



Pro-Poor
Livestock
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The Contribution of Livestock to Household Income in Vietnam: A Household Typology Based Analysis

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PREFACE

This is the 21st of a series of Working Papers prepared for the Pro-Poor Livestock Policy Initiative (PPLPI). The purpose of these papers is to explore issues related to livestock development in the context of poverty alleviation.

Livestock is vital to the economies of many developing countries. Animals are a source of food, more specifically protein for human diets, income, employment and possibly foreign exchange. For low income producers, livestock can serve as a store of wealth, provide draught power and organic fertiliser for crop production and a means of transport. Consumption of livestock and livestock products in developing countries, though starting from a low base, is growing rapidly.

The analysis presented in this paper focuses specifically on the link between poverty and livestock in Vietnam with the aim of evaluating how livestock contributes to household income and the role livestock plays for poor households. In this context, better understanding the link between livestock and the poor will allow more specific targeting of this group of the population through policies that promote livestock, with the final aim of improving their living standards and identifying a possible route out of poverty.

We hope this paper will provide useful information to its readers and any feedback is welcome by the author, PPLPI and the Livestock Information, Sector Analysis and Policy Branch (AGAL) of the Food and Agriculture Organization (FAO).

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Introduction

The poverty analysis and assessment carried out by the World Bank (1999) reports that although overall Vietnam has witnessed a significant reduction in poverty, poverty levels still remain relatively high. Poverty in Vietnam, as in many other developing countries, is found to be strongly correlated with location, households located in rural areas being more likely to be poor. Approximately 90 percent of the poor in Vietnam reside in the rural areas and over 80 percent of poor households are farm based. Poverty in Vietnam also has marked regional characteristics and among the regions, poverty is clearly higher and deeper in the upland regions of the Northern Mountains and the Central Highlands compared to the coastal areas and river deltas.

Given that poor rural households have repeatedly been found to over-proportionally rely on livestock for their subsistence, the main objective of this paper is to assess the role that livestock plays for poor households in Vietnam and to identify which households might effectively be targeted for poverty reduction through policies affecting the livestock sector.

Background Analysis and Typology Groups

The analysis is based on data collected by the second Vietnamese Living Standard Measurement Survey (VLSS II) carried out in 1997-98 under the technical assistance of the World Bank. The analysis in this document only draws on selected sections of the household questionnaire and focuses on agricultural and livestock production activities. The data in the VLSS II is analyzed according to a ten region subdivision that allows to further distinguish amongst urban and rural areas.

In the major and middle-sized urban areas, livestock ownership is relatively low, starting to increase in small urban areas. On the other hand, most households in the rural areas own livestock with the exception of the rural Southeast region where the proportion declines to 1 in 2 families. Livestock ownership is particularly high in the mountainous areas, in the Red River delta region and along the Central coast. Households mostly own pigs and chicken, followed by cattle, ducks and 'other' animals. Pigs are owned by 47.6 percent of households and 51.6 percent of households own chicken. Approximately 7 out of 10 households own pigs in the rural Northern mountains, Red River delta and Central coast areas. The same trends arise for chicken ownership in these regions and also for the rural central highlands.

Total household income in rural areas is considerably lower than household income in the urban areas. Average urban income is more than three times as high as average household income in rural areas. Households living in rural areas report a mean annual total household income of 743 USD per year or 163 USD per capita per year while total household income in urban areas on average amounts to 2,497 USD per annum or 584 USD per capita per year. The proportion of poor people in rural areas is 5 times as high as the proportion of the poor in the urban areas.

We classify households hierarchically according to two criteria, namely the reliance of the household on agricultural income (2 categories) and the share of own home production consumption in total household income (3 categories). The latter is used as a proxy for the level of market integration of the household. Thus five typology groups were set up, ranging from households less/not involved in agriculture to more agriculture oriented households and, within these two groups, from more market integrated households to more subsistence based ones.

Urban households, in their vast majority (>90%), generate income from diverse sources, while agricultural income only represents an average share of 3% of total

income. Nonetheless, seven percent of urban households fall into the category of agricultural households and, for another 1.6 percent of urban households, agriculture still constitutes a significant source of income (33 percent).

In the rural areas slightly more than half of the households (55.6 percent) fall into the 'agricultural household' classification. More specifically 33 percent of the rural sample still show a strong reliance on own production consumed in household. On the other hand, a relatively large share of the households (34.8 percent) belongs to the more market integrated and income diversifying households.

Highest mean agricultural incomes are achieved by the more market-integrated agricultural households. These households also dispose of the largest mean plot sizes but not of the largest herds / flocks. The second highest mean agricultural incomes are achieved by agricultural households with intermediate market integration, 30% of which is derived from livestock. The remaining rural households earn slightly lower incomes from agriculture, of which around 25% is derived from livestock (they also have similar plot sizes of 0.4 to 0.5 ha), but have less income from non-agricultural activities. Pigs generate the highest average livestock income across all household types, the difference in income per pig across household types however being extremely marked, followed by poultry (chicken, ducks and geese). The ratio of income from pigs to poultry is 2.7 across all agricultural household types.

With the exception of more market-integrated households, more than half of the agricultural income is represented by home consumption of agricultural produce. The proportion of income from livestock represented by home consumption ranges from 10 to 30 percent and is considerably lower than the corresponding share of agricultural income, indicating a higher market integration for livestock than for crops. Most income generated by pigs is realized through sales while home consumption constitutes 10 percent or less of income from pigs across all household types. For chicken the opposite is the case with home consumption accounting for 64 to 95 percent of the income derived from chicken. Virtually all (>90%) cash revenue from livestock are derived from the sales of live animals rather than livestock products.

Econometric Analysis

In order to investigate the relationship between poverty and livestock activities, a qualitative binary choice model is specified and estimated utilising data from the survey. The probability of falling below or above the poverty threshold is hypothesized to depend on household characteristics such as involvement in agriculture, livestock ownership, production efficiency, the household's exposure to markets and regional location.

The estimated coefficients are statistically significant and suggest that as the share of income derived from livestock decreases, the probability of a household lying above the poverty line increases. More importantly, a higher number of pigs and chicken increases the probability for a household to lie above the poverty threshold. In fact, the marginal effect, or slope, of the number of pigs on the probability is relatively large. This suggests that pigs are important in determining the position of households relative to the poverty threshold and indicates that policies that aim to increase the number of pigs will be more efficient in alleviating poverty than policies that aim to increase the number of chicken.

The findings in the data also suggest a strong relationship between the level of household income and the degree of market integration. Amongst the agricultural based households, the least commercially oriented group constitutes the poorest group of households. This group on average earns household incomes of around one eighth of the income achieved by the highest income group. Furthermore, households that generate more than 50 percent of their income from agriculture and can be

characterised as less market oriented also depend more strongly on livestock for their livelihood.

We also find that the more commercially oriented households use land and livestock resources more efficiently and the data indicate that there exists a clear relationship between the degree of market integration and production efficiency. Production efficiency is found to decrease by 74 percent in the case of livestock and by 40 percent in the case of land as households are less market integrated. This suggests that there may be more potential to improve livestock production efficiency than to increase land productivity.

Conclusions

Both the typology group analysis and the econometric testing of the data indicate that improved market integration and strategies enhancing production efficiency could be effective in the reduction of poverty. Most rural households are found to own livestock and to earn a considerable portion of their income from livestock. More specifically it was shown that pigs contribute most to household income from livestock. The poorest of the poor are found to have proportionally more access to livestock than land but are also the least market integrated and least production effective. Thus, policies oriented at improving smallholder pig production could significantly contribute to poverty alleviation, while, alternatively, for the poorest households diversification might be a more suitable pathway out of poverty.

1. INTRODUCTION

The majority of the poor in developing countries often live in the rural areas of a country and mostly rely on agriculture for their livelihoods. This study focuses on rural households in Vietnam and analyses the extent to which households depend on agriculture, and consequently also on livestock, for their livelihoods. The analysis aims to clarify the link between livestock and poverty. One of the tools used to carry out the analysis will be a typology-based classification of households. Households will be classified according to criteria elicited during the analysis and, subsequently, the typologies chosen will be used to highlight trends of relevant household characteristics.

Current research is showing how improved knowledge of households' individual livelihood strategies can lead to a better understanding of the impact of policies and furthermore who to target through which policies. In fact current research has debated how an in-depth knowledge of household livelihood patterns is required given the multi-dimensionality of poverty and has illustrated how rural economies divide into a number of 'Rural Worlds' with diverse income profiles, advocating profile specific policies (Vorley 2002, Mahoney 2004, Ellis and Freeman 2004).

The poverty analysis and assessment carried out by the World Bank (1999) reports that poverty levels in Vietnam remain relatively high although the country overall has witnessed a significant reduction in poverty levels. According to the first Vietnamese Living Standard Measurement Survey carried out in 1992-93 (VLSS I) 58 percent of the population was found to be below the poverty line. Subsequent analysis, based on data collected through the LSMS of 1998 and 2000, showed that the proportion of the population below the poverty line had reduced to 37 percent and 32 percent respectively¹. Nevertheless, although overall the proportion of the poor in Vietnam is currently following a downward trend, the number of people that actually live below the poverty line is still very significant². Additionally, the increasing lag in economic progress existing between poor and wealthy households, has further burdened the households that remain in poverty. The gap between the rich and poor households has increased between 1996 and 1999 from 7.3 times to 8.9 times respectively.

