Revised and Expanded Draft

POVERTY DYNAMICS IN VIETNAM, 2002-2006

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Abstract

This paper provides a descriptive and multivariate analysis of poverty dynamics in Vietnam using panel data from the Vietnam Household Living Standards Surveys of 2002, 2004 and 2006. Transition matrices and contour plots confirm that while large numbers of households moved out of poverty between these years, many did not move far above the poverty line and that around a tenth of rural households appear to be trapped in chronic poverty. Different categorical models are then estimated to analyse the correlates of chronic poverty and the drivers of poverty transitions in rural areas. Initial conditions, such as household size and composition, whether the household head comes from an ethnic minority or failed to complete primary school, and residence in northern Vietnam, have important roles in trapping households in poverty. Simultaneous quantile regression models show the chronically poor are more disadvantaged by geography and ethnic minority status, while changes in household size and the share of children matter more to the living standards of the never poor.

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During the 1990s and 2000s, Vietnam has had spectacular success at reducing poverty. Depending on the poverty line used, nationally representative household surveys show the poverty headcount has fallen by between two-thirds and three-quarters between 1993 and 2006.[1] Except for China, there is probably no country in the world that experienced such rapid and sustained reductions in poverty during this period.

Vietnam's poverty reduction record, however, remains fragile. While economic growth of between 7 and 8 percent per annum in the early 2000s has dramatically improved the living standards of most people, it has also changed the structure of the economy and the nature of risks that people face. Rapid migration and urbanisation, volatility in world markets, an ageing population with a rising incidence of non-communicable diseases, natural disasters and climate change all confront Vietnam with unprecented challenges (Joint Donor Group, 2007). The results of recent poverty monitoring exercises suggest that certain sub-groups of the population are particularly vulnerable to falling back into poverty (Oxfam and Action Aid, 2009a and b; VASS, 2009). Due to such exercises and the availability of high quality panel data, poverty dynamics as well as poverty trends are recognised as important issues by many policymakers.

This paper presents descriptive and multivariate analysis on poverty dynamics in Vietnam using the Vietnam Household Living Standards Surveys of 2002, 2004 and 2006. After describing the extant literature and panel data used, it discusses its modellig strategy and presents transition matrices and other descriptive statistics concerning the extent of poverty dynamics and chronic poverty in Vietnam. Various categorical and continuous variable models are then used to examine the drivers of exits and entries into poverty and the determinants of per capita expenditures using the panels for 2002-04 and 2004-06.

[1] Using the General Statistics Office's (national) poverty line, the poverty headcount in Vietnam fell from 58% in 1993 to to 16% in 2006 (VASS, 2007). Using the international PPP $1.25/day standard, extreme poverty in Vietnam fell from 63.7% in 1993 to 21.5% in 2006 (www.povcalnet.worldbank.org). Non-monetary indicators of poverty also generally show dramatic over this period (VASS, 2007; Baulch et al., 2010

Data and Previous Studies

Vietnam is unusual among developing countries in having high quality, nationally representative household surveys which include a panel component. These surveys were implemented by Vietnam's General Statistical Office (GSO) under funding and technical support from UNDP, the World Bank and other donors. The Vietnam Living Standards Surveys (VLSS) of 1992/93 and 1997/98 were multi-topic surveys patterned after the World Bank's Living Standard Measurement Surveys with nationally representative samples of 4,800 and 6,000 households respectively (Glewwe et al., 2004). These surveys were superseded in 2002 by a new biennial household survey programme known as the Vietnam Household Living Standards Surveys (VHLSS), which uses a rotating core-and-module designed survey with an expanded sample size intended to provide statistics that are representative for most provinces (Phung and Nguyen, 2007). Since 2004, just over 9,000 households have been included in the income and expenditure sample of the VHLSS.[2] Both the VLSS and VHLS surveys have clustered, stratified sampling designs. Though the content of the household and communes questionnaires administered has evolved over time, the core information contained within the surveys facilitates the construction of a set of variables that are consistently defined across the survey years.

There is a panel of around 4,300 households between the two earlier VLSS surveys, and a separate rotating panel of around 4,000 households between rounds in the more recent VHLSS surveys. However, there is no panel linking the VLSS and VHLSS. It is also important to recognize that the VLHSS rotating panel design, in which half of the enumeration areas in each round are replaced by new enumeration areas, means that the three wave panel between the years 2002, 2004 and 2006 is less than half the size of the two two wave panels from which it is formed. Once households who drop out from the panel because they have moved, disolved or cannot be interviewed for some other reason are accounted for, there are 3931 panel households between 2002 and 2004, 4193 panel households between 2004 and 2006, and 1844 households between 2002 and 2006 (Le and Pham, 2009). Utilising the fact that three households

[2] The number of households surveyed in the income and expenditure part of the VHLSS 2002, 2004 and 2006 were 29530, 9189, and 9188 respectively. Income data is also collected from a larger sample of household in the VHLSS.

should be interviewed in each enumeration area, we estimate attrition at the household level to be 14.0% between 2002 and 2004, 9.5% between 2004 and 2006, and 14.6 % between 2002 and 2006.[3] This is moderate by the standards of panel surveys in developing countries (Alderman *et al.*, 2001). The analysis of attrition in Appendix 1 finds limited evidence that the pattern of attrition between 2004 and 2006 is non-random, and that correction for attrition using inverse probability weights has a very minor impact on poverty dynamics.

Most previous studies of poverty dynamics in Vietnam have used the earlier VLSS panel. For example, Glewwe *et al.* (2002) and Justino *et al*. (2008) apply multinomial logit (hereafter MNL) models to the panel of 4,300 households surveyed in the 1992/3 and 1997/8. Glewwe *et al.* find that households living in urban areas and the Red River Delta and South East were the most likely to escape poverty. Rising returns to education were also important in explaining rising living standards, with households headed by white-collar workers benefiting significantly. Using the same panel, Justino *et al.* find that trade liberalisation has had a material and positive effect on rural household welfare, with most of this effect transmitted to poor households through labour market channels. In a separate paper, Glewwe and Phong (2004) investigates the impact that measurement error has using the VLSS panel, and finds that found that almost half of income mobility was due to measurement error.

A more recent paper by Vu *et al.* (2007) updates the MNL analysis using the VHLSS for 2002-2004 for rural areas. Again using a MNL model, Vu *et al.* find that ethnic minority households have a much smaller chance of escaping poverty than the Kinh-Hoa majority even when differences in location, education and occupation are taken into account. Secondary schooling and non-farm employment both increase the chances of escaping poverty and reduces the risk of falling into poverty among all rural households. Meanwhile primary education and the presence of a permanent road in the commune reduces the risk of falling into poverty for all households living in rural areas. Pham (2008) comes to similar conclusions using a MNL logit for the VHLSS 2002-2004-2006 panel. He also find that households living in the Northern

[3] Note that because of the way the sample size of the VHLSS was reduced between 2002 and 2004, it is not possible to identify which individual households attrited between 2002 and 2004. It is therefore not possible to test for whether attrition is random between these years. Note also that the VHLSS does not follow households when they split or move from their place of residence.

Uplands and North Central Coast are more likely to be chronically poor compared to other geographic regions.

However, as far as we know, there have been no previous studies which utilize different categorical and continuous variable methods to study poverty dynamics for the 2002-2006 period in Vietnam.

