Policy Analysis Using a Village Model: Land-Use in Vietnam

by

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Abstract

Land-use in Vietnam is an important issue in the future economic growth of the country. There is a long history of many radical changes in land-use policy. Vietnam has become a leading exporter of rice (its main agricultural crop) and thus is subject to the variability of world prices. An extensive survey of some 400 farm households in Vietnam has recently been completed and some of the results are used to provide a description of a small number of households. A report is given on the development of a model, designed to reflect some of the basic economic behaviour of a village for use in examining various policy alternatives and eventually changes in land use and land use policy.

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Introduction

Agriculture in Vietnam is characterised by a very large number of agricultural households with a large number of dispersed small plots of land. Land-use rights are the means of defining the property rights of a household in that land. In addition, Vietnam in very recent years has become the second largest exporter of rice and is rapidly developing other agricultural export industries such as coffee and fruits. As Vietnam opens to the world market, there will be pressure on adjustment of the agricultural system and pressure to rationalise and adjust land use and the level of regulation of agriculture. There may be significant benefits to the country from such adjustments but some of the consequences could be serious. The project on which this paper is based is designed to assist in an examination of some of the issues involved in this adjustment process in the context of the historical setting in Vietnam.

As much of the function of Vietnamese agriculture is based around the communes, collectives and villages more detailed understanding of the economic structure of villages is a part of the project.

Economics of a Village

The literature on the economics of the household is now very substantial. Numerous versions and environments have been analysed with an extensive range of policy recommendations and conclusions being drawn following the early work of Barnum and Squire (1979) and Chayanov (1966) (many studies are reviewed and summarised in Singh, Squire and Strauss,1986). The same cannot be said in the case of the development of the economic concepts of a village. There are two broad approaches that have been taken to the development of village models. These are based on the social accounting matrix and micro level computable general equilibrium formulations (Taylor and Adelman 1996, p. 3).

The basic issue in moving from a household model to a village model is the consideration of what are known as household tradables. The structure of a household model is based on the idea that prices are given for tradable items and are determined as shadow values for non-tradables. These are goods and services whose prices are determined either inside or outside the village but external to the household (Taylor and Adelman 1996, p. 182). Household tradables form a very important part of the activity of many households in both developed and developing countries. These exchanges can be signficantly impacted through the many instruments of policy thereby having impacts on household income, economic growth and development as well as the distribution of incomes and wealth. The approach of microsimulation has been used in an effort to define the nature of the shifts in the distributions of variables as policy changes are made (Lau, Yotopolous, Chou and Lin 1981).

The basic household model is essentially a model in which production and consumption of a family or household involving time and other factors of production are used to maximise utility. In this context the prices of the inputs and outputs are taken as given.

In some cases, however, there are missing markets and in this case each household may determine its own values for such resources. These will usually not be explicit but represented as shadow prices within the household model.

One of the markets of some significance that is often missing is that of family labour. Because it is considered difficult to separate family labour from management on household farms, hired labour is unlikely to be a perfect substitute for family labour in many household production activities. For this reason family labour and hired labour are often distinguished as separate factors of production in the village production function.

Households in Vietnam

A basic description of the way in which villages operate in Vietnam has been given by MacAulay, Hertzler and Marsh (2001) with further more general detail in Marsh and MacAulay (2001). More recent survey data collected in 2001 provides a more up-to-date view of the operation of four representative households in the Thach Hoa Commune, Thach That district in Ha Tay Province and four in the Truong Thanh Commune in Can Tho Province. These descriptions of the households provide a backdrop for the nature of the household models that will be needed and the general structure required to represent interacting households.

Thach Hoa Commune, Thach That district, Ha Tay Province

Ha Tay province is located west of Hanoi in the Red River Delta region of Vietnam. Households from four communes in two districts were sampled in Ha Tay province. Thach That district has a larger than average farm size for this province, and Thach Hoa commune was selected as having a larger than average farm size for the district. Twenty five households were surveyed in March/April 2001 about production activities in 2000.

Thach Hoa commune is some 40 km from Hanoi and is linked to Hanoi with a new sealed road in good condition and this has opened up this district to market opportunities in Hanoi. For example, a number of households conduct intensive livestock enterprises (e.g. broiler chickens) under contract to a joint venture company, and others have planted fruit tree orchards. The army has the use of a considerable amount of land in this area and some of this has been available to households for use without charge. Generally, this commune has a mix of hilly land and land suitable for irrigated rice fields.

Usually, two rice crops are grown, a spring crop and a summer crop, and sometimes the rice fields are used to grow a third “winter” crop, usually vegetables, maize or soya bean. The upland area in this district is used to grow fruit trees, tea and cassava. Additionally, many households have small livestock enterprises raising pigs and chickens, and ponds where fish are raised.

Four households were selected at random for detailed study (from the 25 surveyed in Thach Hoa) to provide a sample of farm data for the region. The households came from two hamlets in Thach Hoa commune, Thon 6 and Thon 9. General farm data is shown in Table 1.

Household

The households vary in size from 3 to 8 people. In all cases, except one, the household head is male. The female-headed household is a single adult household. Education levels of the household head (and his wife) are low, ranging from six to ten years of schooling. Two of the households had female members with off-farm incomes, one as a soldier and the other as a worker in a tea-processing factory. In all cases the household had lived in the commune since before 1993 (the year the Land Law was en-acted).

Table 1 Household and land data from 4 households in Thach Hoa commune in 2000

	Hhold 31	**Hhold 32**	**Hhold 33**	**Hhold 34**
No. of people in hh	5	3	4	8
- Over 18 years	4	1	2	4
- Under 18 years	1	2	2	4
No. earning off-farm income	1	0	1	0
Age, sex of hh head	54, male	36, female	46, male	63, male
Farm size (m^2)	14,020	3,936	500	8,400
No. of plots	8	5	2	10
Area of smallest plot* (m^2)	400	360	200	360
Area of largest plot (m^2)	5000	1800	300	1440

* where possible this excludes settlement land

Land holdings

The variation in farm size was considerable, ranging from 500m^2 to 14,020m^2, and the households had between 2 and 10 plots of land ranging in size from 200m^2 to 5000 m^2. Distance of the plots from the house ranged from 10m to 3000m. All families had been assigned the majority of their land holdings in the years between 1988 and 1995. Three of the households had either rented in or borrowed land without charge in recent years. Household 31 had borrowed 3600m^2 of hilly land, 1500m from the house, without charge since 2000. Household 32 had rented-in 696m^2 of ricefield, located 3000m from the house, since 1997. The lease money for this land was 50kg paddy/sao/year – i.e. about 164,000 VND/year for the 696m^2. In 2000, this household had also rented 360m^2 of hilly land, 2000m from the house, from the army for 50,000 VND/year. Household 34 had borrowed hilly land from the army since 1998 without charge: 480 m^2 500m away, and another 480 m^2 700m away. All the hilly land either borrowed or rented is used to grow cassava.