Poverty in Vietnam, as in many other developing countries, is found to be strongly correlated with the location of the households. Households located in rural areas are more likely to be poor. Approximately 90 percent of the poor in Vietnam reside in the rural areas and over 80 percent of poor households are farm based with low professional and/or business skills, limited access to productive and natural resources, and households for which land, credit and information is a constraint. (World Bank, 2002). Poor rural households, characterized by low levels of educational attainment, little access to information, that mainly rely on agriculture for their income, can live in geographically isolated and harsh areas thus being subject to increased vulnerability to seasonal shocks. It was found that poverty in Vietnam has marked regional characteristics and that, among the regions, poverty is clearly higher and deeper in the uplands regions of the Northern Mountains and the Central Highlands.

Given that poor rural households have repeatedly been found to over-proportionally rely on livestock for their subsistence, the main objective of the analysis is to assess the role that livestock plays for poor households, thus mainly for the rural households, in Vietnam. More specifically, the study assesses which households might effectively be targeted through policies affecting the livestock sector. The question the analysis

¹ In the case of Vietnam a large number of households' expenditure lies close to the poverty line making the poverty estimates very sensitive to small variations in expenditure levels. It is important to bear this in mind when referring to the estimated poverty levels.

² Details on the new poverty line calculated for 2000 and poverty estimates are provided in the World Bank report (World Bank, 1999 and World Development Indicators 2002).

seeks to answer is which households may be efficiently targeted through policies that promote livestock, i.e. households for which livestock policies can have a positive impact and help them move out of poverty. Households may obtain additional income from livestock more fruitfully compared to staple crops, due to land limitation and the faster growing demand for livestock products relative to demand growth for staples. Consequently, livestock may prove to have more value added potential for rural households in spite of the fact that rural economies are generally strongly crop based..

Section 2 outlines household land and livestock ownership characteristics, such as livestock types and herd or flock sizes across the different regions. Section 3 focuses on the estimation of household income levels, providing details on the contribution of relevant income sources to total household income, including the contribution of livestock. Based on this analysis, household typology groups are set up according to thresholds that delineate livestock ownership. On the basis of these typology groups, total household income, income sources and the contribution of livestock are investigated in Section 4. Particular focus is drawn to the rural areas, for which livestock contribution is analyzed in more detail. Section 5 reports the results of econometric analysis undertaken to corroborate and quantify the impact of some key variables, including livestock characteristics, to poverty reduction. Section 6 concludes the report.

2. BACKGROUND ANALYSIS AND TYPOLOGY GROUPS

This section introduces the dataset used for the analysis and investigates patterns in livestock and land ownership, household income and its components, focusing on livestock. Building on the information gathered household typologies are set up and the household variables of interest are examined by this subdivision.

The household dataset

The analysis is based on data³ collected by the second Vietnamese Living Standard Measurement Survey (VLSS II) carried out in 1997-98 under the technical assistance of the World Bank, approximately five years after the first Vietnamese LSMS was conducted.

Table 1: Distribution of household frequency by area and by the regional breakdown of the dataset.

Region Breakdown	Household Frequency (Percent)
Urban/Rural	
Urban	20.0
Rural	80.0
7 Regions	
Mountains and Midlands	14.3
Red River Delta	19.6
North Central Coast	11.8
South Central Coast	12.6
Central Highlands	6.1
Southeast	17.1
Mekong River Delta	18.5
10 Regions	
Major Urban	10.3
Middle-Sized Urban	8.3
Small Urban	10.2
Rural Northern Mountains	11.2
Rural Red River Delta	13.1
Rural North Central Coast	10.0
Rural South Central Coast	8.4
Rural Central Highlands	6.1
Rural Southeast	8.6
Rural Mekong River Delta	13.8

The VLSS II consists of five separate questionnaires related to a household, commune, price, education and health questionnaire. The analysis in this document focuses on

³ Information adapted from "Vietnam Living Standard Survey (VLSS), 1997-98, Basic Information" World Bank (2001). Please refer to this document for a more detailed description of the data collection process.

some sections of the household questionnaire. As our analysis focuses on agricultural and livestock production activities, we utilise data that are collected under section 9 of the questionnaire.

VLSS II covers approximately 6,000 households with an additional 1,200 households compared to the VLSS I, in which households were selected from the total sample of the 1995 Multi-Purpose Household Survey (MPHS). The VLSS sample was collected in three stages from 150 communes or wards that constitute the smallest sampling unit, selected systematically out of the 10,000 present in total in Vietnam with the probability of selection being proportional to their population size. The data in the VLSS II can be analyzed according to two different regional subdivisions: a seven region subdivision, based on the geographical breakdown of the country, and a ten region subdivision that allows to further distinguish amongst urban and rural areas. Table 1 reports on household frequency distributions by region according to both the seven and ten regions breakdown of the data. Approximately 20 percent of the sample lives in urban areas, while 80 percent of households reside in rural areas. As some specific domains were over sampled due to the chosen sampling pattern, the data has to be analysed with the use of the over-sampling weight.

Household livestock and land ownership

Within the livestock section of VLSS II, households are asked if they own livestock, what kind of livestock and how many animals they own. By inspection of the data and according to frequency of the animal types, we divide livestock into 5 groups, namely cattle, pigs, chicken, ducks and geese, and other animals⁴.

As shown in Table 2, an aggregate average herd size is calculated with the use of the Tropical Livestock Units (TLU)⁵ conversion factors, which allows for comparison of total animal herd sizes across households. On average, 62.5 percent of all households own some kind of livestock from the five groups discussed, with an average herd size of 1.3 TLU (Table 2, 3).

The data in Table 2 suggests that livestock ownership, in the major and middle-sized urban areas, is relatively low, starting to increase in small urban areas. On the other hand, most households in the rural areas own livestock with the exception of the rural Southeast region where the proportion declines to 1 in 2 families. Livestock ownership is particularly high in the mountainous areas, in the Red River delta region and along the Central coast. Households mostly own pigs and chicken, followed by cattle, ducks and other animals. Table 2 shows that 47.6 percent of households own pigs and 51.6 percent of households own chicken. Approximately more than 7 out of 10 households own pigs in the rural northern mountains, Red River delta and Central coast areas. The same trends arise for chicken ownership in these regions and also for the rural Central highlands.

Average herd / flock sizes are reported in Table 3. On average the cattle herd size for cattle owners is 1.9 and pig owners on average own 3.5 pigs. Average flock size for duck and geese owners is 15.6, while chicken owners on average own 16.8 chicken, which is the largest mean herd / flock size.

⁴ Cattle includes all cattle and buffaloes. Other animals includes all other animal categories contained in the survey for completeness.

⁵ Tropical livestock conversion units used are as follows: cattle = 0.70, sheep and goats = 0.10, pigs = 0.20 and chicken = 0.01. Please refer to Otte and Chilonda (2002) for a more complete discussion.

Table 2: Ownership of livestock by region.

Ten regional subdivision	Cattle		Pigs		Chicken		Ducks and Geese		Other Animals		Total Livestock (TLU)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Major Urban	6	1.0	11	1.8	6	1.0	2	0.3	-	-	18	2.9
Middle-Sized Urban	7	1.4	65	13.1	53	10.6	3	0.6	-	-	89	17.9
Small Urban	39	6.4	163	26.6	152	24.8	29	4.7	3	0.5	229	37.4
Rural Northern Mountains	441	65.6	568	84.5	587	87.4	210	31.3	50	7.4	632	94.0
Rural Red River Delta	223	28.5	635	81.1	610	77.9	151	19.3	2	0.3	715	91.3
Rural North Central Coast	283	47.2	499	83.2	484	80.7	121	20.2	10	1.7	561	93.5
Rural South Central Coast	207	41.2	336	66.9	332	66.1	44	8.8	1	0.2	430	85.7
Rural Central Highlands	112	30.4	147	39.9	257	69.8	16	4.3	7	1.9	291	79.1
Rural Southeast	82	16.0	135	26.3	225	43.8	54	10.5	2	0.4	279	54.3
Rural Mekong River Delta	33	4.0	297	35.8	391	47.1	170	20.5	2	0.2	508	61.2
Total	1,433	23.9	2,856	47.6	3,097	51.6	800	13.3	77	1.3	3,752	62.5

Note: Frequencies are calculated for livestock owners only.
Source: VLSS (World Bank, 1998), calculations by the author.

Table 3: Average herd / flock sizes by region.

Ten regional subdivision	Cattle		Pigs		Chicken		Ducks and Geese		Other Animals		Total Livestock (TLU)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Major Urban	0.8	0.3	2.4	1.9	7.1	4.1	5.9	1.8	-	-	0.6	0.4
Middle-Sized Urban	0.8	0.3	5.2	10.3	27.9	56.3	4.5	2.1	-	-	1.0	1.9
Small Urban	1.7	1.5	3.9	4.0	19.2	42.6	21.1	30.2	14.7	17.7	0.9	1.0
Rural Northern Mountains	2.0	1.7	3.4	3.0	21.2	17	10.1	10.1	6.7	29.5	1.8	1.5
Rural Red River Delta	1.1	2.9	3.4	3.9	13.4	11.6	16.5	40.7	30.5	10.0	1.0	1.4
Rural North Central Coast	1.9	2.1	3.9	22.0	14.8	12.7	17	34.1	10.1	10.8	1.5	4.3
Rural South Central Coast	2.8	2.7	3.4	2.8	12.7	12.1	27.4	48.6	1.0	0.0	1.6	1.8
Rural Central Highlands	2.4	1.7	3.5	3.2	14.7	14.1	10.4	18.2	4.4	3.3	1.1	1.3
Rural Southeast	3.1	2.5	5.5	5.3	23	28.9	28.8	56.3	1.5	0.5	1.6	2.1
Rural Mekong River Delta	2.1	0.9	2.9	3.4	14.5	12.4	15.6	25.9	1.5	0.5	0.6	0.7
Total	1.9	2.2	3.5	10.4	16.3	18	15.6	31.5	7.8	25.3	1.3	2.3

Note: Average herd sizes are calculated for livestock owners only.