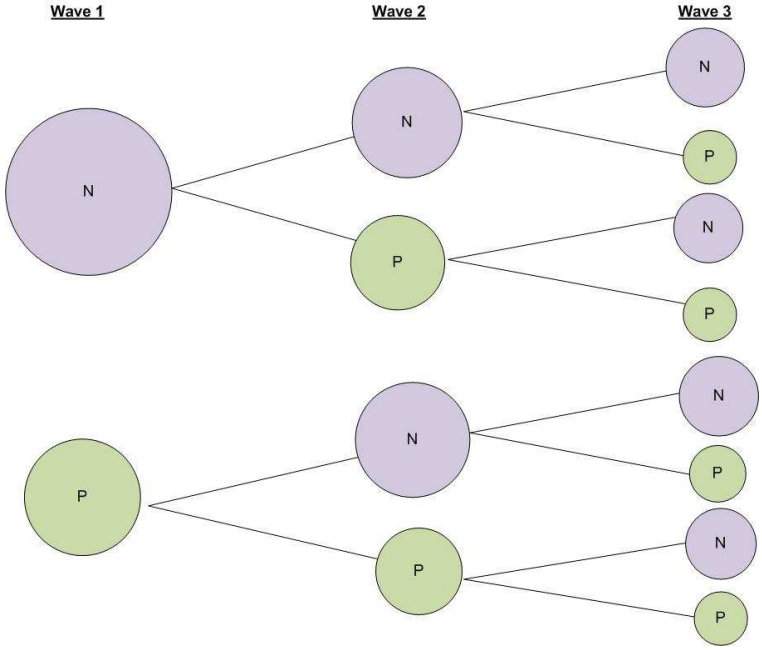
Modelling Strategy

While the multinomial logit (MNL) model is the most frequently used multivariate approach used to study poverty dynamics, and the only model which has been applied in Vietnam to date, it is not without its critics or caveats. First, the MNL may be criticised for reducing a continuous variable (in this case per capita expenditures) to discrete categories in just the same way that bivariate probits and logits are criticised for reducing a continuous variable to two discrete categories (Ravallion, 1996). When the MNL is applied to poverty dynamics, four categories corresponding to the four cells of a standard poverty transition matrix are usually employed as the dependent variable. Second, the MNL model is predicated on the assumption of the independent of irrelevant alternatives (IRR). The IRR assumption states that the odds ratios in the MNL model are independent of the other states (Greene, 1997). The validity of the IRR assumption is often highly questionable in the application of the MNL model to discrete choice issues. Third, the MNL model used unordered categorical outcomes which do not recognise the natural order of poverty transitions.

In this paper, we therefore supplement the MNL model with estimation of two alternative categorical variable models: the sequential and nested logit models. Both these models used the eight poverty dynamics categories that arise in a three wave panel (see Figure 1 below) and recognise the ordered nature of poverty transitions. The main difference between the models is that the branches and sub-branches of the sequential logit are estimated as a series of bivariate logits, while they are estimated simultaneously by the nested logit model. The nested logit model is also more computationally demanding that then sequential logit model, as it requires the

maximum likelihood estimation of eight simultaneous models for a three-wave panel.[4] The great advantage of these two models versus the MNL model is that they focus attention of the correlates of poverty transitions, and also allow the characteristics which trap households in poverty to be identified in a step-wise fashion.

Figure 1: Structure of the Sequential and Nested Logit Models



The multinomial, sequential and nested logit models are all subject to the serious criticism that they reduce a continuous dependent variable to discrete categories. This results in a loss of information about the dependent variable and also makes them susceptible to the influence of outliers among the independent variables (Ravallion, 1996). One possible response to this is to estimate fixed effect panel regressions using income or expenditure as the continuous variable (see for example, Woolard and Klasen, 2005). The drawback of this approach is that it only tells us about the determinants of changes in income or expenditure at the mean, which makes it difficult to establish a direct link between initial household characteristics and poverty transitions. So in this paper, we ultilise an alternative continuous variable approach: quantile regressions, to see if the influence of particular regressors differs across the expenditure distribution. Specifically, we estimate simultaneous regression models for the quantiles of the expenditure distribution corresponding to the mean

[4] The sequential logit model was estimated using the Stata model SEQLOGIT (Buis, 2007) while the nested logit model was estimated using the NLOGIT suite of programs (Greene, 2007). See Henscher et al. (2005) for further details on the sequential and nested logit models.

expenditures of the chronically poor and never poor. This allows us discover whether the chronically poor and never poor expenditure generation functions differ, by utilising the entire expenditure distribution for estimation but weighting it differently according to the quantiles of interest. The estimation of quantile regression also makes sense if we suspects that the error terms in the expenditure equations are hetereoskedastic or there are outliers in the explanatory variables (Koenker, 2005; Koenker and Bassett, 1978).

Transition Matrices and Contour Plots

One of the simplest way of examining the extent to which households move into and out of poverty is using transition matrices. These show the number (or percentage) of households who remain, move-out or into poverty, or remain non-poor across two years. International experience shows that relatively large number of households move into or out of poverty between years, although it is difficult to compare the amount of poverty mobility across countries because of the different time periods and welfare metrics they use (Baulch and Hoddinott, 2000; Dercon and Shapiro, 2005).

Tables 1 to 3 gives show the transition matrices contructed for the panel component of the Vietnam Household Living Standards Surveys. The number in each cell shows the number of households in each of the four poverty transition categories, with poverty identified using per capita expenditures and the GSO's poverty lines. [5]

Table 1: Poverty Transition Matrices for Vietnam: 2002-04, 2004-06 and 2002-06

(a)

		2006	
		Poor	**Non-Poor**
2002	**Poor**	560	470
	Non Poor	186	2,715

(b)

		2006	
		Poor	**Non-Poor**
2004	**Poor**	452	358
	Non Poor	171	3212

(c)

		2006	
		Poor	**Non-Poor**
2002	**Poor**	218	306
	Non Poor	67	1238

Note: These matrices are for urban and rural areas combined without weights.

[5] The GSO's poverty lines for 2002, 2004 and 2006 were VND 1,916,672, VND 2,072,210 and VND 2,559,850 per person per year respectively.

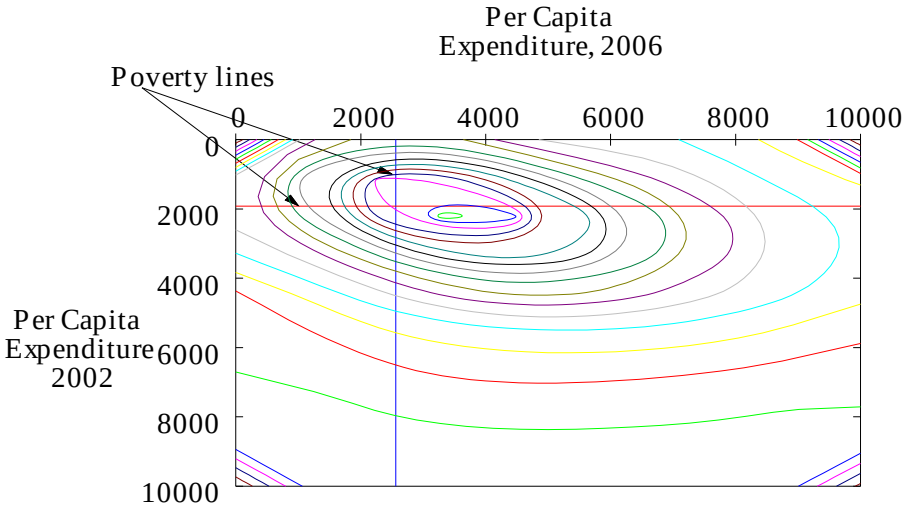
The transition matrices in Tables 1(a) and (b) shows the number of panel household that were in poverty for two consecutive surveys declined from 14.2% to 10.8% between 2002-04 and 2004-06. The number of households moving out of poverty also declined from 12% in 2002-04 to 8.5% in 2004-06, while the percentage of households moving into poverty fell from 4.7% to 4.1% over the same period. The consequence of this was a substantial increase in the number of households who were non-poor in consecutive years, which rose from 6.1% in 2002 to 76.6% in 2004-06. Table 1(c) shows that over the entire 2002-06 period, 11.9% of households were poor in both surveys, 16.7% of households moved out of poverty while 3.7% of households moved into poverty, and 67.7% of households were non-poor in both 2002 and 2006.

There are a number of well know difficulties with transition matrices. These include: (i) households are classified as being poor or non-poor based on whether their incomes (or expenditures) are above or below a pre-determined poverty line (which may or may not vary between survey years). Therefore transition matrices do not :(i) indicate how poor or well-off a household is; and, (ii) if incomes are measured with error, as is likely to be the case, some households will be erroneously classified. This is likely to be a particular problem for households with expenditures that are close to the poverty line in one or both survey years. If, for example, per capita expenditures were 10% higher in both 2002 and 2006, the number of households moving out of poverty in Table 1(c) would drop by 20% (to 244 households). Similarly, if expenditures in these years were 10% lower, the number of households moving out of poverty would increase by 13% (to 346).

Contour plots, which can be regarded as the continous analogue of transition matrices are one way to circumvent these difficulties. Contour plots are diagrams which provide a two dimensional view of a bivariate distribution, and resemble a topological maps of a mountain.[6] They can be interpreted in a similar way to the contours on an topological map, except the contours represent points of equal frequency rather than points of equal height. Once horizontal and vertical lines representing the poverty lines in two survey years are super-imposed on the contour plot, its relationship to the four categories in a standard transition matrix become clear: the four partitions of the contour plot correspond to the four cells of the transition matix. Figure 2 shows an example of a contour plot for the same panel data from Vietnam that was used to construct Table 1(c).