In answers to a series of qualitative questions, two of the households (32 and 34) indicated that they would like to borrow or lease more land but there was no land available. None of the households were interested in transferring their land use rights and all considered that the length of the land use rights was “about right”, and that the rights associated with land use rights were sufficient.

Assets

The value of assets used for production ranged from 3,960mill VND (household 32) to 27,670 VND (households 34) and includes such items as water pumps (4 households), threshers (2), pesticide sprayers (3), hand-pulled carts (3), draught animals (3), reproducing animals (4) and sheds (4). Most assets had been purchased since 1995 and the main items of considerable value were sheds and animals. Households 33 and 34 also had orchards but these were not valued. All households had a durable house, and all except household 32 had a motorbike and colour TV. No household had a telephone or refrigerator. All households stated that they had no savings.

Production

Three of the households were growing spring and summer rice, and cassava. One household (31) also grew tea, and another (34) grew taro. Household 33 (with the small land holding and no rice fields) only grew custard apple. All households raised pigs and chickens, and 2 households (31 and 34) also raised fish. No households were growing winter crops on rice land. Households generally had a mixed garden near their house, which is used to produce fruits and vegetables for home consumption. Some production details are given in Table 2.

Table 2 Production details from 4 households in Thach Hoa commune for 2000

	Hhold 31	**Hhold 32**	**Hhold 33**	**Hhold 34**
Main crops grown	Spring rice Summer rice Cassava Tea	Spring rice Summer rice Cassava	Custard apple	Spring rice Summer rice Cassava Taro
Rice produced (kg)	1600	1200	0	3600
Average rice yield (kg/ha)	4706	4237	na	4167
Percent rice sold	0%	8%	na	28%
Other crops produced (kg)	14000	2000	50	2200
Percent other crops sold	68%	100%	80%	0%
Pigs produced (kg)	650	100	1100	430
Percent pigs (kg) sold	100%	100%	100%	100%
Chickens produced (kg)	1060*	20	90	300
Percent chickens (kg) sold	94%	0%	89%	100%
Fish produced (kg)	150	0	0	400
Percent fish (kg) sold	67%	na	na	75%

* This figure include 1000 kg of beef – sale of one animal

Households did not report any difference between the yield of spring and summer rice, and yields do not vary greatly between households. Most rice produced is consumed,

and cash income derived from other cropping and livestock activities, especially pig production. Exceptions to this are household 34, which uses cassava produced to feed to fish, and household 32 which consumes all chicken meat produced. Most households indicated that over the last 4 years they have had either "a lot more" or "a little more" of some farm products (including rice, cassava, tea, pigs and fish) available for sale.

All households considered that they were not restricted in the way they could use their land, and 2 households indicated that they had changed their production: one by growing fruit trees in the garden (32) and the other by raising lean pork (33). Two households (31 and 33) said that they were now using industrial feedstuffs (concentrates) to feed to animals, especially pigs. Household 34 said that they would like to try different farming activities but were unsure what to do.

Production costs

Data on production costs and labour use was collected on a plot basis for a number of plots for each household. For cropping activities the main costs were for fertiliser, including urea, potassium, phosphorus and NPK, and pesticides. All households used farmyard manure and no cost for this was given. Costs for seed, herbicides and other costs (land tax, and other field costs) were not a large proportion of the costs. No households used hired labour for cropping activities, and whether they exchanged labour for cropping activities with other households was not asked.

An example of the physical costs and labour used for cropping activities by these households is shown in Table 3. Reported production costs vary considerably, but the yield of rice and cassava seems relatively unrelated to production expenses and labour input. It will be interesting to see if this holds true for the data generally. Much of the labour input for all cropping activities seems to be the responsibility of female household members.

Detailed production costs and labour input for livestock activities was not collected from any of these households, except for fish production in households 31 and 34. A summary of these is also shown in Table 3. Again, reported production costs vary considerably, but the yield seems relatively unrelated to production expenses and labour input. The labour reported for household 34 appears excessive and may be a reporting error. For this activity, all the labour input is by male household members.

All cropping households (31, 32 and 34) rated the price of seed and fertiliser as either "medium" or "high", and the price of pesticides as either "high" or "very high". All households said they would use more fertiliser if prices decreased, and two said they would use more seed. All households were unsure about their response to lower pesticide prices. All three households said their use of fertiliser had "increased a little" over the last 5 years, their use of pesticide had either "increased a lot" (one household) or "increased a little" (2), and two households also said their use of seed had "increased a little".

Use of credit facilities

Only one household had borrowed money in the last 5 years, although all households were aware of a wide range of credit sources. Household 31 borrowed 7 million VND for 12 months at an interest rate of 1%/month from the Bank for Agriculture and Rural

Development in July 2000. The loan was used for "agricultural production". No households gave reasons for not borrowing.

Perceptions of yield, price and storage risk

Interviewers reported that households had great difficulty answering questions designed to ascertain perceptions about yield and price risk. All three cropping households made an estimate of high, low and most likely yields for spring and summer rice. These were on average: 223 kg/sao, 90 kg/sao and 157 kg/sao respectively for spring rice; and 207 kg/sao, 83 kg/sao and 150 kg/sao respectively for summer rice. Only household 31 made an estimate of the probability of high, low and most likely yields occurring, and these were 5%, 30% and 65% for spring rice, and 5%, 35% and 60% for summer rice. Prices were not considered to have as much variability as yields. Average estimates of high, low and most likely prices for both spring and summer rice were 1767 VND/kg, 1300 VND/kg and 1567 VND/kg; and household 31 estimated the probability of these prices occurring as 20%, 10% and 70%.