Source: VLSS (World Bank, 1998), calculations by the author.

Table 4 presents a general picture of land ownership, a major factor in livestock production. Out of the whole sample, on average 70.8 percent of households own land with an average plot size of 0.80 ha.

For five out of the seven rural regions, the percentage of households that own land exceeds 90 percent of the sample in the region. The average land plot area in the rural regions varies from a minimum area of 0.31 ha in the rural Red River delta region to a maximum of 1.47 ha in the rural Southeast area. Land ownership appears to be more fragmented in the rural Red River delta and Central coast areas.

As expected, the frequency of land owners in urban areas is considerably lower, ranging from 3.6 percent to 14.7 percent in the Major and Middle Sized urban areas. The number of households owning land rises to 40.5 percent in the small urban areas.

Table 4: Land ownership by region

Region	Number of Land Owners	Proportion of Owners (percent)	Mean Plot Size (ha)	Std. Dev. (ha)
Major Urban	22	3.6	0.17	0.2
Middle-Sized Urban	73	14.7	0.20	0.29
Small Urban	248	40.5	0.55	0.85
Rural Northern Mountains	652	97.0	0.95	1.15
Rural Red River Delta	769	98.2	0.31	0.45
Rural North Central Coast	581	96.8	0.59	1.1
Rural South Central Coast	489	97.4	0.54	0.58
Rural Central Highlands	336	91.3	1.38	1.32
Rural Southeast	389	75.7	1.47	2.04
Rural Mekong River Delta	691	83.3	1.05	1.06
Total	4,250	70.8	0.80	1.15

Note: Average plot areas are calculated for land owners.

Source: VLSS (World Bank, 1998), calculations by the author.

Household income

In this section the discrepancies between urban and rural mean total household income⁶ and the contribution of livestock and agricultural income to total household income are investigated. First we analyse the distribution of total household income by area and by regional subdivisions of the sample. We then proceed to assess the importance of agriculture and livestock income for total household income.

Table 5 presents the total annual household income and poverty head count by area. Total household income in rural areas is considerably lower than household income in the urban areas. As reported in Table 5, average urban income is more than three times as large as average household income in rural areas. Households living in rural

⁶ Total household income was constructed as the annual aggregate of household agriculture income, wage income, self-employment income and other income. Annex I lists the components of income types.

areas report a mean annual total household income of 743 USD per year or 163 USD per capita per year. Total household income in urban areas is relatively higher but remains low, amounting to 2,497 USD per annum or 584 USD per capita per year. These marked differences in income levels between the urban and rural areas suggest lack of growth in the rural economies.

Table 5 also includes the poverty head count values extracted from the World Bank poverty analysis reports (World Bank, 1999). The poverty head count values confirm the large discrepancies in living conditions between the rural and urban areas. The proportion of poor people in rural areas is 5 times as large as the proportion of the poor in the urban areas. Overall 37 percent of the population during the period under examination was living in conditions below the minimal acceptable living standards.

Table 5: Total annual household income and poverty head count by area.

Area	Household income			Per capita household income			Poverty Head Count (percent) ⁷
	Mean ('000 Dong)	SD ('000 Dong)	Mean (USD) ⁸	Mean ('000 Dong)	SD ('000 Dong)	Mean (USD)	
Rural	9,885	60,753	743	2,168	12,402	163	45
Urban	33,208	78,307	2,497	7,770	18,419	584	9
Total	15,494	66,161	1,165	3,515	14,288	264	37

Source: VLSS (World Bank, 1998), calculations by the author.

Table 6 reports average total, agriculture and livestock household income by region. The data confirm that income in all urban areas exceeds income in the rural areas, with income in the Major urban areas being five times as high as the average income in some of the poorest rural regions. Within the rural regional breakdown, the wealthiest rural areas are the rural Southeast region and the rural Central Highlands, while the poorest rural areas are the rural Mekong River Delta and the rural north Central Coast. Livestock income is highest in the rural northern mountains, Red River delta, Central coast and Central highland areas.

⁷ The poverty head count values are extracted from World Bank (1999) and are based on the VLSS II and a calculated poverty line of 1,790 thousand Dong.

⁸ Values are calculated based on the exchange rate of 13 297 Dong for 1 USD reported in the Key Indicators of Developing Asian and Pacific Countries (1998).

Table 6: Mean total, agriculture and livestock household income per annum.

Region	Region Number	Total income		Agriculture income		Livestock income	
		Mean ('000 Dong)	Std. Dev. ('000 Dong)	Mean ('000 Dong)	Std. Dev. ('000 Dong)	Mean ('000 Dong)	Std. Dev. ('000 Dong)
Major Urban	1	42,988	96,633	220	1,146	19	278
Middle-Sized Urban	2	34,689	71,174	434	2,891	91	804
Small Urban	3	23,946	61,372	1,782	10,247	421	3,068
Rural Northern Mountains	4	10,625	18,946	5,621	5,988	1,716	2,418
Rural Red River Delta	5	9,530	49,174	3,703	4,165	1,041	3,284
Rural North Central Coast	6	8,668	18,468	3,848	3,441	1,239	1,881
Rural South Central Coast	7	10,695	17,292	4,767	4,354	1,531	2,215
Rural Central Highlands	8	13,235	39,259	10,659	15,186	1,220	2,276
Rural Southeast	9	13,196	139,452	5,778	10,646	821	3,739
Rural Mekong River Delta	10	8,396	84,744	7,844	9,935	550	1,938
Total		15,494	66,161	4,393	7,597	913	2,507

Table 7: Income composition: total household income shares.

Region	Region Number	Agriculture		Wages		Self-Employment		Other	
		Mean	sd	Mean	sd	Mean	sd	Mean	sd
Major Urban	1	0.03	0.14	0.07	0.21	0.47	0.45	0.38	0.43
Middle-Sized Urban	2	0.08	0.20	0.04	0.14	0.54	0.43	0.31	0.38
Small Urban	3	0.18	0.30	0.06	0.19	0.49	0.43	0.26	0.35
Rural Northern Mountains	4	0.68	0.32	0.05	0.15	0.16	0.28	0.11	0.20
Rural Red River Delta	5	0.58	0.32	0.06	0.17	0.19	0.31	0.17	0.24
Rural North Central Coast	6	0.53	0.33	0.07	0.19	0.19	0.30	0.20	0.27
Rural South Central Coast	7	0.62	0.36	0.13	0.26	0.16	0.30	0.10	0.18
Rural Central Highlands	8	0.71	0.33	0.13	0.24	0.11	0.24	0.06	0.15
Rural Southeast	9	0.41	0.39	0.14	0.28	0.28	0.39	0.16	0.28
Rural Mekong River Delta	10	0.53	0.37	0.16	0.28	0.20	0.33	0.10	0.20
Total		0.46	0.39	0.09	0.22	0.26	0.37	0.18	0.29

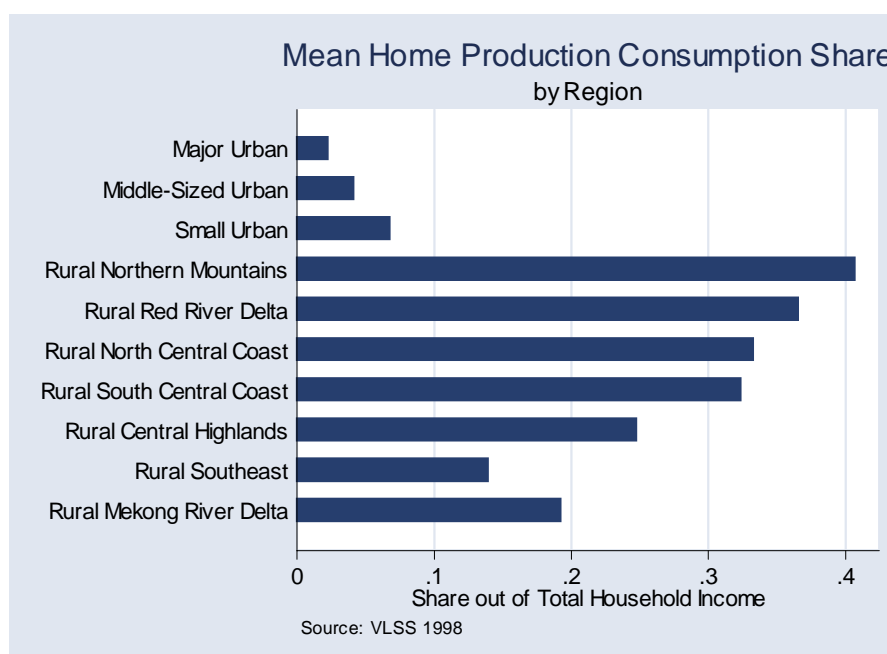
Note: There may be discrepancies between mean incomes and mean shares reported. These are statistical means and are constructed according to data availability.

Source: VLSS (World Bank, 1998), calculations by the author.

Total household income is broken down by source namely agriculture, wages⁹, self-employment and other income sources including remittances. Average income shares by region are shown in Table 7. In the urban areas the larger contributors to total household income are self-employment and other income sources. This starts to change in small urban transition areas. On the other hand, in rural areas the agriculture sector contributes the largest share to total household income. The contribution of agriculture to total household income ranges from 41 percent in the rural Southeast region to up to 70 percent of total household income in the rural Central Highlands denoting that income diversification in some of rural areas is difficult.

For the purpose of the analysis, agricultural income is broken-down into own production consumed in household and cash income. Own production consumed in household income is income foregone since the household consumes the produce instead of selling it in the market to generate profit, thus providing an indication of the subsistence level of the household. Figure 1 illustrates the average income shares of own production consumed in household by region as a proportion of average household income. Rural areas prove to be much more subsistence oriented when compared to urban areas as would be expected. The analysis indicates that the region that least depends on own production consumed in household is the rural Southeast, the rural region with one of the highest mean incomes. The rural Northern Mountains, rural Red River delta, rural North Central coast and the rural South Central coast are the rural areas with the highest shares of own production consumed in household income.