[6] See Deaton (1997: 180-181) for further information on the construction and interpretation of contour plots.

Figure 2: Contour Plot for Vietnam, 2002-2006



The position of the peak of the contour plot just inside the third quadrant (and particularly close to the 2002 poverty line) shows that while many households moved out of poverty between 2002 and 2006, large numbers of households in Vietnam remain vulnerable to falling back into poverty. This finding has obvious relevance to the likely impact of the rise in food and fuel prices in late 2007-08 on poverty in Vietnam. For example, if food expenditures in 2006 are adjusted by the rise in the CPI for food and foodstuffs between December 2006 and October 2008, the number of households moving out of poverty between 2002 and 2006 falls by 45% (to 168 households while the number moving into poverty rises by 128% (to 162).

Are the Chronically Poor also the Poorest?

A well-known question in the poverty dynamics literature is whether the chronically poor also the poorest? (Gaiha, 1989). Table 2 and Figure 3 provide a preliminary examination of this issue for Vietnam by tabulating the mean and median expenditures across the three panel years, for the eight possible poverty dynamics and then constructing box plots for these categories. In this table the chronically poor are identified as the thrice poor (PPP), which account for just under one-tenth of rural households, and whose inter-temporal mean and median per capita expenditures are significantly lower (at the 1% level) than those in the other seven poverty dynamic

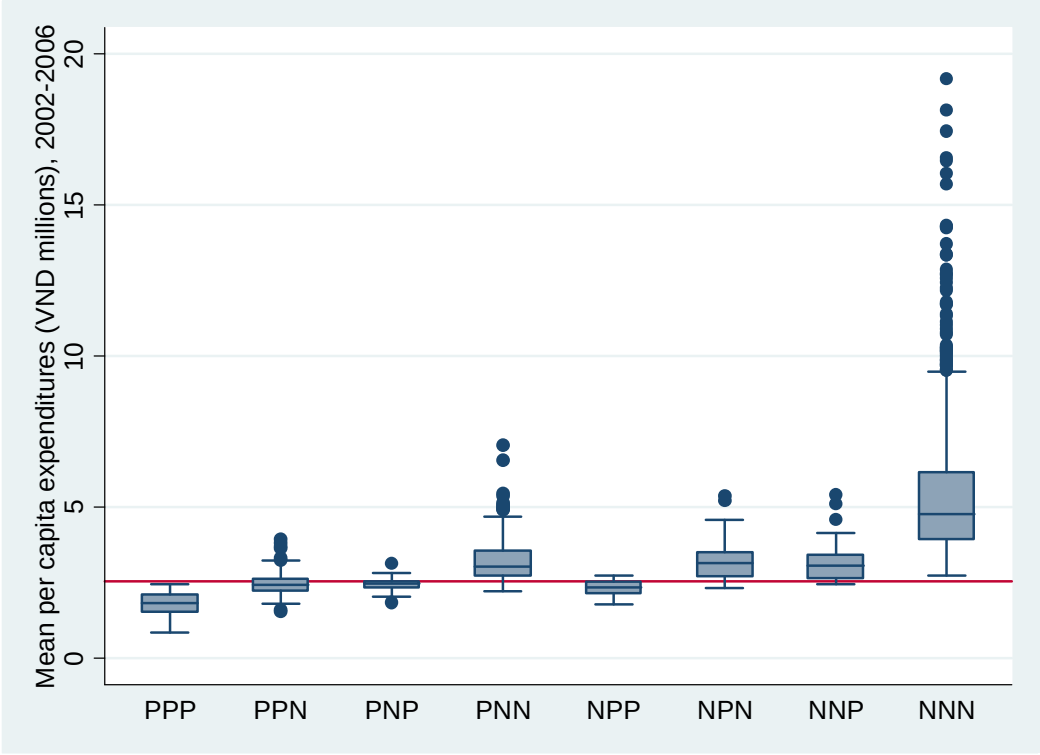
categories.[7] Note however, that the expenditures those who fell into poverty between 2002 and 2004 are statistically indistinguishable (again at the 1% level) from those who fell into poverty between 2004 and 2006.

Table 2: Mean and Median Expenditures by Poverty Dynamic Categories

Poverty Dynamics Category	**Inter-temporal Mean Expenditure** (VND millions)	**Inter-temporal Median Expenditure** (VND millions)	**Number of households**
PPP	1.801	1.836	169
PPN	2.464	2.410	100
PNP	2.458	2.485	49
PNN	3.265	3.039	206
NPP	2.370	2.343	26
NPN	3.201	3.157	50
NNP	3.127	2.970	41
NNN	6.423	5.201	1203
All	5.041	4.085	1844

Note: This figure is for urban and rural areas combined. Intertemporal mean expenditures are in 2006 VND terms and calculated across the three panel years

Figure 3: Box Plot of Inter-temporal Per Capita Expenditures by Poverty Dynamics Category



Note: 2006 poverty line in red. This figure is for rural and urban areas combined.

[7] This uses the spells approach to identifying chronic poverty employed by, *inter alia*, the Chronic Poverty Research Centre (see McKay and Lawson, 2003). An alternative components approach, which classifies the chronically poor as those whose mean inter-temporal incomes are less than the poverty line, has been proposed by Ravallion (1988) and applied to China by Jalan and Ravallion (1998).

Further insights into the poverty of each of these groups can be gained by examining the box and whisker plots in Figure 3. These summarise the distribution of per capita intertemporal expenditures in real terms for the same eight poverty dynamic categories with the size of each box representing the interquartile range, and the 'whiskers' showing 1.5 times the interquartile range. The points above or below the 'whiskers' are usually regarded as extreme data points or outliers (Hamilton, 2006). Several features of this plot are noteworthy. First, the three groups moving out of poverty all have much more dispersed intertemporal expenditures than three groups moving into poverty, with the large number of positive outliers showing that some households have been able to move substantially above the poverty line. Second, the category with the most positive outliers is those who were non-poor in all three years suggesting that the inequality is highest among the non poor. Third, the chronically poor category has both the lowest median expenditures.[8] Finally, while median per capita expenditures are close to each other (and the poverty line) for all categories moving in or out of poverty, they are substantially different for the chronically poor and never poor. This provides part of the justification for the quantile regression approach used towards the end of this paper. However, before that we estimate several categorical variable models, including the commonly used multinomial logit model, to see what they can tell us about the correlates of chronic poverty and poverty transitions in rural Vietnam.

Multinomial Logit Model

In this section, the commonly used MNL model is estimated for rural areas in the VHLSS 2002-2006 panel. Attention is restricted to rural areas because this is where the bulk of the poor in Vietnam live, and hence where the majority of households moving in and out of poverty between 2002 and 2004 are located. We also restrict attention to households whose heads have less than post-secondary education because a head having post-secondary education is an almost perfect predictor of being non-poor in both years. To avoid endogeneity (reverse causality) issues, only values of households and commune characterstics in 2002 plus regional variables are included

[8] This is not the case in all countries. For example in rural South India, Gaiha (1989) finds that households who move into poverty have the lowest per capita incomes.

in the model. These are supplemented by shocks at the household level (adult working days lost to illness in 2002-2004 and 2004-2006) and commune level (floods which occured between 2002 and 2006), and which can reasonably be regarded as exogenous. To reduce the effect of outliers, we have taken the natural logarithms of the continuous variables used (household size, age of the household head, the value of assets, total agricultural land and the number of days in which working adults in the household were ill.[9]

Table 3 shows how well the MNL model is able to predict households' poverty dynamics category between 2002 and 2006.[10] Although 70% of its predictions are correct, the model does much better at predicting which households will be non-poor in both years (93%) or poor in both years (56.6%) than in predict which households move out of poverty (26.%). The MNL also has hardly any ability to predict which households move into poverty (1.7%) although this may be partly due to the relatively small number of households in this category. These differences in the model's predictive ability should be kept firmly in mind in the discussion of the correlates of poverty transition that follows.