All three rice-growing households stored paddy rice for consumption at a later date and agreed that the crop deteriorated over time. Estimates of the deterioration were 2 kg/100kg/month (2 households) and 5 kg/100kg/month (1 household).

Table 3 Costs/sao* and labour/sao* for farming activities on specific plots for 4 households in Thach Hoa commune

	Hhold 31	Hhold 32	Hhold 33	Hhold 34
Spring rice:				
Yield (kg/sao) – Plot a	165	150	na	150
- Plot b	135			
Production cost/sao ('000d) – Plot a	103.5	65.2	na	87.9
- Plot b	106.9			
Male labour/sao (days) – Plot a	4.1	0	na	3.0
- Plot b	2.7			
Female labour/sao (days) – Plot a	9.3	9.0	na	6.0
- Plot b	9.5			
Summer rice:				
Yield (kg/sao) – Plot a	154	150	na	150
- Plot b	135			
Production cost/sao ('000d) – Plot a	99.3	69.6	na	88.8
- Plot b	102.6			
Male labour/sao (days) – Plot a	3.1	0	na	3.0
- Plot b	3.7			
Female labour/sao (days) – Plot a	8.7	8.5	na	6.0
- Plot b	8.6			
Cassava:				
Yield (kg/sao)	900	700	na	750
Production cost/sao ('000d)	69.7	73.0	na	15.4
Male labour/sao (days)	4.6	0	na	1.5
Female labour/sao (days)	9.4	11.5	na	9.8
Tea:				
Yield (kg/sao)	360	na	na	na
Production cost/sao ('000d)	252	na	na	na
Male labour/sao (days)	2.9	na	na	na
Female labour/sao (days)	9.4			
Fish:				
Yield (kg/sao)	75	na	na	53
Production cost/sao ('000d)	188.5	na	na	234.7
Male labour/sao (days)	15	na	na	63.5
Female labour/sao (days)	0	na	na	0

* 1 sao = 360m^2

Income and consumption

Gross income from farm activities varied between the households, ranging from 4,320,000 VND/year to 25,560,000 VND/year. Net income varied similarly. Generally,

all the households rated the prices for their outputs as "low". However, all households considered that they were "better off" (but not "a lot better off"), compared to their situation 5 years ago. Some details of income derivation are given in Table 4.

Table 4 Income and consumption data from 4 households in Thach Hoa commune

	Hhold 31	**Hhold 32**	**Hhold 33**	**Hhold 34**
Household gross income ('000d)	25560	4320	12440	19620
Household net income ('000d)*	14130	2886	6840	11182
Percent gross income from crops	60%	61%	2%	38%
Percent gross income from l/stock	40%	39%	98%	62%
Percent gross income from other	0%	0%	0%	0%
Percent net income from crops	77%	71%	3%	50%
Percent net income from l/stock	23%	29%	97%	50%
Percent net income from other	0%	0%	0%	0%
Household consumption/year ('000d)	17880	3000	9485	8600
Net income - consumption ('000d)	-3750#	-114	-2645#	2582

* Costs deducted here do not include an imputed cost for family labour
# Households 31 and 33 have not reported the salary earned by a household member working off-farm

Only one of the households (33) makes the main proportion of its income from livestock production. Two households (31 and 32) make approximately 75% of their net income from cropping activities and household 34 makes 50% of its net income from cropping activities. The higher costs associated with livestock activities are shown by the lower percentage of net income, compared to gross income, deriving from livestock activities. Note that the costs associated with all farming activities do not include an imputed cost for family labour, although we have estimates of time spent on various farming activities. Consumption expenses do not include the value of rice produced and consumed. The values for net income minus consumption are reasonable, given the likelihood of estimation errors (in both production and consumption) and that two households have not reported salaries earned by family members working off-farm.

It is interesting to note that low income is not strictly determined by farm size, although this is undoubtedly a factor, but is a complex interaction of land, labour and capital available to invest in production. The single adult household is the poorest of these households, despite having considerably more land than household 33, and approximately half the land of household 34, which has a gross income almost 5 times more.

Production indicators

Using the plot based data it is possible to calculate net income/sao for various crop activities. These are shown in Table 5. These net incomes are inclusive of the cost of family labour.

Net incomes/sao for spring and summer rice vary between households but are comparable. A price of 1700 VND/kg was a consistent rice price across households and across seasons, so the variability reflects a difference in the costs of inputs/sao. Interestingly, one rice plot for household 31 is much more productive than the other. There is more variability in the net income/sao for cassava, but except for household 32 the net income/sao for cassava was higher than for rice. Household 32 received 100d/kg less for cassava than the other households. Generally, higher net income/sao is received for alternative enterprises such as fruit trees, tea and fish (especially compared to cassava). The increasing number of orchards in this area is no doubt a reflection of these higher returns.

Table 5 Net income/sao for farm activities for 4 households in Thach Hoa commune

	Hhold 31	**Hhold 32**	**Hhold 33**	**Hhold 34**
Net income/sao ('000d)				
Spring rice	176.3	189.9	na	167.1
	122.6			
Summer rice	163.0	185.4	na	166.2
	126.9			
Rice combined (spring and summer)	339.3	375.3	na	333.3
	249.5			
Cassava	200.3	137.0	na	284.6
Tea	468.0	na	na	na
Custard apple	na	na	355.4	na
Fruit trees	666.7	na	na	na
Fish	561.4	na	na	188.8
Net income/kg produced (VND)				
Pig meat	1769	4500	4727	1395

The lower net income for fish production received by household 34 is a consequence of a lower price/kg (8,000 VND/kg compared to 10,000 VND/kg) and higher costs associated with using feed concentrates. The net income per kilogram produced for pig meat is extremely variable between households, with two having values over 4000 VND/kg produced and two having values less than 2000 VND/kg produced. The price/kg received is not the only reason for the discrepancy as household 34 with the lowest net income/kg produced received the highest price/kg (14,000 VND/kg). Household 33 which indicated in the survey that they had changed their pig production enterprise to produce lean pork had the highest net income/kg produced, but not the highest price/kg (9,859 VND/kg). We have no way of knowing from the data more details of the operation (e.g. age and weight of sale pig, feeding, etc), but considering the large differences in returns and the importance of this activity to farm households, they bear further investigation.