Figure 1: Mean share of own production consumed in household in total household income



Figures 2 and 3 depict the average share of livestock income in total household income and household agricultural income. Generally the rural areas with the highest average share of own production consumed in household generate the highest share of

⁹ Casual observations of Table 7 suggest that the contribution of off-household labour to income is very small even for the major urban regions (0.08 percent). This suggests that the data on wages may be unreliable.

income from livestock, indicating that in these areas, poor households that can also be characterized as subsistence households, rely more heavily on livestock production for their food.

Figure 2: Mean share of livestock income in total household income.

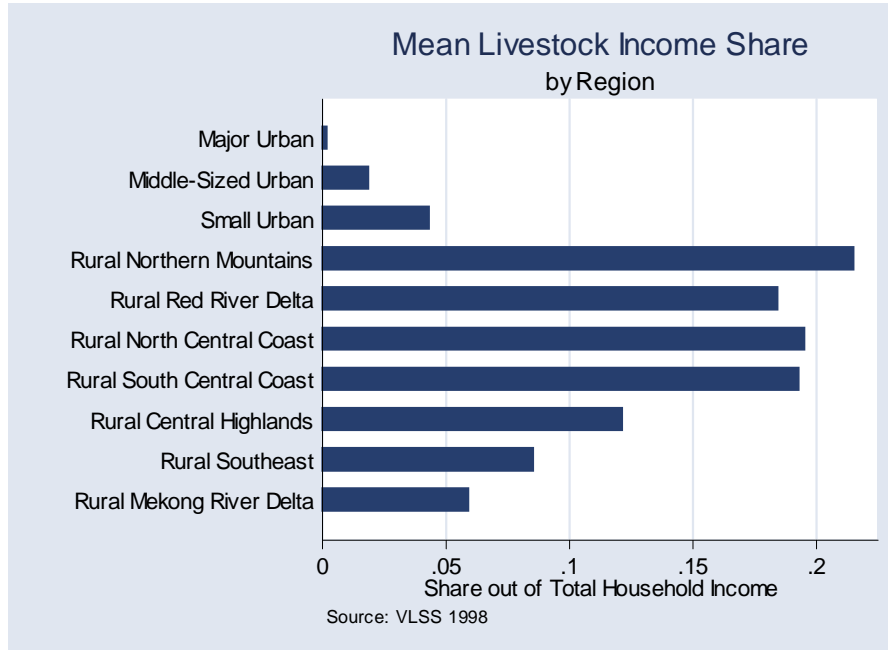
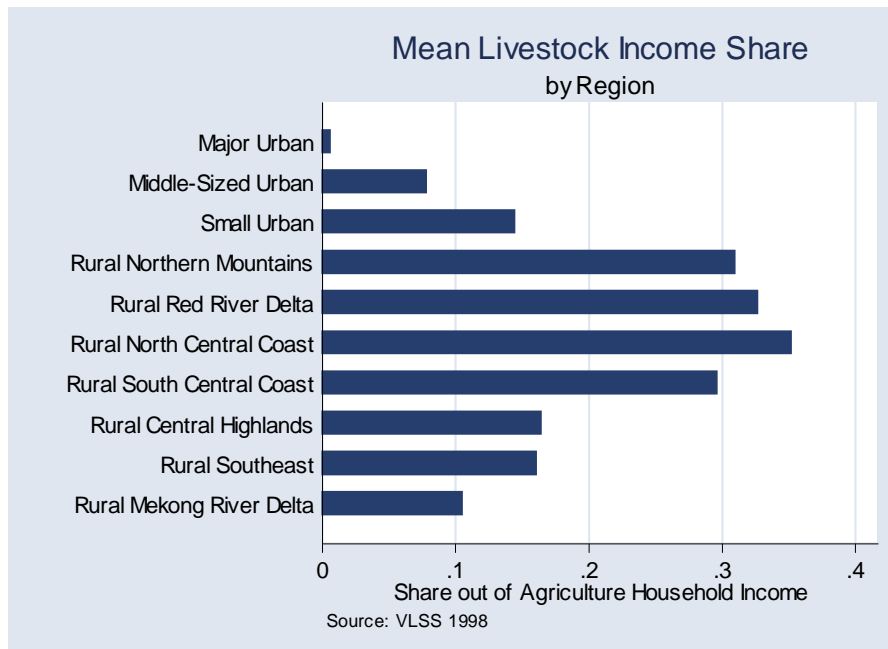


Figure 3: Mean share of livestock income in agriculture income.



Living in isolated and remote areas with limited access to markets also constrains households' possibilities of diversifying their income sources. Households living in these conditions strongly rely on agriculture and especially on livestock production for their livelihoods, as poor infrastructure results in limited access to markets, which in turn limits the possibilities a household has to diversify its income.

In sum, the analysis indicates that:

- rural areas are the poorest areas and that in these areas agriculture is the major contributor to household income, often in the form of own production consumed in-household;
- rural households that strongly depend on their own production for their food consumption mostly rely substantially on livestock production.

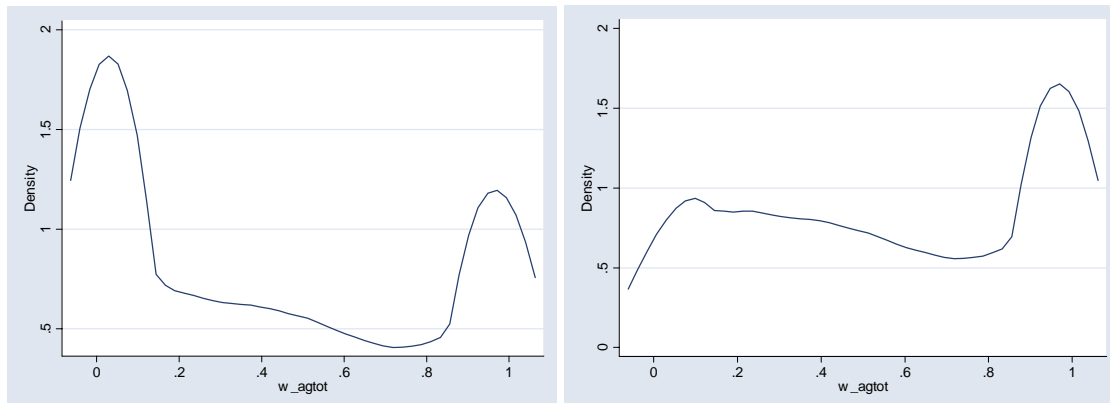
Household typologies

On the basis of the above findings, we proceed by organising the household data into household classifications, or household typologies. This classification of the data into typologies, according to certain key variables of interest, such as livestock activities and the extent to which households consume their own production, is increasingly utilised as an analytical tool. There are several advantages in organising the data in such a way:

- typologies provide a clear picture of the household activities, such as agricultural production, off-farm labour, consumption, and household assets and improve our understanding of why certain households take certain decisions;
- typologies present the income structure of each household class in terms of different income sources, thus highlighting the extent to which households are engaged in markets, or the extent to which households rely on their own production for food; and,
- typologies reveal the causal relationships between variables such as location, access to markets, agricultural activities, production, consumption and the poverty level, thus improving our understanding of possible development pathways for different household types.

We classify households hierarchically according to two criteria, namely the reliance of the household on agricultural income and the degree of household market integration (or subsistence). The former is measured as the share of agriculture in total income, whilst the latter is proxied by the share of own production consumed in household out of total income, measured in monetary terms.

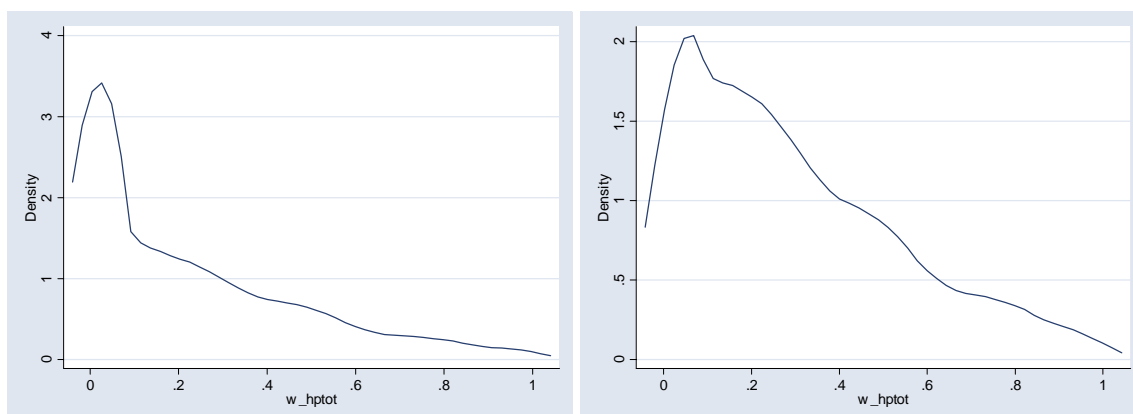
Figure 4: (i) Share of agriculture income for the whole sample,
(ii) Share of agriculture income for the rural sample.



Figures 4 (i) and (ii) show the density distribution of the share of agriculture income for the whole sample and for the rural sub-sample respectively. From inspection of the data, sensitivity analysis runs and following the information reported in these figures we select the 50 percent cut-off as the threshold for the reliance of the household on agriculture income by which we classify households into 'agricultural' and 'diversifying'.

