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# Analysing Chronic Poverty in Rural Cambodia: Evidence from Panel Data

TONG Kimsun

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*Responsibility for ideas, facts and opinions presented in this research paper rests solely with the authors. Their opinions and interpretations do not necessarily reflect the views of CDRI.*

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# Acronyms

| | |
|---|---|
| EADN | East Asian Development Network |
| MDGs | Millennium Development Goals |
| CSES | Cambodia Socio-economic Survey |
| CDRI | Cambodia Development Resource Institute |
| CPI | Consumer Price Index |
| PCA | Principal Component Analysis |

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## Abstract

This paper uses four years of panel data on 793 households collected during 2001–11 to measure chronic poverty in rural Cambodia and to identify its key determinants. A household wealth index—a proxy for long-term welfare—constructed by polychoric principal component analysis is used as welfare indicator. Both ordered logistic and multinomial logistic regression models are adopted to identify the causes of chronic and transient poverty by focusing particularly on five explanatory variables: agricultural land and livestock, demography, human capital, social capital and natural resources. To ensure the robustness of our results, two poverty lines are applied: 40th percentile and 60th percentile of the wealth index. The findings indicate that households experiencing chronic poverty account for only 4–10 percent of the total sample, while transient poverty affects 40–52 percent. Among the total poor households, transient poverty is 84–90 percent. Our ordered logistic regression reveals that the composition of household size, the education of the household head, social capital (i.e. connection with three or more people in the community), agricultural land and livestock are likely to be the most important factors that help the chronically poor to move into better off groups. Common property resources seem to have an opposite effect. Multinomial logistic regression results reconfirm that household composition, particularly the number of children aged 7–14 years and females aged 15–64 years, the education of the household head, agricultural land and livestock play an important role in reducing the likelihood of chronic poverty. It appears that education, agricultural land and livestock would also help to reduce transient poverty. Social capital is likely to be strongly correlated with both transient poverty and being never poor.

# 1

# Introduction

Poverty analysis in Cambodia is based primarily on cross-sectional household survey data that provide estimates of the aggregate and static poverty rates. Poverty reduction strategies and policies drawn from these studies are likely to address poverty in the long rather than the short term. Estimates of poverty over time provide a richer picture. As discussed widely in the literature (Haddad & Ahmed 2003; Jalan & Ravallion 2000; Kedir & McKay 2003), poverty over the long term is called "chronic poverty" and poverty resulting from income shocks that is likely to be temporary is called "transient poverty". This reflects the vulnerability of the non-poor.

Between 2007 and 2010, it is possible that the poverty rate in Cambodia increased by 1–4 percent (World Bank 2009; 2010a). Tong *et al.* (2009) also found that poverty increased between 2008 and 2009, partly because of a World Bank-predicted economic contraction of 2 percent in 2009 (World Bank 2010b). The global financial and economic crisis posed a great challenge to achieving the 2015 Millennium Development Goals (MDGs), particularly the goal of eradicating extreme poverty and hunger. In 2007, the poverty rate was 30.1 percent and, taking into account rates of poverty decline of 1 percent per year and the increase in poverty owing to the economic crisis, the achievement of this MDG is in doubt. This implies that current poverty reduction policies are failing to protect vulnerable households from falling into poverty and to address chronic poverty efficiently. It is widely noted in the literature that different policies have different implications for transient and chronic poverty (Jalan & Ravallion 2000). Improving the capacity of the poor to earn income, for example through schooling or by increasing opportunities in the economy, is thought to be more appropriate for reducing chronic poverty in the long run. In the short term, chronic poverty can be alleviated through social transfers. The chronically poor would also need more opportunities, protection and support. While transient poverty can be alleviated by mechanisms that help families smooth their consumption over time—such as formal or informal insurance, or loan or income stabilisation programmes—these policies also have implications for chronic poverty.

In other developing countries, the study of poverty dynamics has recently increased (Jalan & Ravallion 2000; Baulch & Hoddinott 2000; Kedir & Mckay 2003; Haddad & Ahmed 2003). However, a rigorous analysis of poverty dynamics in Cambodia has never been undertaken, mainly due to a lack of panel data. This study aims to address this limitation by using seven rounds of unique panel data concerning 793 households interviewed in 2001, 2004/05, 2008 and 2011 in nine rural villages (two rounds in each specified year except 2011). The main objectives of this study are: (1) to deepen the understanding of poverty dynamics, particularly the nature of chronic poverty and the processes that underpin persistent poverty, (2) to increase the attention that researchers and policy makers give to chronic poverty and its reduction and (3) to contribute to the knowledge about policies and methodologies to assist the chronically poor. The results could also help policy makers to launch evidence-based and effective poverty reduction strategies. The paper is organised as follows: Section 2 reviews a selection of previous studies. Section 3 describes the characteristics of the data. Section 4 explains how to construct the wealth index and measure poverty. Section 5 provides descriptive analysis and econometric results. Section 6 presents a conclusion and discussion on policy implications.