Some issues:

Given that this is a very small sample and that there could be data errors, the following points are raised as significant observations

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- There are ome indications of significant technological/extension issues – e.g. yield of rice and cassava crops appear unrelated to input costs and labour; variability in returns from pig and fish production are high.
- Seeing land is in such short supply why is there not a strong market for all types of land – e.g. some land borrowed without charge (and producing net returns from cassava of around 200,000 VND/sao), whereas rice land is leased for a value of 84,828 VND/sao which represents approximately 17% of the value of the gross income/sao (2 rice crops).
- The minimal use of credit facilities – is it a matter of availability, procedure or risk (or all)? It does mot appear to be a lack of awareness of the credit facilities.
- Small farm size does not necessarily mean small incomes from farm activities – enterprise choice is important. Low income appears to be a result of a complex interaction between availability of land, labour and capital.
- What are the men doing with all their time, seeing that the women do the majority of the farm work (and we know that women will do all the home work)? Labour use is clearly a significant issue.
- Why no winter crops – especially seeing the farms are so close to Hanoi? It is hard to believe that there are no winter crops worth growing, but less and less winter cropping appears to be happening.
- Costs associated with buffalo have not been taken into account – are these minimal and what is the role they play in the income of the household?

Truong Thanh Commune, O Mon district, Can Tho Province

Can Tho province is located west of Ho Cho Minh City in the Mekong Delta region of Vietnam. Households from four communes in two districts were sampled in this province. O Mon district has a larger than average farm size for this province, and Truong Thanh commune was selected as having a larger than average farm size for the district. Twenty five households were surveyed in August 2001 about production activities in 2000.

O Mon is considered to be the heart of the major rice growing area of Vietnam. In this region, three rice crops are grown, a winter-spring crop, a summer crop, and monsoon crop. Many farms also have extensive fruit orchards. Seventy percent of Vietnam's fruit is grown in the Mekong Delta region. Additionally, many households have small livestock enterprises raising pigs and chickens, and ponds where fish are raised.

As the data entry from our survey is not complete, four households were selected at random (from the 25 surveyed) to provide a sample of farm data for this region. The households came from two hamlets in the commune, Truong Thanh and Truong Thanh A. General farm data are shown in Table 6.

Table 6 Household and land data from 4 households in Truong Thanh commune in 2000

	Hhold 421	**Hhold 422**	**Hhold 423**	**Hhold 424**
No. of people in hh	5	4	6	3
- Over 18 years	3	3	6	2
- Under 18 years	2	1	0	1
No. earning off-farm income	1	0	0	2
Age, sex of hh head	73, male	55, male	51, male	41, male
Farm size (m^2)	22,000	24,000	28,000	800
No. of plots	5	2	2	1
Area of smallest plot (m^2)	2,000	2,000	8,000	800
Area of largest plot (m^2)	7,000	22,000	20,000	800

Household

The households vary in size from 3 to 6 people and in all cases the household head is male. Generally, the education levels of the household head (and his wife) are low, except for one household where the household head had a University education. Several households had children at university or studying for entrance examinations. Two of the households had members with off-farm incomes, one as a teacher and the other where both adults had small off-farm incomes (e.g. family planning worker in the village). In all cases the household had lived in the commune since before 1993 (the year the Land Law was en-acted).

Land holdings

The variation in farm size was considerable, ranging from 800m^2 to 28,000m^2, although three of the households had comparably sized landholdings. Number of plots per household was between 1 and 5, ranging in size from 800m^2 to 22,000 m^2. Distance of the plots from the house ranged from nearby to 1000m. All families had inherited all their land holdings (from grandparents, parents or parents-in-law). Only one household (421) had acquired more land in recent years. This land (7000m^2) had been acquired under a contract known as "cam co" (literally, pawned). The household paid 7 grams of gold for use of the land for 2 years. If the owner cannot pay back the gold at the agreed time, the land will be lost to the original owner and become the property of the household who paid the gold.

One of the households (424, the small landholder) indicated that they would like to borrow or lease more land but were unable to do so as there was no land available, and they also didn't have enough capital or labour. None of the households were interested in transferring their land use rights. The households seemed unsure about questions related to land use rights, suggesting that it was not an issue and depended on government policy. The enumerator left this question unanswered in the survey.

Assets

The value of assets used for production was generally low (around 2,200 mill VND, usually a water pump) except for household 421 who owned a ploughing machine (purchased in 1991) and hence had assets worth 27,500 mill VND. Only one household (424) owned a reproducing animal, and no draught animals were owned. Orchards were not valued. All households had a durable house and a colour TV, and all except household 424 had a motorbike. No household had a telephone or refrigerator. All households stated that they had no savings.

Production

Two of the households were growing winter-spring, summer and monsoon rice. Some production details are given in Table 7. There was a great difference in the yield of the three different rice crops, with the best yield for winter-spring rice and successively lower yields for summer and monsoon rice. Unlike in the north, both households sold more than 50% of their rice crop (one selling 90%). All produce from other cropping and livestock activities, such as fruit and pig production, was sold. None of the households were producing meat apart from pigs, and none were raising fish. Both rice-producing households indicated that over the last 4 years they have had "a little more" available to sell, and households 424 said they had sold "a little more" pig over the last 4 years.

All households considered that they were not restricted in the way they could use their land, and none indicated that they would like to try different farming activities. Two households indicated that they had changed their production activities, both by changing their fruit production from orange and mandarin to banana, durian and mango. One household (422) said that they were 'feeding' (fertilising) their durian orchard differently.