Figures 5 (i) and (ii) show the density distribution of the share of own production consumed in household income for the whole sample and for the rural sub-sample respectively. From inspection of the data, sensitivity analysis runs and following the information reported in these figures we select two cut-off points to classify the household data in this case, namely the 25 percent threshold and the 75 percent threshold. Although from a density distribution point of view these may not be optimal choices, following the sensitivity analysis of the households to the thresholds of the second criterion and the fact that the 25 percent and 75 percent thresholds delineate more strongly the subsistence level of households, the two thresholds mentioned were selected. The urban households are divided according to the 25 percent threshold while the rural households are subdivided according to both the 25 percent and the 75 percent thresholds.

Figure 5: (i) Share of own production consumed in household income for the whole sample,
(ii) Share of own production consumed in household income for the rural sample.



According to these two criteria households can belong to one of five different typologies, as follows:

'Diversifying' households

- households with a share of agriculture income less than 50 percent of total income and
 - a share of own production consumed in household less than 25 percent (type 1 'diversified');
 - a share of own production consumed in household more than 25 percent (type 2, 'semi-diversified');

'Agricultural' households

- households with a share of agriculture income more than 50 percent of total income and
 - a share of own production consumed in household less than 25percent (type 3, 'agriculture, commercial')
 - a share of own production consumed in household between 25 percent and 75 percent (type 4, 'agriculture, semi-commercial'); and,
 - a share of own production consumed in household more than 75 percent (type 5, 'agriculture, subsistence').

In the text we will mainly refer to the typology number in brackets for ease of reference.

3. TYPOLOGY BASED ANALYSIS

Introduction

Total household income distribution, agriculture and livestock income, agricultural assets and other household characteristics of interest are investigated based on the five typologies created in the previous section.

The analysis in this section will distinguish between urban and rural areas. As shown and discussed to this point, urban and rural areas have significantly different traits. Therefore, at first we will illustrate how households distribute across the five typology groups in the case of the whole sample. We then divide the sample between rural and urban areas and tabulate some key variables according to the five typology groups. A more detailed breakdown of livestock and agricultural variables will be presented in the case of the rural households' typology groups.

Whole sample

Table 8 lists the distribution of the households across the five typology groups. Most of the households belong to typology group 1 ('diversified') and typology group 4 ('agricultural, semi-commercial'). By construction, households in typology group 1 rely less on agriculture and very little on home production consumption. Out of the whole sample, 53.3 percent belong to this typology group. Households in typology group 4 rely strongly on agriculture for their household income and between $\frac{1}{4}$ and $\frac{3}{4}$ of total household income is obtained from home production consumption, making them more subsistence based. Out of the whole sample, 23.3 percent belong to this typology group. Smaller groups of households belong to typology groups 2, 3 and 5, respectively 6.9, 12.0 and 4.5 percent of the whole sample.

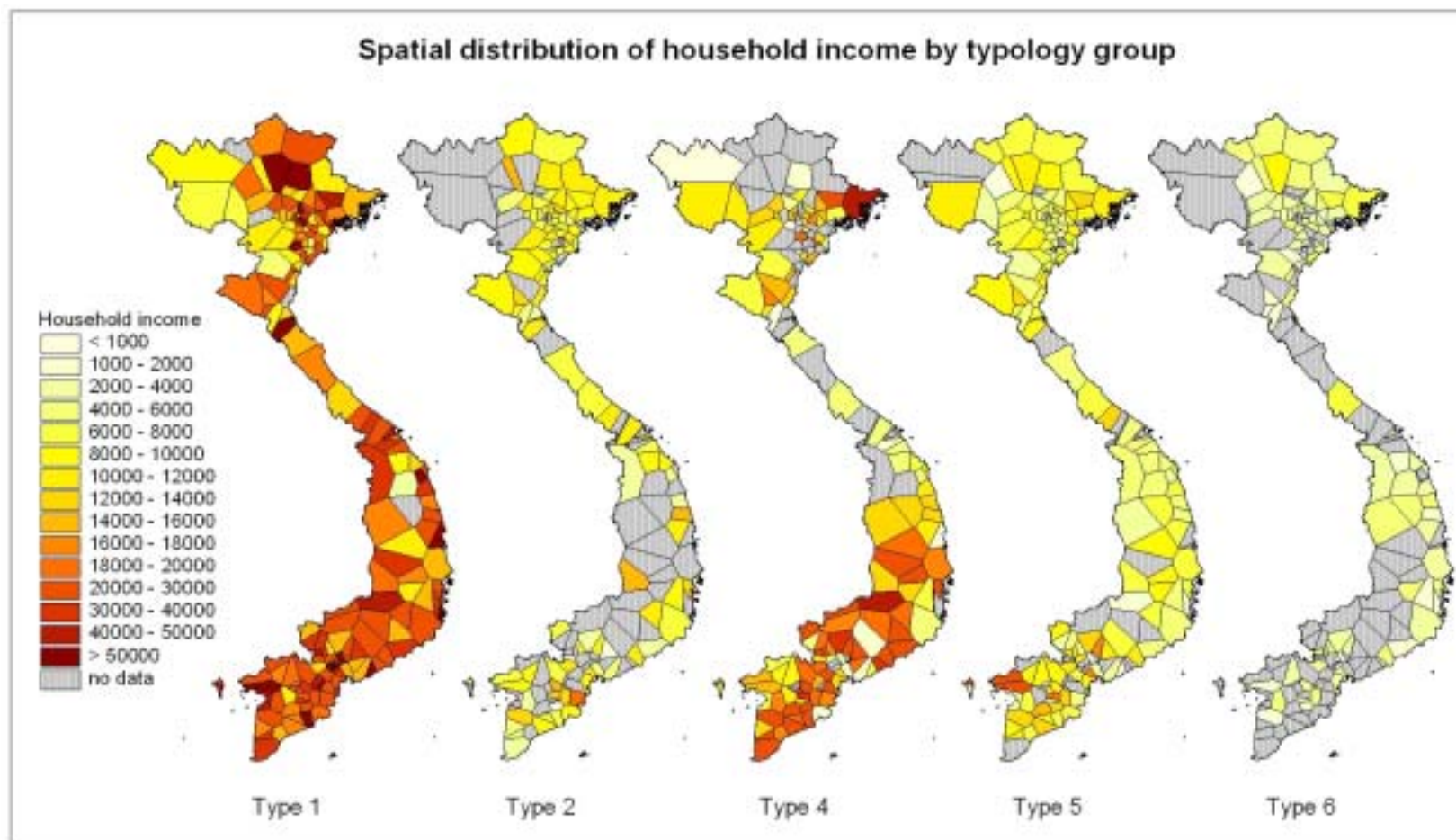
Table 8: Whole sample: Household characteristics, household income and shares by typology.

	All Areas				
	Share of Agriculture in Total Income				
	<50 percent		>50 percent		
	Share of home production in total income				
	<25 percent	>25 percent	<25 percent	25-75 percent	>75 percent
	Type 1	Type 2	Type 3	Type 4	Type 5
Household Distribution					
Number of households	2,503	327	563	1,094	210
Share of total households (percent)	53.3	6.9	12.0	23.3	4.5
Household Income					
Total household income ('000 Dong)	32,781	8,739	17,738	7,572	3,300
USD ¹	2,340	624	1,266	541	236

¹ Using a conversion rate of 14,008 Dong per USD (World Bank, 1999)
Source: VLSS (World Bank, 1998), calculations by the author.

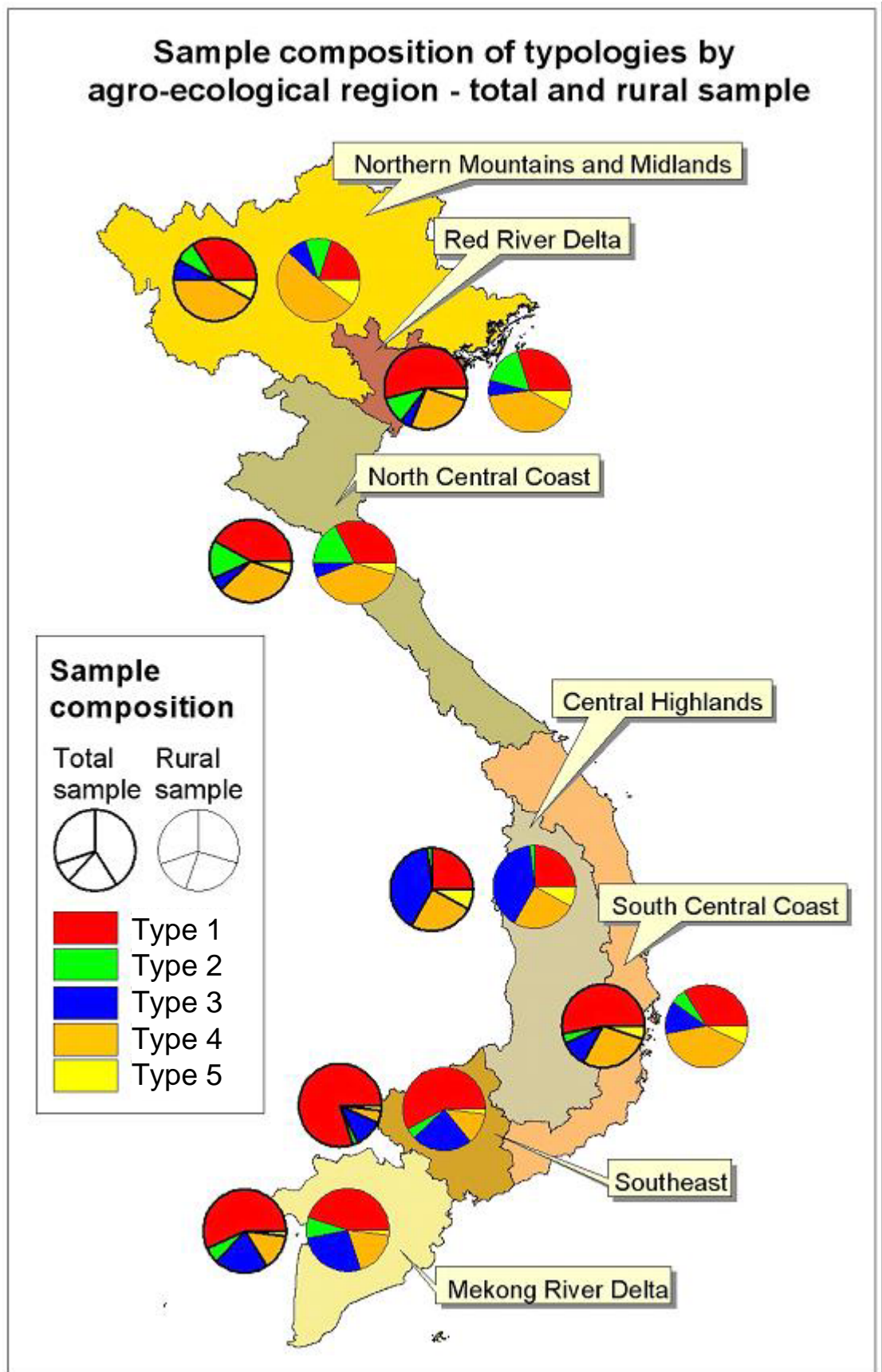
Average total household income is highest for the households that fall into typology group 1, namely for households that rely less on agriculture and diversify their income sources more. As households rely progressively more on agriculture, as is the case for households that belong to typology group 3, average income decreases to approximately half of that of typology group 1 households. Income varies significantly as households become more subsistence based. That is to say, households in typology groups 2 and 4 earn approximately 25 percent as compared to typology group 1 households. The poorest households are the most subsistence oriented ones. This is also evident in Figure 6 which shows the spatial distribution of household income by typology group.