Table 3: Actual and Predicted Outcomes of the Multinomial Logit Model, 2002-06

Actual Outcomes	Predicted Outcomes			
	PP	**PN**	**NP**	**NN**
PP	116	37	0	52
PN	50	73	0	156
NP	11	10	1	37
NN	29	30	0	779

Note: The MNL model was estimated using a sample of 1381 rural households

As the coefficients of the MNL logit model cannot be interpreted directly (Greene, 1997), results are reported in terms of marginal effects which show the effect of a one-unit change in a particular variable on the probability of being in a particular

[9] To avoid the problem of trying to take the log of a negative or zero number, 1 m^2 of land and VND 1,000 (approx US 6 cents) worth of productive assets has been added to all the amount of agricultural land and productive assets owned by each household in the sample. Similarly, one working day lost to illness has been added to each household in the sample.

[10] The MNL model has also been estimates separately for the 2002-2004 and 2004-06 panels but the results are not qualitatively different from those for the 2002-04 panel. Chow tests indicate that the vast majority of the coefficients from the MNL for 2002-04 and for 2004-06 do not differ significantly from one another (at the 5% level).

poverty dynamics category holding all other variables constant. These marginal effects are estimated relative to a base category which have been choosen to highlight which household and community characteristics are associated with staying in poverty (Table 4) or remaining non-poor (Table 5).[11] These base categories are the median values in 2002 for a poor (P) household living in the Northern Uplands whose head has not completed primary school in Table 4 and for a non-poor household living in the South-East who has completed primary school in Table 5.

Table 4 show that ethnic minority households are roughly one-fifth more likely to be poor in 2002 and 2006 and more than a quarter less likely to be non-poor in both years. [12] Households size and the share of children (under 15 years old) in the household in 2002 are positively associated with chronic poverty in Table 4, but also with moving out of poverty. This may reflect the effect of children growing-up and starting to work.

The effect of education on the probability of being poor and non-poor in both years is strong. Relative to households whose heads have not completed primary school, Table 4 shows that households whose heads have completed upper secondary school are a third more likely to be never poor. If their heads have completed primary and lower secondary school, this also increase the probability that the household is never poor (by one-sixth and one-quarter, respectively) although such households are also less likely to move out of poverty. Table 5 shows that households whose heads have not completed primary school are more likely to be poor in both 2002 and 2006, while those whose heads have completed lower secondary school are less likely to be so. Both tables show that households whose heads have completed upper secondary school are less likely to fall into poverty, although the sample size for this category is small.

[11] Note that this choice of base categories also means that the marginal effects in Tables 4 cannot be directly compared with those in Table 5.
[12] Coming from an ethnic minority also increases the probability of exiting poverty by about 7% in Table 5 .

Table 4: Results from the Multinomial Logit Model, 2002-2006

	PP	**PN**		**NP**		**NN**		**Base**
Variable	dp/dx	dp/dx		dp/dx		dp/dx		PP
Ethnic minority	0.195	0.026	*	0.005		-0.225	***	0
Household size (log)	0.285	0.271		-0.093	***	-0.463	***	log(5)
Share of children	0.438	0.179		-0.145	***	-0.473	***	0.5
Share of elderly	0.069	0.372		-0.037		-0.404		0
Female head	0.072	0.037		-0.039		-0.071		0
Age of Head (log)	-0.104	-0.249		0.005		0.348	**	log(41)
Age of Head squared (centered)	0.472	0.072		-0.022		-0.522	***	0.049
No schooling			omitted category					
Primary school	-0.097	-0.017	*	-0.034		0.148	***	0
Lower secondary school	-0.159	-0.016	***	-0.068		0.243	***	0
Upper secondary school	-0.167	-0.038	*	-0.107	***	0.311	***	0
Value of Productive assets (log)	-0.060	-0.031	***	0.002	***	0.089	***	0.963
Long-term land area (log)	0.001	0.000		0.006		-0.006		7.937
Mains electricity	-0.227	0.011	***	0.032	**	0.183	***	1
Clean Water	-0.098	-0.075		-0.017		0.189	***	0
Days lost to illness, 2004	-0.011	0.013		0.014		-0.016		log(3)
Days lost to illness, 2006	-0.016	0.013		0.001		0.002		log(4)
Floods in Commune	0.188	-0.026	***	0.004		-0.166	***	0
Permanent Road	-0.080	0.041	**	-0.036		0.075	**	0
Northern Uplands			omitted category					
Red River Delta	-0.059	0.151	*	-0.004		-0.088		0
North Central Coast	0.219	0.005	*	-0.018		-0.206	***	0
South Central Coast	-0.157	0.000	**	0.039	**	0.118	**	0
Central Highlands	-0.067	0.161	**	-0.085		-0.010		0
South East	-0.194	-0.030	***	-0.030		0.255	***	0
Mekong River Delta	-0.197	-0.083	***	-0.065		0.344	***	0
p(y|x)	0.241	0.230		0.107		0.421		
Number of observations	205	279		59		838		
Pseudo R2	0.275							
Wald chi2(72)	32189.830							
Prob > chi2	0.000							

Note: Note: marginal effects of the multinomial logit model are shown. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 5: Results from the Multinomial Logit Model, 2002-2006

	PP		PN		NP		NN	Base
Variable	dp/dx		dp/dx		dp/dx		dp/dx	NN
Ethnic minority	0.019	***	0.050	***	0.031		-0.100	0.000
Household size (log)	0.016	***	0.095	***	0.003		-0.114	log(4)
Share of children	0.021	***	0.079	***	-0.010		-0.090	0.400
Share of elderly	0.008		0.107	***	0.015		-0.130	0.000
Female head	0.004		0.017		-0.008		-0.013	0.000
Age of Head (log)	-0.009	**	-0.079	***	-0.021		0.108	log(46)
Age of Head squared (centered)	0.023	***	0.063		0.028		-0.114	0.041
No schooling	0.009	***	0.016		0.027	*	-0.052	0.000
Primary School			omitted category					
Lower Secondary School	-0.004	**	-0.005		-0.016	*	0.025	0.000
Upper Secondary School	-0.004	*	-0.012		-0.031	***	0.047	0.000
Value of Productive assets (log)	-0.003	***	-0.014	***	-0.005	***	0.023	1.947
Long-term land area (log)	0.000		0.001		0.002		-0.003	7.966
Mains electricity	-0.017	***	-0.026	*	-0.005		0.049	1.000
Clean Water	-0.004	***	-0.023	***	-0.012		0.039	0.000
Days lost to illness, 2004	0.000		0.004	*	0.005	*	-0.009	0.000
Days lost to illness, 2006	-0.001		0.002		0.000		-0.002	0.000
Floods in Commune	0.013	***	0.017		0.019		-0.050	0.000
Permanent Road	-0.003	**	0.001		-0.013	*	0.016	0.000
Northern Uplands	0.047	***	0.028		0.031		-0.106	0.000
Red River Delta	0.041	***	0.094	***	0.038		-0.173	0.000
North Central Coast	0.155	***	0.070	***	0.048	**	-0.274	0.000
South Central Coast	0.008		0.015		0.038		-0.062	0.000
Central Highlands	0.034	***	0.082	***	-0.018		-0.098	0.000
South East			omitted category					
Mekong River Delta	-0.001		-0.014		-0.015		0.031	0.000
p(y|x)	0.008		0.044		0.031		0.917	
Number of observations	205		279		59		838	
Pseudo R2	0.275							
Wald chi2(72)	36388.890							
Prob > chi2	0.000							

Note: Note: marginal effects of the multinomial logit model are shown. * significant at 10%, ** significant at 5%, *** significant at 1%

Unsurprisingly households' ownership of productive assets increases the probability of being never poor but access to long-term land does not affect the probability of moving in and out of poverty in any of the MNL models estimates. This may reflect the fact that the allocation of agricultural land in Vietnam mostly took place during the 1990s, and that there is now relatively little arable land left to be allocated or reallocated. What is more surprising is that the level of productive assets a household has appears to be negatively related to its chances of moving out of poverty in both Tables 4 and 5. This may, perhaps, be due to households using their assets to smooth consumption against shocks−which is consistent with the limited effect of shocks noted above.

Shocks at the households level have relatively little effect on household's poverty dynamic category. Dyas lost to sickness of working household members in both 2002-04 and 2004-06 have largely insignificant effects in Tables 4 and 5. However, shocks are the community level are more importnat with floods decreasing the probability that a household is never poor by 17% and also decreases the probability of moving of out poverty by a modest amount in Table 4.