Table 7 Production details from 4 households in Truong Thanh commune for 2000

	Hhold 421	**Hhold 422**	**Hhold 423**	**Hhold 424**
Main crops grown	Wtr-spr rice Summer rice M'soon rice Mixed fruit Orange	Banana Durian	Wtr-spr rice Summer rice M'soon rice Mixed fruit	None
Rice produced (kg)	19,800	0	9,800	0
Average rice yield (kg/ha)	5077	na	4083	na
Percent rice sold	90%	na	56%	na
Other crops produced (kg)*	6,000	10,000	0	0
Percent other crops sold	100%	100%	na	na
Pigs produced (kg)	0	0	2200	1080
Percent pigs (kg) sold	na	na	100%	100%
Chickens produced (kg)	0	0	0	0
Percent chickens (kg) sold	na	na	na	na
Fish produced (kg)	0	0	0	0
Percent fish (kg) sold	na	na	na	na

* Fruit and vegetables produced for consumption are not included as no production in kg was recorded. Both households 421 and 423 recorded a value of foods other than rice produced and consumed.

Production costs

Data on production costs and labour use were collected on a plot basis for a number of plots for each household. For winter-spring rice the main costs were fertiliser, including urea, potassium, and DAP, pesticides and herbicides, fuel, and harvesting services, and for household 423 the amount paid for land preparation and crop protection. Less fertiliser was used for the summer rice crop, but levels of pesticide and herbicide use still appeared to be high. Costs for producing monsoon rice were lower again, with less fertiliser, pesticide and herbicide being used and fees for land preparation and crop protection greatly reduced. For all crops, costs for seed, hired labour and other costs (land tax, and other field costs) were not a large proportion of the costs. Neither household used farmyard manure. Labour used for cropping was considerably less than in the south.
An example of the physical costs and labour used for cropping activities by these households is shown in Table 8.

Data on costs of fruit production were collected from plots owned by households 421, 422 and 423. As some of these orchards have been recently established they may not be in full production. For example, the data for durian yield is very low (0.7kg/sao) which suggests these trees are still being established. Detailed production costs and labour input for livestock activities were not collected from any of these households.

Three households (421, 422 and 423) rated the price of pesticide and fertiliser as either "medium" or "high", household 423 rated the price of machinery hire as "high", and household 424 rated the price of animal feed (rice bran) as "high". All households said they would not use more inputs if prices decreased, except for households 422 who indicated they would use more fertiliser. All cropping households said their use of inputs (including seed, fertiliser, pesticide, labour and machinery) had either "stayed the same" or "decreased a little" over the last 5 years, while household 424 indicated their use of pig feed (rice bran) had "increased a little".

Table 8 Costs/sao* and labour/sao* for farming activities on specific plots for 4 households in Truong Thanh commune

	Hhold 421	Hhold 422	Hhold 423	Hhold 424
Winter -spring rice:				
Yield (kg/sao)	248	na	225	na
Production cost/sao (‘000d)	187.7	na	125.0	na
Male labour/sao (days)	0.6	na	0.3	na
Female labour/sao (days)	0.1	na	0.2	na
Summer rice:				
Yield (kg/sao)	167	na	135	na
Production cost/sao (‘000d)	135.3	na	117.3	na
Male labour/sao (days)	0.6	na	0.3	na
Female labour/sao (days)	0.1	na	0.2	na
Monsoon rice:				
Yield (kg/sao)	140	na	81	na
Production cost/sao (‘000d)	68.1	na	52.4	na
Male labour/sao (days)	0.4	na	0.3	na
Female labour/sao (days)	0.1	na	0.2	na
Orange:				
Yield (kg/sao)	309	na	na	na
Production cost/sao (‘000d)	166.6	na	na	na
Male labour/sao (days)	4.6	na	na	na
Female labour/sao (days)	0.0	na	na	na
Banana:				
Yield (kg/sao)	na	na	259	na
Production cost/sao (‘000d)	na	na	61.9	na
Male labour/sao (days)	na	na	1.0	na
Female labour/sao (days)	na	na	0	na
Banana and durian:				
Yield (kg/sao)	na	164	na	na
Production cost/sao (‘000d)	na	85.9	na	na
Male labour/sao (days)	na	1.1	na	na
Female labour/sao (days)	na	0	na	na

* 1 sao = 360m^2. A sao is not a common unit of measurement in the south and these costs would be more normally expressed on a per hectare basis. For the sake of comparison with data from the north they are expressed on a per sao basis.

Use of credit facilities

All households were aware of credit sources, and two households had borrowed money in the last 5 years. Household 421 has an on-going seasonal loan from the Bank for

Agriculture and Rural Development to cover production costs. Commencing in January 2000, they have borrowed 5 million VND for a 4 months term at an interest rate of 1%/month. The loan is repaid at the end of each cropping season, and taken out again to cover the costs of the next crop. Household 423 took out a 12 month loan at 1%/month in January 2000 with the Bank for Agriculture and Rural Development for 5 million VND which was used to improve the fruit garden. In both instances, the "red book" defined land-use rights provided the collateral required for the loans.

When asked about problems with either getting loans or existing loans, household 421 complained that the loan term was too short, and household 423 complained about the complicated procedures and the long time that it took to arrange loan finance.

Perceptions of yield, price and storage risk

Households 421 and 423 made an estimate of high, low and most likely yields for winter-spring and monsoon rice and the probabilities of these yields occurring. These were on average: 6625 kg/ha, 3899 kg/ha and 5800 kg/ha respectively for winter-spring rice; and 4850 kg/ha, 1125 kg/ha and 4175 kg/ha respectively for monsoon rice. The average estimate of the probability of high, low and most likely yields occurring were 10%, 20% and 70% for winter-spring rice, and 17.5%, 7.5% and 75% for monsoon rice. Prices were not considered to have as much variability as yields. Estimates of high, low and most likely prices for both spring and monsoon rice made by household 423 were 1600 VND/kg, 1200 VND/kg and 1500 VND/kg. No probabilities of receiving these prices were estimated.

Only household 423 stored paddy rice for sale at a later date and although they agreed that the crop deteriorated over time, they gave no estimate of the rate of deterioration, or the probability of selling the grain for a higher/lower price at a later time.

Income and consumption

Gross income from farm activities varied between the households, ranging from 19,500,000 VND/year to 45,520,000 VND/year. Generally, all the households rated the prices for their outputs as "low". However, all households considered that they were "better off" (but not "a lot better off"), compared to their situation 5 years ago. Opinion about future opportunities for household\ members ranged from "a little less opportunity" to "a little more opportunity". Two households considered that off-farm income earned in the future by their household would be "a little more", and the other two thought it would be "about the same". Two households currently earned income from off-farm activities (aside from salaried work). Some details of income derivation for the households are given in Table 9.