Figure 6: Spatial distribution of household income by typology group.



A comparison between the typology group classification according to the whole sample and according to the rural sample is presented in Figure 7. Transition from the whole sample to the rural sample shows how households move from the more commercial typology groups toward the more subsistence and agriculture oriented typology groups.

Figure 7: Sample composition of typologies by agro-ecological region - total and rural sample.



Notes for legend:

Type 1: households with a share of agriculture income less than 50 percent and a share of own production consumed in household less than 25 percent

Type 2: households with a share of agriculture income less than 50 percent and a share of own production consumed in household more than 25 percent

Type 3: households with a share of agriculture income more than 50 percent and a share of own production consumed in household less than 25percent

Type 4: households with a share of agriculture income more than 50 percent and a share of own production consumed in household between 25 percent and 75 percent

Type 5: households with a share of agriculture income more than 50 percent and a share of own production consumed in household more than 75 percent

Urban areas

Table 9 lists the values of the household variables for the urban areas by typology group. The data indicate that more than 90 percent of the urban households belong to typology group 1. Namely, households do not significantly rely on agriculture as an income source and diversify their income across a wider range of sources as compared to rural households. A remaining 6.9 percent of urban households continue to be significantly involved in agriculture.

Table 9: Urban sample: Household characteristics, household income and shares by typology.

	Urban Areas				
	Share of Agriculture in Total Income				
	<50 percent		>50 percent		
	Share of home production in total income				
	<25 percent	>25 percent	<25 percent	25-75 percent	>75 percent
	Type 1	Type 2	Type 3	Type 4	Type 5
Household Distribution					
Number of households	1400	25	40	48	17
Share of total households (percent)	91.5	1.6	2.6	3.2	1.1
Household size	4.4	3.7	4.1	4.0	3.8
Land and livestock ownership					
Mean herd size (TLU)	0.06	0.31	0.64	0.66	0.19
Mean land plot area (ha)	0.02	0.18	0.87	0.46	0.05
Household Income					
Total household income ('000 Dong)	39,703	5,096	11,294	4,517	558
USD ¹	2,834	364	806	322	40
Agriculture income ('000 Dong)	518	1,715	9,282	3,584	493
USD	37	122	663	256	35

Share of total income from:					
Wages	0.06	0.05	0.03	0.06	0.00
Self employment other than agriculture	0.55	0.15	0.03	0.01	0.00
Other income	0.18	0.37	0.09	0.10	0.05
Agricultural income	0.03	0.33	0.83	0.76	0.93
Livestock Income	0.01	0.07	0.25	0.17	0.00
Own production consumed in household	0.01	0.37	0.10	0.45	0.94

¹ Using a conversion rate of 14,008 Dong per USD (World Bank, 1999)
Source: VLSS (World Bank, 1998), calculations by the author.

In the urban areas average income for typology group 1 households is higher than that of the urban sample as a whole. On the other hand, although the number of households is low, households that do not belong to typology group 1 earn lower average incomes when compared to the respective clusters in the whole (as well as in the rural) sample¹⁰. Furthermore, the small percentage of households that do not rely on agriculture but who are less market integrated (Type 2) witness a reduction in their income of approximately 90 percent. Average household sizes do not vary considerably across the typology groups.

The vast majority (>90%) of urban households generates income from diverse sources (mostly self-employment and other income, and possibly wages), while agricultural income represents an average share of 3% of total income. Nevertheless, seven percent of urban households fall into the category of agricultural households and, for another 1.6 percent of urban households, agriculture still constitutes a significant source of income (33 percent). Only Type 3 households market a sizeable proportion of their agricultural produce (88 %), while around 1 percent of urban households make a living from subsistence agriculture (type 5). These are the poorest household type.

Livestock is an important source of household income for typology group 3 and 4 households, while typology group 5 households are mostly subsistence based households. Average land area is highest for type 3 households, the agriculture households with highest incomes. Household types 3 and 4 own approximately the same average herd size, while average land area of subsistence households is one third smaller. Proportionally though, subsistence households have larger herd sizes in relation to land plot areas.

Obviously in urban areas agriculture does not prove the best strategy to support households' livelihoods. Nevertheless, amongst the households involved in agriculture the households belonging to type 3, which have the largest plots and make ¼ of their income from livestock, are at a considerably higher average level of income than types 4 and 5. Furthermore, although the poorest subsistence households may have proportionally more access to livestock than other assets, for type 5 the contribution of livestock to household income is negligible.

Rural areas

In this section we focus on the households in rural areas. Table 10 reports values for household variables, including asset ownership, total household income and income shares. Table 11 focuses more specifically on livestock and presents information on

¹⁰ Note that the misreporting of wage income may underestimate mean household income. In urban areas households could be relying more on wage income than reported.

livestock ownership by species, income by livestock species, sales from livestock and livestock products and average foregone income from own produce consumed in household.

In the rural areas more than half of the rural households (55.6 percent) fall into the 'agricultural household' classification (types 3, 4 and 5). More specifically 33 percent of the rural sample belongs to typology group 4, still showing a strong reliance on own production consumed in household. On the other hand, a relatively large share of the households (34.8 percent) belongs to typology group 1, the more market integrated and income diversifying households. Average household sizes do not vary considerably across the typology groups.

Thirty three percent of rural households earn less than half of the average income of typology group 3 households and approximately a third of typology group 1 average income. It is important to note that the data in Table 10 suggests a strong relationship between the level of household income and the degree of market integration. Households with progressively lower levels of income report higher shares of own production consumed in household. Type 5 households have the highest share of income from subsistence agriculture and constitute the poorest group of households. This group of households on average earns household incomes of around one eighth of the income achieved by the highest income group.

Highest mean agricultural incomes are achieved by the more market-integrated agricultural households (Type 4). Type 4 households also dispose of the largest mean plot sizes but not of the largest number of livestock resources (expressed in TLUs) and consequently have the lowest stocking density. The second highest mean agricultural incomes are achieved by agricultural households with intermediate market integration (Type 5), 30% of which comes from livestock. The remaining rural households earn similar incomes from agriculture, of which around 25% is derived from livestock (they also have similar plot sizes of 0.4 to 0.5 ha). With the exception of Type 3 households, more than half of the agricultural income is represented by home consumption of agricultural produce.

Households in agriculture significantly rely on livestock for income generation. Table 10 shows that the share of household income from livestock income ranges between 20 percent and 25 percent of household income. Furthermore, households that generate more than 50 percent of their income from agriculture and can be characterised as less market oriented also depend more strongly on livestock for their livelihood. On average, type 5 households earn 22 percent of their total income from livestock, proving an important source of income for the poorest households.

Table 10: Household income variables and shares by typology for the rural areas.

	Rural Areas				
	Share of Agriculture in Total Income				
	<50 percent		>50 percent		
	Share of home production in total income				
	<25 percent	>25 percent	<25 percent	25-75 percent	≥75 percent
	Type 1	Type 2	Type 3	Type 4	Type 5
Household Distribution					
Number of households	1,103	300	523	1,046	193
Share of total households (percent)	34.8	9.5	16.5	33.0	6.1
Mean household size	4.6	4.6	4.8	4.9	4.9
Land and livestock ownership					
Mean herd size (TLU)	0.6	1.3	1.0	1.4	1.1
Mean land plot area (ha)	0.42	0.52	1.36	0.82	0.49
Mean herd size per hectare (TLU/ha)	2.6	3.6	1.7	2.1	2.5
Household Income					
Total household income ('000 Dong)	25,687	8,960	18,234	7,677	3,472
(USD) ¹	1,834	640	1,302	548	248
Agriculture income ('000 Dong)	3,608	3,346	15,245	6,370	3,277
(USD)	258	239	1,088	455	234
Livestock income ('000 Dong)	1,031	902	2,708	1,874	770
(USD)	74	64	193	134	55
Efficiency²					
Agriculture income per hectare (USD/ha)	613	459	800	555	477
Livestock income efficiency (USD/TLU)	123	50	193	96	50
Share of total income from:					
Wages	0.19	0.16	0.04	0.03	0.00
Self employment other than agriculture	0.43	0.23	0.05	0.04	0.01
Other income	0.11	0.17	0.06	0.06	0.03
Agricultural income	0.19	0.37	0.82	0.84	0.94
Livestock Income	0.05	0.09	0.20	0.25	0.22
Own production consumed in household	0.10	0.34	0.14	0.47	0.86
Share of agriculture income from:					
Livestock	0.24	0.25	0.25	0.30	0.23
Own produce consumed in-farm	0.51	0.80	0.18	0.56	0.87

¹ Using a conversion rate of 14,008 Dong per USD (World Bank, 1999)² Values calculated from reported averages.

