Poorest income quintile	748	728	(20)	-2.65	20.0	
Next	1,461	1,444	(17)	-1.14	20.0	
Mid quintile	2,187	2,176	(11)	-0.51	20.0	
Next	3,349	3,344	(6)	-0.17	20.0	
Highest income quintile	8,345	8,367	22	0.26	20.0	
Poorest expenditure quintile	1,200	1,201	1	0.11	20.0	
Next	1,851	1,841	(11)	-0.59	20.0	
Mid quintile	2,501	2,482	(19)	-0.76	20.0	
Next	3,347	3,327	(20)	-0.60	20.0	
Highest expenditure quintile	7,189	7,207	17	0.24	20.0	
Rural	2,431	2,410	(21)	-0.86	77.6	
Urban	5,937	5,981	44	0.74	22.4	0.000
Not poor	4,269	4,261	(8)	-0.18	62.6	
Poor	1,456	1,452	(4)	-0.27	37.4	0.000
Not food poor	3,587	3,579	(8)	-0.23	85.0	
Food poor	1,117	1,122	5	0.43	15.0	0.000
Kinh	3,420	3,414	(6)	-0.19	83.8	
Chinese	6,387	6,406	19	0.30	2.0	
Khmer	1,931	1,852	(80)	-4.20	2.0	
Central minorities	1,225	1,235	10	0.78	2.8	
Northern minorities	1,585	1,586	1	0.06	9.3	
No electricity in com	1,481	1,484	3	0.18	8.1	
Electricity in commune	3,371	3,364	(7)	-0.21	91.9	0.095
Interviewed in Vietnamese	3,286	3,279	(6)	-0.20	97.1	
Not int. in Vnese.	1,112	1,113	1	0.09	2.9	0.013
No lr sec sch in com	1,953	1,968	14	0.73	3.9	
Lr sec sch in com	2,653	2,639	(14)	-0.52	96.1	0.014
No children	4,433	4,425	(8)	-0.18	16.9	
1 child	3,922	3,913	(9)	-0.24	21.3	
2 children	3,236	3,239	3	0.09	27.6	
3 children	2,358	2,345	(13)	-0.57	18.9	
4 children	2,053	2,042	(10)	-0.50	9.3	
5 children	1,822	1,818	(4)	-0.21	4.4	
6 children	1,446	1,443	(3)	-0.21	1.3	
7 children	1,979	1,992	13	0.65	0.4	
Red River Delta	3,170	3,162	(8)	-0.26	19.6	
Northern Uplands	2,128	2,131	3	0.13	15.1	
Northwest mountains	1,671	1,699	28	1.63	2.9	
North Central Coast	2,392	2,392	1	0.03	13.8	
Central Coast	3,081	3,082	1	0.03	8.5	
Central Highlands	2,313	2,324	12	0.50	2.8	
Southeast	5,492	5,503	11	0.20	15.9	
Mekong Delta	3,249	3,212	(37)	-1.15	21.5	

Source: Based on VLSS98 data.

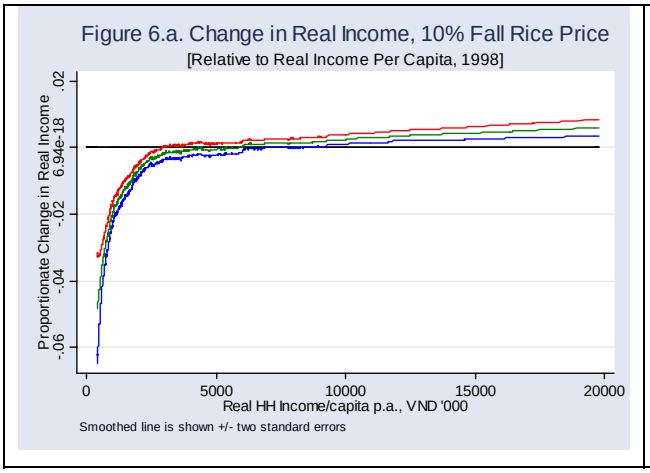
This point also emerges clearly from the appropriate graphs: Figure 6a shows a smoothed curve of the proportionate change in real income graphed against real per capita income, along with an associated confidence interval (of ± 2 standard errors).[4] Households with annual per capita income above 5 million dong ($407 in 1998) gain from the lower rice price; all others lose, on average. The picture is somewhat