Finally, infrastructure and facilities have relative modest effects on household poverty dynamics. The absence of mains electricity and clean water at the household level decreases the probability that a household will move out of poverty or be never poor, and increases the probability that it will remain in poverty. Living in a commune with an agricultural extension centre also increases by probability of moving out of poverty by about 7% in Table 4. However, the existence of a permanent road in the commune or a market in the commune centre does not have a strong impact of poverty dynamics. This reflects the fact that by 2002, all but the most remote communes already had roads and markets.

Finally, households from Northern Uplands and Central Highlands, where large number of the ethnic minorities live, are more likely to be chronically poor according to Table 5, while households living in the prosperous South East and Mekong River Delta are more likely to be never poor according to Table 4. Living in the Red River Delta or North Central Coast is positively associated with chronic poverty and

negatively associated with being never poor in this tables. Whether there is a regional pattern for households moving into poverty is more difficult to discern, with households living in the South Central Coast and Central Highlands being more likely to move out of poverty in Table 5 compared to households in the Red River Delta, North Central Coast and Central Highlands in Table 6. This and other apparent inconsistencies in the marginal effects in Tables 4 and 5 largely reflect the failure of the MNL model to be able to distinguish between the characteristics of households moving in and out of poverty, although the model does reasonably well in discriminating between the chronically poor and never poor.[13]

Sequential and Nested Logit Models

While the multinomial logit model has become the standard models used to analyse poverty dynamics, it is by no means the only model available for this purpose. The MNL model suffers from three limitations: 1) the IIA (Independence of Irrelevant Alernative) assumption, which makes the odds ratio independent of other outcomes; 2) the IID (Independently and Identically Distributed) assumptions, which does not allow heterogeneity in the variance and covariance of outcomes; and, 3) the unordered nature of its outcomes (Hensher et al., 2005). In this section, we employ two related models─the sequential and nested logit models─to try overcome these limitations and tease out the drivers of movements into and out of poverty more clearly. The sequential logit model imposes greater structure on the poverty dynamics than the unordered categories of the multinomial logit model, while the nested logit model allows some levels of heterogeneity in the variance and covariance of outcomes.

The sequential logit model consists of a series of seven logit models estimated in the order in which a Vietnamese household would naturally make poverty transitions. As shown in Figure 3 (above), these are:

1. Non-poor versus poor in 2002
2. Non-poor versus poor in 2004, given that the household was poor in 2002
3. Non-poor versus poor in 2004, given that the household was non-poor in 2002

[13] This finding is consistent with those of Vu *et al.* (2007) for the 2002-04 rural panel.

4. Non-poor versus poor in 2006 given the household was poor in both 2002 and 2004
5. Non-poor versus poor in 2006 given the household was poor in 2002 and non-poor in 2004
6. Non-poor versus poor in 2006 given the household was non-poor in 2002 and poor in 2004
7. Non-poor versus poor in 2006 given the household was non-poor in both 2002 and 2004

As the base case in each model is one with more poverty, we therefore chose to omit the dummy variables which are most likely to be correlated with poverty. In Vietnam, these are residence in the Northern Uplands and households who head have not completed primary schooling. To reduce the effect of outliers, we have again taken the natural logarithms of the continuous variables used (household size, age of the household head, the value of assets, total agricultural land and the number of days in which working age members of the household were ill).

Table 6 shows the results of the sequential logit model, with the odds ratios (rather than coefficients or marginal effects) shown for each of the explanatory variables. For variables where the odds ratio is greater than one, this means the variable increases the probability of the household escaping poverty in the relevant transition period. When the odds ratio is less than one, the opposite is true. Column 1 shows that most of explanatory variables have a significant impact on whether or not a rural household is poor in 2002, with minority status, household size and the share of children and elderly people in the household all reducing the probability of a household escaping poverty substantially. In contrast the age of the head and the head's level of education increase the probability of a household escaping poverty, along with the (logarithm of) the value of assets. However, the amount of productive land owned does not affect the probability that a rural household is poor, again demonstrating the effective of Vietnam's land rellocation programs. Whether a household has mains electricity or clean water increases its chances of moving out of poverty. As expected most of the forward looking shock variables, such as the number of days working members of the household were sick between 2002-04 and 2004-06, do not affect the odds of poverty significantly, although the number of

Table 6: Sequential Logit Model Results for Poverty Transitions, 2002-06

	2002		2004			2006					
	N v P		N v P 2002=P	N v P 2002=N		N v P |2002=P |2004=P	N v P |2002=P |2004=N	N v P |2002=N |2004=P		N v P |2002=N |2004=N	
Variable											
Ethnic minority	0.381	***	0.335 ***	0.57		1.097	0.534	1.275	*	0.601	
Household size(log)	0.105	***	0.556	1.2		0.664	1.704	29.031	*	0.629	
Share of children	0.112	***	0.308	0.039	***	0.989	0.222	0.005		7.132	
Share of elderly	0.132	***	0.964	0.16	*	57.897 ***	0.365	0.008		1.005	
Female head	0.674	*	1.311	0.557		0.358 *	1.311	1.871		1.525	
Age of Head (log)	4.807	***	0.782	5.142	**	0.151 **	1.6	0.448		4.251	*
Age of Head Squared (centred)	0.143	**	0.125	1.348		0.035	9.487	0	***	3.07	
No schooling	omitted category										
Primary School	1.519	*	1.397	1.678		1.606	0.746	0.094	*	2.505	*
Lower Secondary School	1.952	***	4.163 ***	3.776	***	2.706 *	1.165	0.147		6.774	***
Upper Secondary School	2.263	***	2.475 *	4.068	**	1.597	3.141	1.60E+08	***	6.40E+06	***
Value of productive assets (log)	1.425	***	1.126 ***	1.215	***	1.098 *	1.193 **	0.593	*	1.201	***
Long-term land area (log)	0.992		1.036	0.91		0.95	1.065	1.017		0.906	
Mains electricity	2.17	***	2.267 ***	0.925		2 *	1.429	0.963		1.547	
Clean water	2.099	***	0.994	1.473		1.143	0.974	4.919		1.441	
Days lost to illness, 2004	0.953		1.167 **	1.17		1.133	1.056	0.573	*	0.786	**
Days lost to illness, 2006	0.989		0.889	0.906		1.189 *	1.253	0.18	**	1.276	*
Floods in commune	0.582	**	0.811	0.715		0.342 **	0.466	2.956		0.515	*
Permanent road	1.112		1.168	1.392		2.072 **	2.385 *	2.264		1.655	
Northern Uplands	omitted category										
Red River Delta	0.587	*	0.373 **	1.514		4.428 **	2.642	0.141		0.923	
North Central Coast	0.41	***	0.292 ***	1.069		0.653	0.89	0.284		1.579	
South Central Coast	1.789	*	0.876	1.891		2.875	7.448 *	0.011	***	2.02	
Central Highlands	0.673		0.912	3.888		2.375	4.661 **	7.50E+06	***	3.538	
South East	2.515	**	3.38 **	6.585	***	5.562 *	4.227 *	7.80E+06	***	1.599	
Mekong River Delta	3.577	***	1.212	3.623	**	6.4 ***	2.738	15.356		5.327	*
Number of Observations	1381		484	867		253	232	68		829	
Psuedo R2	0.254										
Wald Chi2 (24)	95.59										
Prob >chi2	0.000										

Note: Odds ratios. * significant at 10%, ** significant at 5%. *** significant at 1%

floods experienced in the commune in which they live (which are presumably are presumably correlated across years) do. Finally, while most of the regional dummies are significant, households living in Vietnam's booming South East, the South Central Coast and Mekong River Delta were more likely to move out of poverty in 2002, while those in the northern regions were less likely to do so.

The next two columns of Table 6 show the logits for a household escaping poverty between 2002 and 2004, given its poverty status in 2002. The most noticeable thing about these results is that the number of variables with odd ratios significantly different from one is much smaller than in 2002. The education variables, however, continue to exert a positive influence on the likelihood of moving out of poverty, while ethnic minority status increases the likelihood that a household will be poor in both 2002 and 2004. The value of assets increase the odds of households moving or staying out of poverty, but ownership of long-term land, which does not change much between years in rural areas of Vietnam, does not influence poverty transitions between 2002 and 2004. Main electricity increases the odds of leaving poverty significantly, but has a little impact on households that were non-poor in 2002 falling into poverty (though its odds ratio is, as expected, less than one). Living in the north again increases the probability that a household willl be poor in both ears, while living the South-East improves its chances of moving out of poverty by 2004.