Source: VLSS (World Bank, 1998), calculations by the author.

Table 10 also shows the efficiency of production, expressed as average agricultural income earned per hectare and average livestock income earned per average herd size (TLU). The data suggests that households that belong to typology group 3 are using land and livestock resources more efficiently. Average agriculture income per hectare ranges from 800 USD/ha to 459 USD/ha. The value generated by one TLU varies from 50 USD/TLU to 193 USD/TLU.

As households become less market orientated the corresponding value generated by one TLU decreases to 25 percent of that of commercially oriented households (households in typology group 3 are four times more efficient than those in typology group 5). Thus production efficiency overall decreases by 74 percent in the case of livestock and by 40 percent in the case of land. This illustrates the potential impact of enhancing livestock production efficiency.

The spatial distribution of the contribution of livestock to total household income is shown in Figure 8.

Figure 8: Spatial distribution of the share of livestock income total household income by typology group in rural areas.

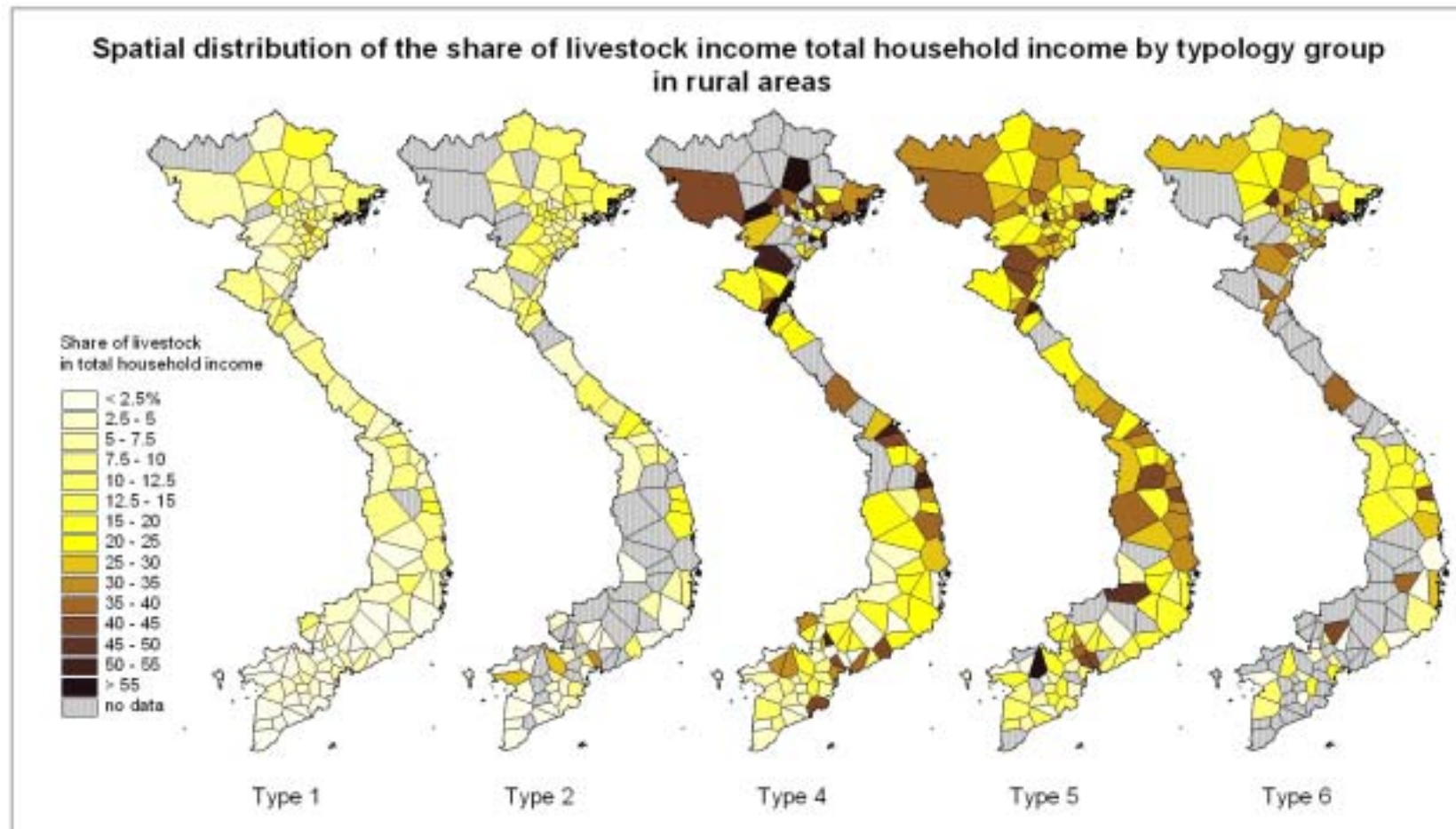


Table 11: Household livestock variables by typology for the rural areas.

	Rural Areas				
	Share of Agriculture in Total Income				
	<50 percent		>50 percent		
	Share of home production in total income				
	<25 percent	>25 percent	<25 percent	25-75 percent	≥75 percent
	Type 1	Type 2	Type 3	Type 4	Type 5
Livestock ownership by species:					
Cattle	0.2	0.6	0.7	1	0.8
Pigs	1.6	3.7	1.8	2.6	2.1
Chicken	7.7	10.5	15.7	15.4	12.7
Ducks and Geese	1.5	2.8	5.8	3.7	2.3
Other	0.02	0.01	0.03	0.34	0.42
Livestock income by species ('000 Dong):					
Cattle	36	-39	376	196	-37
Pigs	821	736	1,541	1,250	625
Chicken	157	228	294	369	206
Ducks and Geese	30	47	277	98	25
Other	7	0	166	44	9
Sales of animals by species ('000 Dong):					
Cattle	104	104	586	389	99
Pigs	1,336	1,127	2,204	1,618	866
Chicken	100	86	269	163	97
Ducks and Geese	30	27	321	61	23
Other	4	5	280	22	13
Sale of animal products ('000 Dong):					
	43	61	457	106	16
Own produced consumed in household ('000 Dong):					
Cattle	0	0	0	3	1
Pigs	17	48	17	46	60
Chicken	149	180	223	238	157
Ducks and Geese	16	26	32	36	17
Other	3	2	1	3	0

* Using a conversion rate of 14008 Dong to the 1 USD (World Bank, 1999)
Source: VLSS (World Bank, 1998), calculations by the author.

Table 11 presents livestock specific variables. Pigs generate the highest average livestock income across all household types followed by poultry (chicken, ducks and geese). The ratio of income from pigs to poultry is 2.7 in all household types with the exception of Type1, which earns 4.4 times as much income from pigs than from poultry.

The proportion of income from livestock represented by home consumption ranges from 10 to 30 percent and is considerably lower than the corresponding share of agricultural income, indicating a higher market integration for livestock than for crops.

Most income generated by pigs is realized through sales while home consumption constitutes 10 percent or less of income from pigs across all household types. For

chicken the opposite is the case with home consumption accounting for 64 to 95 percent of the income derived from chicken.

Cattle produce little direct income across all household types and constitute a cost to household Types 2 and 5 (in fact cattle may have to be hired for cropping activities)

Ducks and geese only constitute a sizeable proportion of livestock income in households of types 3 and 4, the bulk of the derived income coming from sales rather than home consumption (in contrast to chicken).

The difference in income per animal across household types is extremely marked for pigs ranging from approximately 184,000 to 770,000 Dong per pig per year for household Types 2 and 4 respectively.

Virtually all (>90%) cash revenue from livestock are derived from the sales of live animals rather than livestock products.

4. ECONOMETRIC ANALYSIS

This section focuses on the quantification of the link between poverty and livestock by means of econometric techniques. The qualitative analysis in the preceding sections indicates that households that are more involved in agriculture and more subsistence oriented are worse off in terms of income level, as compared to households that have more diversified income sources. It is also evident that poorer households significantly rely on livestock for income generation.

In order to investigate the relationship between poverty and livestock activities, a qualitative binary choice model is specified and estimated utilising data from the survey. Binary choice models assume that households fall into one or another category, or state, below or above a predetermined poverty threshold, depending on their characteristics. The purpose of binary choice models is to determine the probability that a household with a certain set of attributes will fall into a category, rather than the alternative. In this context the dependent variable of such a model assumes the values of one or zero depending on which alternative state a household falls into. In our case, households that find themselves below the predetermined poverty line assume the value of one, whilst households that are above this threshold assume the value of zero. The assignment of these values results in interpreting the dependent variable as a probability that lies within the range [0,1]. The regression form of the model specified according to the probit probability model is associated with the cumulative normal probability function¹¹.

The probability of falling below or above the poverty threshold¹² is taken to depend on household characteristics such as involvement in agriculture, livestock ownership, production efficiency, the household's exposure to markets and regional location.

Table 12: Probit estimation results for household poverty and asset correlation (Dependent variable = Household poverty head count).