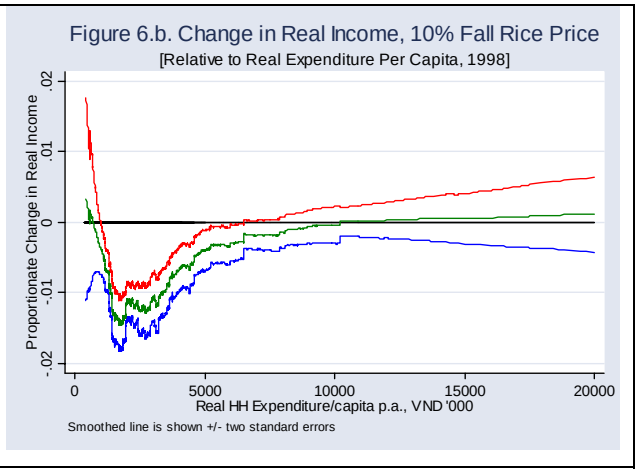
[4] Non-parametric regressions, using the technique proposed by Cleveland (1979) and employed by Friedman and Levinsohn (2003), shows very similar patterns.

different when the change in real income is graphed against real per capita *expenditure*, as is done in Figure 6b. Here the very poor, and the affluent, gain, at the expense of those in the middle.

To clarify this apparently confusing situation, Table 10 provides some additional breakdowns. A drop in the price of rice would have the following effects:

- It would benefit urban households while hurting rural households.
- The very poor ("food poor," whose spending levels are not even sufficient to acquire enough calories for an adequate diet) would gain; they are net purchasers of rice, either as agricultural laborers or because they are located in poor and remote parts of the country. On the other hand the merely poor would, as a group, lose; among the poor, those that are less poor tend to be net sellers of rice.
- It would benefit ethnic minority groups in the northern and central highlands, as they are net purchasers of rice. Households living in remote areas (as measured by the absence of electricity or of a lower secondary school), or interviewed in a language other than Vietnamese, would also gain.
- Regionally, the main loser would be the Mekong Delta, with more modest losses in the Red River Delta; on balance, all other regions would gain from a low-rice-price policy, as they are net purchasers of the grain.





5. Conclusions

The trend towards liberalization in the rice sector is almost complete; thinking has run ahead of that in the industrial sector. Future rice policy will mainly be concentrated on the appropriate level of taxation or subsidies, and the concomitant implications for food self sufficiency and distributional effects.

With no change in the current, essentially liberal, regime, we have shown that exports can be expected to continue for the foreseeable future. Rice consumption per capita is close to peaking, and if incomes continue to rise rapidly, will soon begin to fall, although modest population growth will continue to raise the total demand for rice.

Supply has proven more buoyant that most observers anticipated, but further growth will be constrained by rising wages, which will drain workers away from agriculture, and lead farmers to economize on labor-intensive activities such as manual transplanting.

Vietnam taxed rice exports in the 1990s, but does so no longer. Judging by the experience of middle- and upper-income countries, Vietnam too may at some point being to subsidize its farmers, although perhaps not while it is still a robust exporter of rice. Our results show that the effects of such a policy on poverty are unclear, and depend on whether poverty is defined using expenditure per capita (in which case rice export subsidies would hurt the very poor) or income per capita (in which case the poor would be helped).