The final four columns of Table 6 show the logits for a household escaping poverty between 2004 and 2006, given their poverty status in 2002 and 2004. Again relatively few variables influence the chances of household escaping poverty given their previous poverty history. Most of the odds ratios for the columns that shows households moving into and out of poverty are either not significantly different from zero, or have inconsistent effects across columns. Because of the smaller sample sizes, particular in the penultimate column, some of the odds ratios reported are also very large. Nevertheless, the number of workers experiencing sickness between 2004 and 2006 seems to be an important driver of households who were poor in 2004 staying in poverty. Households whose heads have completed upper and lower secondary schooling, and who lived in the Mekong Delta are most likely to be non-poor in all three years. Indeed the size of the odds ratios for upper secondary schooling are so large that they suggest it is almost impossible for a households whose

head has completed secondary schooling to be poor in any of the three years. This is consistent with the access to formal sector jobs that this level of education confers in Vietnam.

We have also estimated a nested logit model using the structure shown in Figure 3. This model is more demanding to estimate that the sequential logit, and certain variables (e.g., age of household head squared, primary and secondary schooling, illness of working-age members at the household level as well as the permant road variable) have to be modified or dropped before the model converges.[14] The underlying choice theoretic foundations of the nested logit model, which is usually applied to discrete choices within a utility maximization framework, are also more questionable than those of the sequential logit in a poverty dynamics context. Nevertheless, the nested logit model's results are generally consistent with those of the sequential logit model, and therefore serve as a useful check on the sequential logit results as well as multinomial logit model.

Table 7 shows the direct effects of different variables in the nested logit model. Notice that effects are only produced for seven of the eight poverty dynamics categories because the NNN category is omitted (along with no schooling and the Northern Uplands).[15] Ethnic minority status, household size, the share of children, the share of the elderly and coming from the North Central Coast all increase the probability of a household being chronically poor (PPP), while access to electricity and the value of assets as well as coming from the South East and Mekong River Delta reduce it. Household size increases the probability of households moving out of poverty (PPN and PNN) and also increases the probability of moving into poverty (NPP and NPP) to a much smaller extent. Primary and secondary education and the value of productive assets consistently reduce the probability of experiencing poverty, but the size of their marginal effects differen substantially between cateogries. There are a few variables (such as ethnic minority status and mains electricity) which matter to the probability of a household being in the PPP or PPN categories but not to other categories. This suggests that these variables play a more important role in.

[14] To obtain convergence, we have set the inclusive value parameters for PR2, P2P4, and P2NP4 equal to one. The restricted model converges normally and the restriction passes the likelihood ratio test. The log likelihood ratio statistics is 1.958 and the χ^2 (3, 0.95)) value is 7.815.

[15] The total effects of all variables for all eight categories are provided in Appendix 2.

Table 7: Direct Marginal Effects of the Nested Logit Model, 2002-2006

Variable\Outcome	PPP		PPN		PNP		PNN		NPP		NPN		NNP	
Ethnic Minority	12.206	***	9.414	***	3.059	*	5.525		2.332		0.303		1.222	
Household size (log)	19.356	***	16.816	***	6.507	***	26.261	***	3.406		-0.250		3.511	***
Share of children	8.748		4.156		3.485		4.078		-0.649		-0.202		-9.753	***
Share of elderly	14.817	*	22.457	***	9.094	*	28.537	***	7.045		-1.978		2.834	
Female Head	-0.207		-2.591		-0.455		1.075		-2.600		1.862		-2.715	**
Age of head	-0.423	***	-0.486	***	-0.203	**	-0.660	***	-0.128	**	-0.134		-0.157	***
No schooling	omitted category													
Primary School	-12.851	***	-7.264	***	-3.039	*	-11.979	***	-5.198	**	-0.029		-3.717	***
Lower/Upper Secondary school	-21.369	***	-14.125	***	-5.119	***	-14.067	***	-6.347	***	-2.748		-6.633	***
Value of productive assets (log)	-4.146	***	-2.931	***	-1.750	***	-4.735	***	-0.782	**	-0.754		-0.633	***
Long-term land area (log)	-0.140		-0.622	*	-0.204		-0.128		-0.321		0.372		-0.360	**
Mains electricity	-10.403	***	-5.201	**	-2.000		-4.363		-1.152		0.737		-0.189	
Clean water	-8.371	***	-5.818	**	-3.488	**	-10.198	***	-2.313	*	-0.892		-1.920	*
Northern Uplands	omitted category													
Red River Delta	3.379		10.175	***	-1.512		4.745		3.045		-3.067		1.422	
North Central Coast	13.757	***	9.101	***	2.759		5.436		6.193	**	-10.869		0.770	
South Central Coast	-0.919		2.866		-5.581		0.192		5.237	**	-7.372		2.086	
Central Highlands	-1.492		4.321		-3.133		4.551				-5.059		-1.585	
South East	-18.947	***	-7.157		-5.824	*	-6.467				-6.087	*	-0.352	
Mekong River Delta	-20.558	***	-8.180	**	-8.495	***	-20.484	***	-9.200		-1.369		-3.656	**
					IV parameters									
P2P4	1	Fixed			NP2P4		8.668	**			PR2		1	Fixed
P2NP4	1	Fixed			NP2NP4		29.106	***			NPR2		0.329	***
Number of Observations	159		94		46		185		23		45		36	
Pseudo R-squared	0.482													
Wald Chi2 (127)	2765.852													
Prob >chi2	0.000													

Note: Average direct effect (percent) calculated over all observations in the sample. * significant at 10%, ** significant at 5%, *** significant at 1%. Central Highlands and South East omitted in NPP equation due to no observations in the category.

perpetuating poverty than others.

Taken together the results of the sequential and nested logit models demonstrate the powerful lock-in effects that initial conditions had on households' subsequent poverty transitions in Vietnam in the early 2000s. Initial conditions such as household size and composition, whether the household head comes from an ethnic minority or lived in the northern part of Vietnam played a role in trapping households in poverty. Failure of the household to complete primary education is also a powerful factor trapping households in chronic poverty, as has been observed in other countries (Rose and Dyer, 2008). In contrast, completing secondary or post-secondary education has strong effects on a household's ability to escape from poverty and to remain out of poverty once they have escaped it. This would confirm the priority which successive Vietnamese Governments have given to education, and the current focus on achieving universal lower secondary school enrolments, although challenges still remain in getting some ethnic minority children to complete primary school (Baulch et al, 2010). The value of productive assets affect only some poverty transitions ─and have their strongest impact on determining whether or not a household is poor in the first place. This is linked to the gradual way in which households typically accumulate assets. Now that most communes have access to electricity, clean water and roads, investments in community infrastructure are becoming less important as drivers as poverty reductions, though they still matter to the overall economic growth. In contrast, health shocks matter to downward poverty dynamics in the 2004-06 period, but matter less in the 2002-04 period suggesting that as time passes many households are able to overcome periods of ill health. Finally, living in the (generally more dynamic and market oriented) southern part of Vietnam increases households ability to escape from (though not to remain out of) poverty. This is consistent with the higher levels of vulnerability to poverty that often accompanies market-led development.

Determinants of Per Capita Expenditure: Simultaneous Quantile Regressions

As mentioned above, while they are informative for analysing the correlates and drivers of poverty dynamics, the multinomial, sequential and nested logit models are

subject to the serious criticism that they reduce a continuous dependent variable to discrete categories. This results in a loss of information about the dependent variable and also makes them susceptible to the influence of outliers among the independent variables (Ravallion, 1996). In this section, we therefore simultaneous estimate quantile regressions to see if the influence of household and community characteristics or regional variables differs across the expenditure distribution.

Table 8 shows simultaneous quantile regression results using the logarithm of per capita expenditure in 2006 calibrated to the 8^{th} and 67^{th} percentiles of the distribution (corresponding to the mean expenditures of the chronically poor and never poor respectively). As with the various categorical (logit) models estimated previously, the sample is restricted to rural households only but now households whose heads have completed post-secondary education are included. To avoid endogeneity, all the regressors are initial 2002 values, except for the shock variables (adults working days lost to illness, floods in the commune) which are regarded as exogenous.[16] Independent variables which are seriously skewed (such as age of the head, the value of productive land, and days lost to illness) have also been logged, while the squared age of the head has been centred to avoid multicollinearity. As the pseudo R-squared at the bottom of the table show, together these variables explain around 29 and 23 percent of the variation in per capita expenditures of the chronically poor and never poor in 2006.