Two of the households (422 and 424) make the main proportion of their income from off-farm activities, and one household (421) only derives income from cropping activities. Livestock activities are a substantial component of income for two households (423 and 424). Note that the costs associated with all farming activities do not include an imputed cost for family labour, although we have estimates of time spent on various farming activities. Consumption expenses do not include the value of rice produced and consumed. The values for net income minus consumption are reasonable (except for households 422), given the likelihood of estimation errors (in both

production and consumption), and that household 421 has not reported the salary earned by a family member working off-farm (as a teacher).

Production indicators

Using the plot based data it is possible to calculate net income/sao for various crop activities. These are shown in Table 10. These net incomes are inclusive of the cost of family labour.

Table 9 Income and consumption data from 4 households in Truong Thanh commune

	Hhold 421	**Hhold 422**	**Hhold 423**	**Hhold 424**
Household gross income ('000d)	35,540	19,500	45,520	23,840
Household net income ('000d)*	16,350	18,000	24,644	5,240
Percent gross income from crops	100%	38%	49%	0%
Percent gross income from l/stock	0%	0%	51%	44%
Percent gross income from other	0%	62%	0%	56%
Percent net income from crops	100%	33%	72%	0%
Percent net income from l/stock	0%	0%	28%	50%
Percent net income from other	0%	67%	0%	50%
H/hold consumption/year ('000d)	20,580	28,900	18,000	7,788
Net income - consumption ('000d)	-4,230#	-10,900	6,844	-2,548

* Costs deducted here do not include an imputed cost for family labour
# Household 421 has not reported the salary earned by a household member working off-farm

The major point of note is the profitability of rice cropping, even though returns from the monsoon crop are comparatively low. It appears to be much more profitable than fruit production, although both the banana orchards are probably only recently established. Household 421 owns more factors of production than household 423 (notably a ploughing machine) and hence might be expected to have lower costs of production (the same rice price of 1700 VND/kg) has been used to calculate incomes). It is important to note that depreciation expenses have not been calculated and deducted as part of production expenses for households 421. This would result in a lower net income/sao for rice production for this household.

Table 10 Net income/sao for farm activities for 4 households in Truong Thanh commune

	Hhold 421	Hhold 422	Hhold 423	Hhold 424
Net income/sao ('000d)				
Winter-spring rice	233.1	na	257.5	na
Summer rice	147.8	na	112.2	na
Monsoon rice	169.0	na	85.3	na
Rice combined (3 crops)	549.9	na	455.0	na
Orange	234.5	na	na	na
Banana	na	na	154.1	na
Banana and durian	na	99.8	na	na
Net income/kg produced (VND)				
Pig meat	na	na	3136	2407

Some issues:

Given that this is a very small sample and that there could be data errors, the following points are raised as issues for consideration in further work.

- Rice production in the south appears to be much more commercial in nature – production loans, use of machinery, use of contract services, sale of all the crop after harvest are all practised. Also, rice is much more profitable (on the basis of net income/sao).
- Cost data need to be collected differently for surveys in the south – space is needed for recording fuel, loan repayments, depreciation, contract services, etc. The original survey as it exists was really appropriate for cropping in the north
- Not much evidence of land leasing, etc. was provided in this small sample
- Livestock enterprises seem to be fairly minimal – despite the fact that labour requirements for cropping are much less than in the north. What are people doing with their time? Women, in particular, do not appear to be involved in farm work. Two households were running other enterprises (one selling mixed goods in the market, and the other making wine), and in household 424 both adults had low paying off-farm work.
- Despite higher incomes, household assets are still very minimal.
- Despite being grain sellers, it was difficult to ascertain their perceptions of price risk and the risk associated with storing grain for sale at a later date.
- "Cam co" as a procedure for land "leasing" is interesting. Do any farmers ever manage to raise the money needed to "buy back" the land at the agreed time?

Differences between the north and the south

- The south appears to be less diversified than the north–fewer livestock enterprises.

- The farms in the south had larger land holdings and less fragmented land, and land appears to have been owned by families for generations
- These farms in the south had generally higher gross and net incomes – a reflection of the profitability of rice cropping and larger land size.
- Draught animals appear to have been replaced by machinery.
- More use of hired labour and contract services was apparent – such as, land preparation, threshing, and spraying.
- Less farm assets appeared to be owned in the south (e.g. no household owned a pesticide sprayer but they spent money on pesticides) – with the exception of household 421 who owned a ploughing machine
- Rice was usually sold after harvest and not kept for consumption – rice was then bought back in for consumption as needed

Similarities

- Even though households are poor everybody agrees they are better off than 5 years ago.
- Nobody wants to lose their land ("cam co" is an indication of the extent people will go to not actually sell land)
- Generally, people do not seem to visualise off-farm opportunities for themselves or their families – although generally children appear to be at school and some are at university.

Based on this background it would seem that modelling work designed to assess some of the consequences of changes in agricultural policies and an assessment of their consequences will need to include some of the following issues:

- A mixture of cropping and small scale animal enterprises
- The possibility of the introduction of different credit policies and the more extensive use of credit
- An increase in the use of labour for off-farm work and the role of labour sharing between households
- Changes in the enterprise mix to a more diverse agriculture
- An understanding of the role and value of land to the household and the implications of "cam co".
- The effects of productivity increases through better use of inputs
- The effects of distance between plots and the trade off with diversification through the use of a variety of plots as a risk reduction strategy.
- The roles of women and men
- The ways in which the prices of goods are determined for a household
- The differences in behaviour in relation to storage of rice in the north and the south and the consequences of different rates of deterioration
- The role of seasonality of production and income flows.
- The renting and leasing of land as well as the possibility of land-use title sales and purchases.

These are extensive requirements and clearly are unlikely to be all taken into account in one model. In the following the focus is on the issue of the interaction between households in determining, in particular, the prices of goods that are exchanged. First

the basic household model is considered and then how two or more households may be linked.