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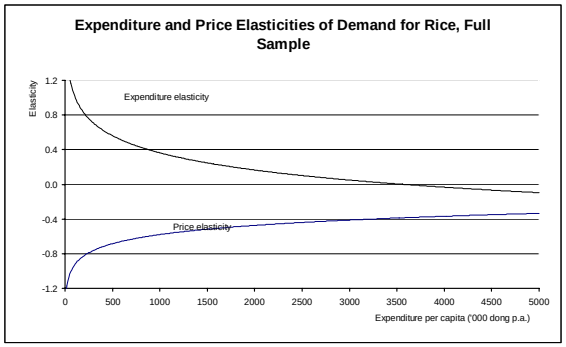
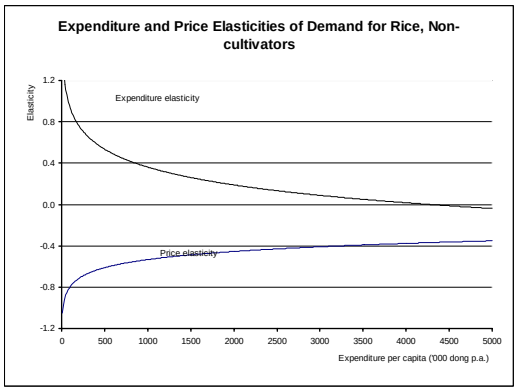
Appendix 1
Estimation Results of Rice Demand Equation, 1993

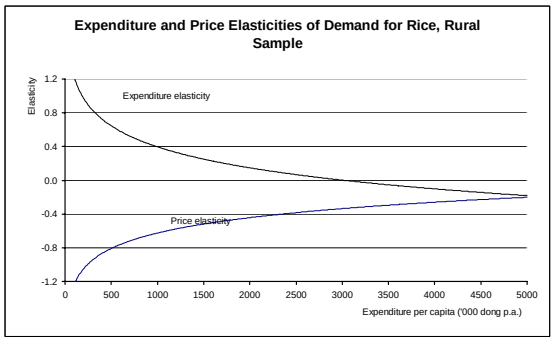
	Coefficient	p-value	Mean
Dependent variable:			
Ln(value of rice consumed by household)			
Independent variables:			
Ln(price of rice in village)	-1.523	0.04	
Ln(household expenditure)	3.672	0.00	
Ln(household expenditure) squared	-0.258	0.00	
Ln(price of rice)×Ln(household expenditure)	0.304	0.00	
Ln(price index, non-rice)	-0.702	0.00	
Urban (yes = 1)	-0.196	0.00	0.199
Age of household head in years	-0.0009	0.15	45.3
Gender of household head (male=1)	-0.078	0.00	
Number of household members who are aged:			
< 1	0.082	0.00	0.11
1 through 3	0.160	0.00	0.36
4 through 6	0.163	0.00	0.38
7 through 12	0.198	0.00	0.79
13 through 19	0.214	0.00	0.78
Male, 20 through 39	0.207	0.00	0.71
Female, 20 through 39	0.174	0.00	0.79
Male, 40 through 59	0.171	0.00	0.30
Female, 40 through 59	0.225	0.00	0.37
Male, 60 and over	0.201	0.00	0.18
Female, 60 and over	0.114	0.00	0.24
Regional dummy variables:			
Region 3 (north central coast)	-0.023	0.28	0.13
Region 4 (central coast)	-0.133	0.00	0.11
Region 6 (southeast)	-0.144	0.00	0.11
Region 7 (Mekong delta)	-0.081	0.00	0.21
Intercept	-3.762	0.00	

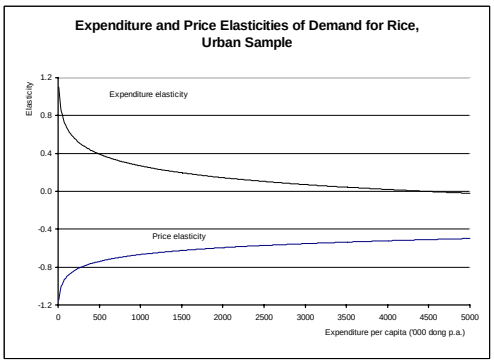
Notes: Adjusted R^2=0.544. Number of observations 4792. Means refer to underlying variables, prior to taking logs. Full definitions of variables are given in Appendix table A1.
Source: Based on Vietnam Living Standards Survey 1992-93.