Independent Variables	Coefficient	Standard Error	Z	P>z	dF/dx
Share of income from livestock	0.5544	0.1569	3.53	0	0.1267
Market integration	-0.6046	0.0539	-11.21	0	-0.1508
Land area per household	-1.2E-05	2.84E-06	-4.1	0	-2.66E-06
Pig ownership per capita	-0.4622	0.0543	-8.52	0	-0.1056
Chicken ownership per capita	-0.0908	0.0098	-9.29	0	-0.0207
Livestock efficiency	-1.7E-05	4.78E-06	-3.58	0	-3.92E-06
Regional dummy 1	-1.8351	0.1898	-9.67	0	-0.1990
Regional dummy 2	-1.1435	0.1296	-8.82	0	-0.1526

¹¹ More details for the probit model can be found in Greene W. (2000). *Econometric Analysis*

¹² The best estimate of household expenditure for 1998 is used following the information contained in the reference documentation (World Bank, 2001). The poverty line, based on 1998 household expenditure data, was calculated to be 1,790 ('000 Dong) (World Bank, 1999).

Regional dummy 3	-0.7821	0.1062	-7.36	0	-0.1254
Regional dummy 4	0.7102	0.0879	8.08	0	0.2070
Regional dummy 5	0.2313	0.0885	2.61	0.009	0.0578
Regional dummy 6	0.5134	0.0899	5.71	0	0.1427
Regional dummy 7	0.1598	0.0909	1.76	0.079	0.0390
Regional dummy 8	0.4699	0.0973	4.83	0	0.1302
Regional dummy 9	-0.6352	0.1143	-5.56	0	-0.1069
Constant	-0.0548	0.0748	-0.73	0.464	0.1267

In more detail, the explanatory variables are as follows:

- the level of reliance on livestock, measured as the share of livestock income from total household income;
- households' market integration represented by a dummy variable according to whether the households' share from own production consumption is above or below the chosen threshold, in this case 25 percent;
- land ownership estimated by the household's land plot area;
- households' pig herd size calculated as per capita pig herd size;
- the household chicken flock size evaluated as per capita chicken flock size;
- livestock efficiency calculated as livestock income per household total herd size in tropical livestock units; and
- regional dummies that reflect household location with respect to the base region, the rural Mekong River Delta.

The model is estimated by maximum likelihood and the results are presented in Table 12. The estimated coefficients are statistically significant and suggest that as the share of income derived from livestock decreases, the probability of a household lying above the poverty line increases. In addition, as households are less involved in livestock, it is more likely that their level of expenditure be higher than the minimum required for basic living needs.

Increasing households' market integration increases the probability of a household not to be poor. More importantly, a higher number of pigs and chicken increases the probability for a household to lie above the poverty threshold. In fact, the marginal effect (dF/dx), or slope, of the number of pigs on the probability is relatively large, amounting to -0.10. This suggests that pigs are important in determining the position of households relative to the poverty threshold and indicates that policies that aim to increase the number of pigs will be more efficient in alleviating poverty than policies that aim to increase the number of chicken. Market integration is also an important determinant of poverty. The marginal effect of market integration on the probability of falling below the poverty line amounts to -0.15, suggesting that policy prescriptions should also focus on the creation of regional markets, or the minimisation of transaction costs.

Land area and livestock efficiency are found to be significant variables for households and increase the probability of lying above the poverty line, although their impact is

relatively small. As households improve the efficiency they use livestock with or the land area available, the probability of not being poor increases.

5. MAIN FINDINGS AND CONCLUSIONS

The analysis presented in this paper focuses on the link between poverty and livestock in Vietnam with the aim of evaluating how livestock contributes to household income and the role livestock plays for the poor.

In order to assess the contribution of livestock a household typology based analysis was implemented. This approach seeks to better understand strategies pursued by different household groups and thus offers guidance on possible policy reforms and interventions.

The initial descriptive findings of the analysis showed that households in rural areas mostly own land and livestock. The income levels reported confirm the large discrepancies in income existing between urban and rural areas. The breakdown of the data show, that as moving out of the main urban areas towards smaller urban areas and then to the rural areas, household income declines significantly. Income in urban areas can be as much as five times the income in some rural areas. Rural households mainly rely on agriculture for their livelihood. In most rural areas the average share of own home production consumption income still makes up for a large portion of household income, showing that agriculture remains strongly subsistence oriented. Livestock groups were divided into cattle, pigs, chicken, ducks and geese and other livestock. Initial findings of the data show that households mostly own pigs and chicken.

Based on the information gathered in the initial stages of the analysis and the strong reliance of rural households on agriculture, we use the share of agriculture in total household income and the share of own production consumption in total household income as the two criteria on which to base the household typology groups. The share of agriculture in total household income is used as a measure of the reliance and involvement of the household in agriculture. The share of own home production consumption in total household income is used as a proxy for the level of market integration of the household. Thus five typology groups were set up, ranging from households less/not involved in agriculture to more agriculture oriented households and, within these two groups, from more market integrated households to more subsistence based ones. The typology structure presented allowed for a compact stratification of the data. Interestingly the typology groups elicited are in line with the 'Rural Worlds' subdivision of households presented by Vorley, 2002).

Overall, households that are less involved in agriculture and diversify their income sources more earn higher household incomes. From investigation of the whole sample we find that, as households are more agriculture and subsistence based, they have significantly lower mean total household incomes. Overall household income is found to decrease to as little as one tenth across the spectrum of the typology groups.

In the case of the urban household sub-sample, although the majority of the households (91.5 percent) belong to the 'diversified' typology group, seven percent of the households still have an agricultural profile. Obviously in urban areas agriculture does not prove to be the best strategy for households' livelihoods. Nevertheless amongst the households involved in agriculture, the more market oriented generate ¼ of their income from livestock and are at a considerably higher average level of income compared to the other typology groups.

In the rural areas, the majority of the households (55.6 percent) belong to the agriculture based groups, although a significant portion of the households belong to the 'diversified' households (34.8 percent). The findings in the data suggest a strong relationship between the level of household income and the degree of market integration. Amongst the agricultural based households, the least commercially oriented group constitutes the poorest group of households. This group on average earns household incomes of around one eighth of the income achieved by the highest

income group. The share of income generated from livestock ranges between 20 percent and 25 percent of household income. Furthermore, households that generate more than 50 percent of their income from agriculture and can be characterised as less market oriented also depend more strongly on livestock for their livelihood.

We also find that the more commercially oriented households use land and livestock resources more efficiently and the data indicate that there exists a clear relationship between the degree of market integration and production efficiency. Production efficiency is found to decrease by 74 percent in the case of livestock and by 40 percent in the case of land as households become less market integrated. Furthermore, this suggests that there may be more potential to improve livestock production efficiency than to increase land productivity.

Pigs generate the highest average livestock income across all household types followed by poultry (chicken, ducks and geese). Furthermore, the proportion of income from livestock represented by home consumption ranges from 10 to 30 percent (poultry meat produced in household is mostly used for home consumption) and is considerably lower than the corresponding share of agricultural income, indicating a higher level of market integration for livestock than for crops.

In the last stage of the study an econometric approach was used to formalize the analysis of the link between poverty and livestock. We investigated the correlation between poverty measured by the position of household expenditure with respect to the poverty line and a number of household characteristics related to livestock. The household characteristics used included pig and poultry ownership, reliance on livestock income and households' exposure to markets. The results of the econometric analysis show that poor households are more likely to rely on livestock, to have little exposure to markets, own pigs and chicken, and use livestock less efficiently. Nevertheless, the results suggest that the number of pigs is an important determinant of income and indicate that policies that aim to increase the number of pigs will be more efficient in alleviating poverty than policies that aim to increase the number of chicken. Market integration is also an important determinant of poverty and policy prescriptions should also focus on the creation of regional markets, or the minimisation of transaction costs.

Conclusions

- Amongst the agricultural households, a large percentage still belongs to the more subsistence based households. This leads to advocating agriculture policies that aim at improving the market integration of rural households in order to align income strategies of these households with the more market integrated and higher income profile households.
- Both the typology group analysis and the econometric testing of the data conclude that improved market integration and efficiency enhancing production strategies could be effective in the reduction of poverty. Most rural households are found to own livestock and to earn a considerable portion of their income from livestock. More specifically it was shown that pigs contribute most to household income. It might therefore be concluded that livestock oriented policies could amount to welfare improving strategies for households, especially in the case of pigs.
- Livestock plays an important role as an income source in the livelihoods of more agriculture based households. Data show that mostly livestock income is obtained from the sale of animals. Therefore improving the market integration of livestock could have a significant impact.
- The poorest of the poor are found to have proportionally more access to livestock than land but are also the least market integrated and least production effective households. Consequently livestock specific policies that aim at improving market integration and production efficiency in the case of livestock might prove effective

when targeting the poorest households in rural areas, but. alternatively, diversification might be a more suitable pathway out of poverty.

- Wealthier households adopt a higher degree of income diversification. Policies aimed at promoting income diversification (human capital generation, credit support, etc) alongside the above, may prove important.

6. ANNEX: INCOME COMPONENTS

Total Income Components

Income Component	Elements
Agriculture	Crop Income
	Livestock Income
	Net Land Income
	Other Own production consumed in household
	Farm and Input Expenditures
Wages	Primary wages from past 12 months
	Secondary wages from past 12 months
Self-Employment	Enterprise revenue
	Enterprise expenditures
	Enterprise wages
Other	Remittances
	Other income

Livestock Income Components

Income Component	Elements
Livestock	Livestock sales
	Expenditures on livestock
	Expenditures on livestock purchases
	Animal own production consumed in household
	Animal production sales
Livestock by Species	Animal sales
	Animal purchases
	Animal own production consumed in household
	Share of animal expenditures
	Animal production sales

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