A Household Model

The basic household model is well described by Ellis (1998). A modified version is presented here so as to provide a formulation suitable for combining of individual households together to form a village model through tradables and price linkages. The basic model is formulated with a utility function, two production functions (for two crops) or products and a full income constraint. The formulation parallels that of MacAulay and Hertzler (2000) through relaxation of the risk parameters. In this way the basic model can then be expanded if needed to include the issues involved in risk.

The model is designed to allow for goods produced and sold and not consumed, Q

Let the Stone-Geary utility function be:

(1) $J = \max (y_b, y_c, y_d)$

$= \max (y_b - \beta_b)^{\alpha_b} + (y_c - \beta_c)^{\alpha_c} + (y_d - \beta_d)^{\alpha_d}$

where y_I are consumption levels above the minimum of β_I . Three groups of goods are assumed to enter the utility function for the purposes of the model development..

Full income constraint

(2) $p_a X_a(l_a, z_a, k_a, A) - x_a X_1 A + y_2 Y_2(L_2, X_2, (1-K_1)A) - x_2 X_2 (1-K_1)A +$

$l\,[T - L_1 K_1 A - L_2(1-K_1)A - Q_4] - y_2 Q_2 - q_3 Q_3 = 0$

where the lower case letters are costs or prices associated with the quantities of labour, L, variable inputs X, share K_1 of the land area A allocated to the first crop and l is the wage rate. The total time available to the household is T and Q_2 is produced, consumed and sold, Q_3 is purchased and Q_4 is time used in the production of Z-goods (see Becker 1965)

Production functions

(3) $Y_1(L_1, X_1, K_1, A) = f_1(L_1, X_1)\, g_1(K_1)\, h(A)$

$f_1(L_1, X_1) = \gamma_1 L_1^{\eta_1}, X_1^{\mu_1} e^{\nu_1 X_1}$

$g_1(K_1) = K_1^{\phi_1} e^{\theta_1 (1 - K_1)}$

$h(A) = \omega A^{\xi} e^{\psi A}$

(4) $Y_2(L_2, X_2, K_1, A) = f_2(L_2, X_2)\, g_2(K_1)\, h(A)$

$f_2(L_2, X_2) = \gamma_2 L_2^{\eta_2}, X_2^{\mu_2} e^{\nu_2 X_2}$

$g_2(K_1) = (1 - K_1)^{\phi_2} e^{\theta_2 K_1}$

$h(A) = \omega A^{\xi} e^{\psi A}$

The system of production functions for two crops is designed to allow for effects important to the analysis of the links between the farm and the consumption side of the model. The functions are for two products which are Cobb-Douglas in labour and transcendential in variable inputs. Yield interactions are specified through the parameters $\phi = 1$ and $\theta = 0$ if there are no interactions. In this case g_1 will be equal to K_1 and g_2 will be equal to $(1-K_1)$. The function h is designed to capture economies of farm size and is common for both commodities. If there are no economies of size in terms of farm area then ω and ξ will be 1 and ψ will be zero so that function h will equal A. If there are no yield interactions or economies of size, then the production per farm is simply the yields per unit of area multiplied by the area after taking the share of the land allocated to the crop K_1 into account.

The optimality conditions for the model are essentially those given in MacAulay and Hertzler (2000) and require the following:

- The marginal utility for each consumption good divided by the marginal utility of income equals the price of the good. For the household prices for each of the goods are given.

- For labour input for a given crop (input per hectare) the value of the marginal product of labour is equated to the wage rate times the area used for the particular crop.

- For variable inputs for a given crop (input per hectare) the value of the marginal product of the variable inputs is equated to the input price multiplied by the area used for the crop.

- For land the value of the marginal product of land for each crop is equated to the sum of the input prices of labour and variable inputs each multiplied by the input level and the share of land used for the crop.

- For the land share to each crop (a variable in the model) the value of the marginal product for the land share is equated to the sum of the input prices for labour and variable inputs each multiplied by the input level and the total area of land.

Although storage was included in the model of MacAulay and Hertzler (2000) this ahs been ignored for the initial consideration of linking households together.

Village Model

For the village model essentially two household are specified and linked together with the possibility of trade between them, The links involve the physical flow of goods and allowing the associated prices to be endogenous. Thus, analgously to Takayama and Judge (1994) the following general relationships are included:

(5) $y_1 = x_{11} + x_{21}$

(6) $y_2 = x_{12} + x_{22}$

(7) $x_1 = x_{11} + x_{12}$

(8) $x_2 = x_{21} + x_{22}$

Where y_1 and y_2 are the demand quantities, x_1 and x_2 the supply quantities and x_{ij} the trade flows from i to j. In addition to the physical flows there are price linkage relationships as follows:

(9) $dp_i - sp_j \leq t_{ji}$

where dp_I and sp_I are demand and supply prices.

Such linkages may be specified for produced goods and factors of production such as labour. The transfer of land and land use rights poses some special issues in terms of the pricing of assets. These are left for future work.

In graphical form and considering the trade in a product such as rice, as distinct from that of labour or variable inputs a representation is given in Figure 1. In this representation two households are portrayed in which a production function and a utility function indifference curve for each household are indicated. The points of consumption and production are shown with large round dots. The difference between these two on the vertical axis is the marketable surplus. In an exchange between households the price of the output will adjust relative to the wage rate (assumed given exogenously for separable household models) so that for two households the marketable surplus for one household will equal the deficit for the other household. Of course, it is possible for both households to have a marketable surplus and the surplus sold outside the village. In this case, the 'rest of the world' demand would need to be represented.

The third diagram is a excess supply demand diagram in which a mapping of the marketable surplus with price change for each household is given. The transaction cost for the exchange implies that the supply price for the supplying household will be less than that of the purchasing household. The cash flows associated with the exchanges will enter into the household full income equation and thereby affect the purchasing of other goods, and the amount of labour hired in and out and the level of variable inputs used.

A small-scale model of this type has been constructed using MS Excel and the nonlinear solver system within Excel. Experience with this model at the present time suggests that it is quite sensitive to parameter settings and to the specification of the accounting relationships within the model.