Appendix 2. Expenditure and price elasticities for subgroups of the population









Appendix 3
Complete Estimation Results of Rice Production Function, 1998

	Coefficient	p-value	Mean**
Dependent variable:			
Ln('000 kg of rice/household/year)			2,035
Independent variables:			
Ln(area sown to rice, in square m/hh/year)	0.728	0.00	7,951
Proportion of rice area irrigated	0.099	0.00	0.82
Ln(male daily field preparation wage, '000 dong)	-0.070	0.00	19.37
Urea: (=1 if used, else = 0)	-0.104	0.04	0.93
Ln(kg of urea used)*	0.082	0.00	140
Phosphates: (=1 if used, else = 0)	-0.040	0.31	0.63
Ln(kg of phosphates used)*	0.025	0.00	89
Organic fertilizer (=1 if used, else = 0)	-0.201	0.00	0.64
Ln(kg of organic fertilizer used)	0.045	0.00	1,337
Other fertilizer (=1 if used, else = 0)	-0.117	0.00	0.72
Ln(kg of other fertilizer used)*	0.061	0.00	28
Pesticides (=1 if used, else = 0)	-0.055	0.11	0.89
Ln('000 dong spent on pesticides used)*	0.050	0.00	206
Other costs (=1 if applicable, else = 0)			
Spending on seed, VNDm	0.090	0.00	0.24
ln('000 dong spent on other inputs used)*			
Age of head of household	0.008	0.01	46.9
Age of head of household, squared	0.000	0.00	
Years of education of household head	0.005	0.00	6.6
Gender of head of household (male = 1)	0.045	0.00	0.80
Distance in km to nearest road	-0.007	0.10	0.33
Number of months road is impassable	0.224	0.00	0.04
Advice received from government? (yes=1)	0.066	0.01	0.38
Advice received from extension agent? (yes=1)	0.056	0.05	0.11
Advice received from radio? (yes=1)	0.055	0.04	0.16
Advice received via TV/other? (yes=1)	0.036	0.23	0.09
Advice about crop season? (yes=1)	-0.022	0.38	0.59
Advice about seeds? (yes=1)	-0.022	0.36	0.12
Advice about other matters? (yes=1)	0.000	0.99	0.05
Advice about insecticides? (yes=1)			
Advice about fertilizers? (yes=1)			
Agricultural extension center in village? (yes=1)	0.038	0.01	0.20
State farm nearby? (yes=1)	-0.104	0.00	0.14
% of households with electricity	0.002	0.00	70
Do most households have electricity? (yes=1)			
Do no households have electricity? (yes=1)			
Is there a local market?	0.001	0.96	0.44
Frequency of local market (0 = never, 1 = daily)			
Is there a large enterprise nearby?	0.039	0.00	0.42
Regional effects:			
Northern Uplands	0.078	0.00	0.16
Northwest Mountains	-0.274	0.00	0.02
Red River Delta (reference region)			0.23
North Central Coast	-0.086	0.00	0.15
Central Coast	-0.051	0.03	0.12
Central Highlands	0.287	0.00	0.06
Southeast	-0.110	0.00	0.10
Mekong Delta	0.204	0.00	0.17
Constant	-6.998	0.00	

Notes: Adjusted R^2=0.88. Number of observations = 3,484. * Ln(0) set equal to 0 in these cases.
** Means of underlying variables, prior to taking logs.
Source: Based on Vietnam Living Standards Survey 1998.