The second and third columns of Table 8 show the determinants of expenditures in 2006 for the chronically poor and never poor. Ethnic minority status, household size, and the presence of floods in the commune, all have a significant negative effect on expenditures for both the chronically poor and never poor. Coming from an ethnic minority reduces per capita expenditures among the chronically poor by approximately 17 percent, while floods in the commune reduce the expenditure of both groups by around 10 percent. The head having completed secondary or post-secondary education, the household possessing mains electricity and clean water, and living in the South East or Mekong River Delta all have significant positive effects on the expenditures of both the chronically and never poor. Age has the expected

[16] This means that some variable which are likely to be highly correlated with per capita expenditures, such as wage employment or the presence of a migrant, are not taken account of.

declining (inverse quadratic) effect for both groups, although only one of the coefficients on age and age-squared are significantly different from zero in each quantile regression. There are also some variables which are significant determinants of expenditures for the chronically poor, but not for the never poor, and vice-versa. For example, the head having completed primary school only increases the expenditures of the chronically poor significantly, while living in the South Central Coast is associated with higher expenditures of only the chronically poor. Similarly, the share of children and elderly people in the household has a negative effect on expenditures among the never poor but not the chronically poor, while living in the Central Highlands only has a positive effect on the never poor.

Differences in the significance of variables do not, however, imply that the responsiveness of chronically poor and never poor to these variables differ statistically from each other. This is tested formally in the last column of Table 8, which shows the results of an interquantile regression for the difference between coefficients at the 8^{th} and 67^{th} percentiles of the expenditures distribution. The results shows that responsiveness of the chronically poor and never poor to the share of children in the household, and residence in the North Central Coast are statistically different, but that other coefficients are identical from a statistical point of view.[17] That the share of children in the household only has a significant negative effect among never poor households is likely to be explained by the heavier cost of education among more prosperous households, as well as the fact that children start to work (usually within the family farm or business) much earlier in poorer households (Edmonds and Turk, 2004). That residence in the North Central Coast only has a depressing effect on the chronically poor is consistent with the geographic diversity of the North Central Coast, which includes both poor, remote upland areas close to the Lao border and prosperous and well connected lowland areas along the coast. At first glance, it is surprising that ethnic minority status and residence in the Central Highlands, who coefficients differ in size by more than a factor of two, are not found to be statistically different from one another. In both cases, however, the small number of households

[17] The coefficients on the age of head squared are also statistically different for chronically poor and never poor households. However, this is probably explained by the significant coefficient on the complementary variable for the age of the head (not squared) for the never poor only. In both cases, these two coefficients combined show the usual inverted U (quadratic) shape between expenditure and the age of head.

from ethnic minority and the Central Highlands in the VHLSS panel probably explains the lack of statistical difference between these variables.

Table 8: Simultaneous Quantile Regressions of Per Capita Expenditure in 2006

Variable	Chronically Poor (8th percentile)		Never Poor (67th percentile)		Difference	
Ethnic minority	-0.169	**	-0.150	***	0.019	
Household size	-0.037	**	-0.042	***	-0.005	
Share of children	-0.029		-0.439	***	-0.410	**
Share of elderly	0.065		-0.223	*	-0.288	
Female head	0.048		0.001		-0.047	
Age of Head (log)	0.160		0.244	***	0.084	
Age of Head Squared (centered)	-0.928	***	-0.090		0.838	*
Primary School	0.149	***	0.052		-0.097	
Lower Secondary School	0.321	***	0.129	**	-0.192	
Upper Secondary School	0.386	***	0.258	***	-0.128	
Post-Secondary Education	0.623	***	0.464	***	-0.159	
Value of productive assets (log)	0.063	***	0.052	***	-0.011	
Long-term land area (log)	-0.007		-0.011	**	-0.005	
Main electricity	0.156	**	0.178	***	0.021	
Clean water	0.130	***	0.117	***	-0.013	
Days lost to illness, 2004	-0.018		-0.004		0.014	
Days lost to illness, 2006	-0.001		0.031	***	0.032	
Floods in commune	-0.095	*	-0.113	**	-0.018	
Permanent road	0.015		0.087	***	0.072	
Red River Delta	0.034		-0.002		-0.036	
North Central Coast	-0.242	**	-0.117	*	0.125	**
South Central Coast	0.172	**	0.088		-0.084	
Central Highlands	0.102		0.219	***	0.118	
South East	0.398	***	0.294	***	-0.104	
Mekong River Delta	0.379	***	0.321	***	-0.058	
Constant	6.985	***	7.592	***	0.607	
N	1464		1464			
Pseudo R2	0.289		0.233			

Note: Coefficients. * p<0.10, ** p<0.05, *** p<0.01

To sum-up, the simultaneous quantile regression results provide some evidence that chronically poor and never poor households in rural Vietnam have different expenditure generation functions. While many household and community characteristics have similar effects on expenditures for both groups, the chronically poor seem to be more disadvantaged by geography and ethnic minority status while changes in household size and the share of children matter more to the living standards of the never poor.

Summary and Conclusions

This paper has provided a descriptive and multivariate analysis of poverty dynamics in Vietnam using panel data from the Vietnam Household Living Standards Surveys of 2002, 2004 and 2006. Transition matrices and contour plots confirm that while large numbers of households moved out of poverty between these years, many did not move far above the poverty line and remained vulnerable to falling back into poverty. Furthermore, around a tenth of rural households appear to be trapped in chronic poverty. Different categorical models are then estimated to analyse the correlates of chronic poverty and the drivers of poverty transitions in rural areas. Multinomial logit models show that ethnic minority households with little or no education and those living in the Northern Uplands or Central Highlands are most likely to be chronically poor. The sequential and nested logit models demonstrate the powerful lock-in effects that initial conditions had on households' poverty transitions in the early 2000s. Initial conditions such as household size and composition, whether the household head comes from an ethnic minority or failed to complete primary school, and residence in northern Vietnam play an important role in trapping households in poverty. Finally, simultaneous quantile regression models are estimated to investigate whether the chronically poor and never poor have different expenditure generation functions. While many household and community characteristics have similar effects on expenditures for both groups, the chronically poor again seem to be more disadvantaged by geography and ethnic minority status while changes in household size and the share of children matter more to the living standards of the never poor.

Taken together these results demonstrate four facets of poverty dynamics in rural Vietnam. First, certain household and geographic characteristics (such as ethnicity, lack of education, and residence in northern Vietnam) exert powerful effects which lock households into chronic poverty. Since many of these interlocking characteristics are hard if not impossible to change, they demonstrate the structural nature of chronic poverty in rural Vietnam. Second, as in many countries, education provides the foundation for many to escape from poverty (and to remain out of poverty once they have escaped it). In Vietnam, this is linked to the greater access which those with secondary and post-secondary have to wage jobs, as well as their higher propensity of educated people to migrate. It confirms the priority which

successive Vietnamese Governments have given to secondary education, although challenges still remain in getting some disadvantaged children to complete primary school. It also suggests that further easing of domestic restrictions on migration may provide further opportunities for reducing rural poverty. Third, control over land appears to play a relatively minor role in the transitions from poverty. This is linked to both the growing importance of the non-farm economy in Vietnam, and the shortage of arable land available for reallocation. Other types of physical capital and community infrastructure have mixed effects on households' poverty dynamics, although access to electricity at the household level was important in allowing some households to escape poverty. Finally, while rural households in Vietnam seem able to protect themselves against illness and other idiosyncratic shocks, floods and other covariant shocks have the potential to push many households back below the poverty line, at least temporarily. As the effects of the recent food price shocks and global economic crisis demonstrate, Vietnam's poverty reduction record remains fragile.

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Appendix 1: Analysis of Pattern of Attrition

This appendix analyses the pattern of attrition in the VHLSS04-06 panel.[18] In particular it tests for whether household attrition is random using attrition probits (Fitzgerald et al, 1998) and pooling tests, in which the equality of coefficients from the baseline sample with and without attritors are equal (Becketti, Gould, Lillard and Welch, 1988). Note that 477 out of 4,670 households dropped out of the VHLSS panel between these years, and that the survey does not follow households who move from their original communes.