The basic construction of the model began with a standard primal dual spatial equilibrium model formulation as given in Batterham and MacAulay (1994). Since the basic household model is in terms of maximising a utility function it was necessary to formulate a set of demand functions for the consumed goods. From the Stone-Geary utility function the derived demand functions have the form (Sadoulet and de Janvry 1995):

(10) $q_i = c_i + b_i/p_i \, (y - \Sigma \, c_j \, p_j)$

Using specified minimum consumption levels and the exponent values for the utility function it was possible to derive parameters for such functions using Mathematica and these are in terms of income and prices. This conversion then allowed the objective function of the model to be in net revenue terms which is consistent with the primal dual spatial equilibrium formulation of the spatial model.

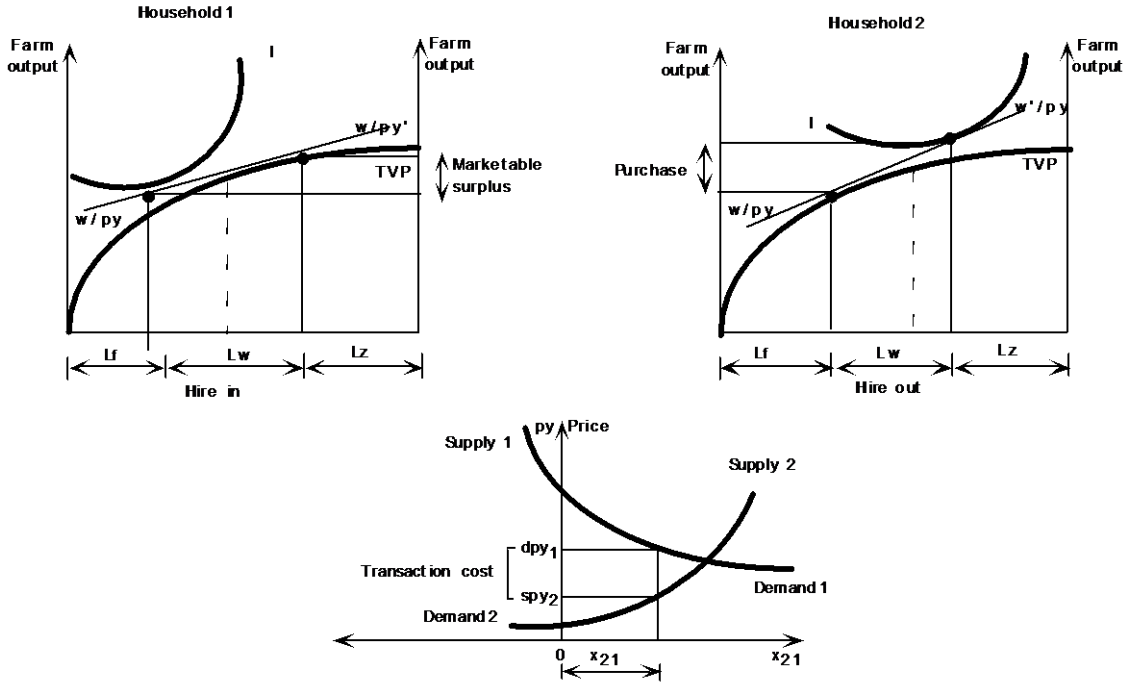

Figure 1 Product exchange between households

Next a full income constraints and activities were developed for each household in which the cash flow consequences of trade between the households were taken into account. The full income constraint provided income to the income activities within the model to allow simultaneous shifts to take place in the demand functions. The full income constraint is as in equation (2) above. The total time available to the household and the uses for that time are included in the full income constraint and valued at the wage rate (assumed to be exogenously determined).

Finally, the production functions were included as nonlinear functions of the inputs of labour, variable inputs and land adjusted for a crop share (K_1). These are complex functions which allow for many different effects to be included as experiments in the model.

Further work is required to incorporate the exchange relationships for land and labour and to take into account in-kind exchanges as well as monetary based changes.

Some Policy Experiments

At the time of writing of the paper the model was not behaving in an adequate fashion probably because of the set of parameters chosen on which to develop the model.

Technical issues involved negative values for inputs, values of the crop share over 1.0 or less than zero, and very rapid adjustment of inputs to policy changes so that households tended not to trade with each other but to be self-sufficient. This paper is therefore a work in progress in which the set of policy experiments will be reported at a later date

The simplest experiment is to examine the effect of a change in the price of purchased only goods and examine the effects on the exchange of goods. This is rather like observing the effects of an external price change on the household. It is clear that a rise in the price of a second good will reduce purchases of that good but depending on the revenue effects may increase or decrease the households income level. Many adjustments are possible. Reduced purchases of inputs and reduced production of the primary product (for example, rice), reduced consumption associated with the fall in full income and a change in the level of exchange in goods between households.

A similar experiment could be carried out on the good that is both produced and sold (not consumed in the household) so as to examine the effects of price changes on the commercial part of households.

A second simple policy experiment is to raise (or lower the price of the variable inputs) or change the wage rate. This change may also have perverse effects as it works through the full income constraint and shifts in the demand structure.

Changes in the level of efficiency of production, changes in the returns to scale in the use of land, changes in the effects of crop rotations on other crops, etc can all be evaluated in such a model.

Concluding Comments

Adjustment of the rural sector in Vietnam is taking place in a number of areas very rapidly. Vietnam has recently become one of the world's major exporters of rice. This will put pressure on for further adjustment and lead to significant policy change. The data and tools to analyse the changes and associated policy changes are being constructed and progress in this area reported in this paper.

The character of Vietnamese farming is complex as a total picture but initial survey results are suggestive of a reasonable degree of homogeneity in the nature of the production system at the household level. Farms clearly differ greatly in profitability and a number of other characteristics and some of these differences may have much to do with the human capital resources but also much to do with how the inputs and outputs from farming are used. Policy change can clearly affect these differences.

Modelling is one way of examining some of the consequences of policy change. Such models need a solid database. This is being set up through survey work of over 400 households in 2001 and another set will be interviewed in 2002. Construction of suitable models is a tedious and tortuous process when there do not seem to be many other models on which to base the work. The combination of household models into 'village models' seems like an appropriate way to get at the effects of changes to levels of productivity, changes in prices, changes in transaction costs, changes in income levels and changes in the riskiness of the environment. Changes to the rules for land use can

also be examined in this framework but more work is needed to develop a suitable model for this purpose.

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