One of the simplest tests for whether attrition is random is to estimate a bivariate probit in which the dependent variables takes the value one for the households which drop out of the sample between 2004 and 2006 and zero for the remaining household. Explanatory variables are 2004 values for all variables that are used in the simultaneous quantile regression in Table 8 plus other auxiliary variables which are believed to capture the quality of the interview process or otherwise directly affect the probability of attrition. To capture the quality of the interview process we include dummy variables for whether an interviewer was needed, the interview month and how many sources of income the household has (which is a rough proxy for the length of the interview, as a separate section or sub-section of the VHLSS questionnaire is administered for each income source). We also include the type of house in which the household lives and whether the commune in which it lived experienced droughts, floods or storms, as variables which may directly affect the probability of a household dropping out of the sample.[19] As is usual, we also include the lagged values of the (natural logarithm) of per capita expenditure in 2004.

Table A1 shows the results of estimating the attrition probit both for the complete sample and for rural areas only. Just eight of the 44 explanatory variables included in the probits are significantly different from zero at the 1% level of statistical significance. There variables are the age of the household head squared), whether the household has access to clean water or has more than three incomes sources, and residence in the Red River Delta. In addition, living in a permanent house or in an urban area, per capita income and having two income sources have weak effects on the probability of attrition. While a joint Wald test for all these variables being significantly different from zero can be decisively rejected ($\chi^2(17)=58.4$), it is important to note that the pseudo R^2 statistics at the bottom of the table show that only around 4% of attrition are explained by the variables included in the probit.

Another commonly used test for whether attrition is random is the pooling test due to Becketti, Gould, Lillard and Welch (1988). This involves regressing per capita expenditures from the 2004 round of a survey on the same explanatory variables, an attrition dummy, and the attrition dummy interacted with the other explanatory variables. The logarithm of per capita expenditures are the appropriate outcome variable in this case because expenditure is the key variable used to classify

[18] Note that it is not possible to test for the randomness of attrition between the 2002 and 2004 waves of the VHLSS because the sample size of the VHLSS was reduced substantially between these years, and survey teams were instructed to choose three out of five potential panel households to re-interview in most communes.

[19] Note that there are nine households in the panel with missing information on house type. This reduces the sample used in the attrition analysis to 4,661 households.

Table A1: Attrition Probit for 2004-06 VHLSS Panel

	Urban and Rural Areas		Rural Areas	
Ethnic minority	-0.111		-0.200	
Age of Head (log)	-0.013		0.177	
Age of Head Squared (centered)	0.888	***	1.031	***
Female head	0.091		0.096	
Household size(log)	0.003		-0.000	
Share of children	0.189		0.009	
Share of elderly	-0.092		-0.310	*
No schooling	omitted category			
Primary School	0.010		0.030	
Lower Secondary School	-0.049		-0.128	
Upper Secondary School	-0.009		-0.103	
Post-Secondary Education	0.038		-0.117	
Value of Productive Assets (log)	-0.006		0.006	
Long-term land area (log)	0.009		0.003	
Urban	0.143	**		
Mains electricity	-0.144		-0.096	
Clean water	-0.202	***	-0.235	***
Northern Uplands	omitted category			
Red River Delta	0.273	***	0.355	***
North Central Coast	-0.076		-0.065	
South Central Coast	-0.182		-0.134	
Central Highlands	0.084		0.066	
South East	0.153		0.077	
Mekong River Delta	0.048		0.059	
Log of expenditure per capita	0.134	**	-0.008	
Interpreter needed	0.230		0.256	
Permanent house (not shared)	omitted category			
Permanent house (shared)	-0.242	*	-0.457	**
Semi-permanent house	-0.096		-0.232	
Temporary house	-0.037		-0.162	
Interview month: May	omitted category			
Interview month: June	-0.117		-0.084	
Interview month: July	0.114		0.174	
Interview month: August	-0.129		-0.244	
Interview month: September	-0.056		-0.067	
Interview month: October	0.023		0.024	
Interview month: November	-0.013		0.183	
One income source	-0.118		-0.243	
Two income sources	-0.199	*	-0.245	
Three income sources	-0.344	***	-0.426	***
Four income sources	-0.352	***	-0.443	***
Five income sources	-0.482	***	-0.555	***
Six income sources	-0.777	***	-0.801	***
Droughts in commune	0.148		0.162	
Storms in commune	0.232		0.232	
Floods in commune	-0.126		-0.163	
Constant	-1.965	**	-1.242	
Number of observations	4661		3510	
Pseudo R2	0.045		0.041	
Wald Chi2	135.152		98.332	
P-value	0.000		0.000	

Note: coefficients of probit model, p<0.1, ** p<0.05, *** p<0.01

households' poverty transition category and is also the dependent variable in the simultaneous quantile regressions. An F-test of the joint significance of the attrition dummy and the interactions is then conducted to determine whether the coefficients from the explanatory variables differ between households who are stay-in or attrit from the panel. In this case, the test statistic produced (F(35, 1556) = 1.12) cannot reject the null hypothesis that attrition from the panel is random.

Finally, inverse probability weights are computed for the expenditure model. To do this we first calculate the predicted probabilities from the unrestricted attrition probit in Table A1, and then re-estimate it excluding the auxiliary variables that predict attrition. After calculating the predicted probabilities from the restricted attrition probit, the inverse probability weights are calculated straightforwardly by taking the ratio of the restricted to unrestricted probabilities. The inverse probability weights produced in this way vary from 0.25 to 9.63 with a mean of 1.21 for rural and urban areas combined.[20] When applied to the poverty transition between for 2004-06, the inverse probability weights produce the following transition matrix:

Table A2: Poverty Transition Matrix 2004-05 with Attrition Weights

		2006	
2004		**Poor**	**Non-Poor**
	Poor	462	397
	Non Poor	178	3150

Which may be compared to the poverty transition matrix calculated without attrition weights in Table A3:

Table A2: Poverty Transition Matrix 2004-05 without Attrition Weights

		2006	
2004		**Poor**	**Non-Poor**
	Poor	450	356
	Non Poor	170	3211

While Table A2 has a slightly higher number of households in the PP and NP categories than Table A3, with a slightly lower number of households in the other two categories, the discrepancy between the cell frequencies is not more than about 1%.

To sum-up, the two tests we have conducted on the randomness of attrition for the 2004-2006 VHLSS panel only provide limited evidence that attrition is non-random, and when we correct for attrition using inverse probability weights we find it has a very minor impact on poverty dynamics. The main text of the paper therefore analyses poverty dynamics in Vietnam without correcting for attrition bias.

[20] For rural areas alone, the inverse probability weights have the same range a slightly higher mean of 1.29.

Appendix 2: Total Effects (%) from the Nested Logit Model

Variable\Outcome	PPP	PPN	PNP	PNN	NPP	NPN	NNP	NNN
Ethnic Minorities	7.209	5.089	0.549	-1.415	0.695	0.042	-0.039	-12.131
Household size (log)	7.052	7.184	1.144	13.430	-0.852	-2.990	0.904	-25.872
Share of children	10.698	5.407	3.777	7.737	4.190	5.384	-10.291	-26.901
Share of elder	-0.075	13.292	3.721	15.282	2.618	-1.420	-0.339	-33.078
Female Head	1.912	-1.369	0.203	4.019	-0.477	1.738	-2.412	-3.615
Age of Head	-0.044	-0.216	-0.055	-0.265	-0.019	-0.049	-0.078	0.725
Primary School	-5.838	-0.846	0.311	-3.084	-1.917	-0.093	-1.944	13.409
Lower/Upper secondary school	-10.094	-4.009	0.286	1.403	-1.461	-0.820	-3.958	18.654
Value of Productive assets (log)	-1.750	-0.942	-0.698	-2.075	-0.189	-0.347	-0.067	6.071
Long-term land area (log)	0.283	-0.394	-0.074	0.366	0.018	0.410	-0.305	-0.304
Mains electricity	-7.641	-2.070	-0.264	0.002	-0.082	0.892	0.606	8.555
Clean Water	-3.103	-1.441	-1.208	-4.323	-0.566	-0.190	-0.701	11.531
Red River Delta	-0.614	8.379	-3.097	0.821	0.888	-2.256	0.638	-4.758
North Central Coast	9.158	4.742	0.263	-1.089	1.748	-7.652	-0.425	-6.746
South Central Coast	-1.679	2.715	-6.097	-0.746	2.157	-4.369	1.879	6.142
Central Highlands	-1.633	5.323	-3.144	6.249	-0.551	-4.081	-1.484	-0.679
South East	-14.156	-1.271	-2.827	1.741	-0.097	-4.119	1.152	19.578
Mekong River Delta	-9.997	1.856	-3.611	-7.733	-5.584	-3.764	-0.608	29.445

Note: Total marginal effects over all outcome equations