# 2

# Literature Review

Over the past decade, poverty studies in Cambodia have been increasing. The best known is the Cambodia Poverty Profile, which provides poverty estimates using the nationally representative cross-sectional Cambodia Socio-Economic Surveys (CSES) in 1993–94, 1997, 1999, 2003–04 and 2007. The latest report shows that the poverty headcount rate fell from 47 percent to 30 percent between 1993–94 and 2007 (World Bank 2009). However, it fails to show what happened to individual households over time—the dynamics of poverty: why some households move out of poverty, some fall into it and some remain there.

The Moving Out of Poverty study by Fitzgerald and So (2007) used two-period panel data and employed mixed methods (qualitative and quantitative). It categorised households into very poor, moderately poor (between 20 percent above and below the poverty line) and well-off. It found that 52 percent of households did not change their status between 2001 and 2004. About 14 percent of the very poor in 2001 managed to move to moderately poor or well off. Approximately 7 percent of the moderately poor became very poor, while 12 percent became well off. Some 15 percent of the well off fell to moderately or very poor. The study's descriptive analysis might have ignored other useful economic information concerning simultaneous effects on the key determinants of the defined poverty measure. Therefore, the analysis led to inconclusive results.

Tong (2011), for the first time in Cambodia, attempted to analyse the key determinants of chronic and transient poverty using an econometric approach from three-period panel data of 827 households.[1] Welfare was measured by both real consumption per capita and a wealth index (which was estimated by principal component analysis). Households that had wealth index below the 39th percentile of the wealth index (cut-off line) in all three years were defined as chronic poor, and the transient poor as those with wealth index below the cut-off line for at least one period.[2] The study found that the transient poor accounted for more than 75 percent of the total poor households.

That study also found that determinants of chronic poverty differ from those of transient poverty. Household size, particularly the number of males aged 15–64 years, household head characteristics such as education and occupation, agricultural land and livestock are important factors in chronic poverty but are not significant determinants of transient poverty. Only non-land assets are negatively associated with chronic and transient poverty. The study noted further that the asset approach provided a more reasonable result than a consumption approach on the key determinants of chronic and transient poverty.

There is a significant literature on poverty dynamics in other developing countries. Kedir and Mckay (2003) examined chronic poverty in urban Ethiopia using panel data on 1500 households collected during 1994–97. Defining the chronically poor as households with real total expenditure per adult per month below the poverty line in all three years and the transient poor as those below the line in one or two of the years, they found more transiently poor than chronically poor households. Using multinomial logit regression, they argued that

1 Tong (2011) used the same panel data set as Fitzgerald and So (2007) for the period 2001–04.

2 With the same concept, household which had real consumption per capita below the defined poverty line in all three years were defined as chronic poor, and the transient poor as those with real consumption per capita below the poverty for at least one period.

chronic poverty was positively associated with household composition, unemployment, lack of asset ownership, casual employment, lack of education, ethnicity, the age of household head and female head.

Haddad and Ahmed (2003) applied quintile regression to two-period panel data of 347 households in Egypt to identify the causes of chronic and transient poverty. They categorised households that had real consumption per capita below the poverty line in both periods as chronic poor, and households below the poverty line in one of the two years as transient poor. They used quintile regression to determine the causes of chronic and transient poverty and found that household size, number of members aged less than 15 years, age of household head, livestock assets, agricultural land, education of household members and employment status affect chronic poverty. Only members aged over 60 and agricultural land increased the likelihood of transient poverty.

Jalan and Ravallion (2000) used data of 5854 households in south-west rural China over 1985–90 to test whether transient poverty is determined similarly to chronic poverty. They defined chronic poverty as having time-mean consumption below the poverty line. Households experienced transient poverty if they had been observed to be poor at least once in the available data and had time-mean consumption above the poverty line. Using quintile regression, they found that age of household head, physical wealth and cultivated land are the most important variables for transient poverty. Demographic characteristics (household size, ages of the children), education, household members' employment status, physical wealth and cultivated land seemed to be more important for chronic poverty.

Although the determinants of chronic and transient poverty differ slightly among countries, it is commonly noted that health and education services, asset redistribution and infrastructure development are likely to reduce chronic poverty. Unemployment and health insurance, income stabilisation programmes, micro-credit and temporary social safety nets are important when poverty is transient. To alleviate poverty, there is also a need to know the location of the two types of poverty.

# 3

# Data and Methods

This study uses CDRI's seven-round panel data collected in 2001, 2004/05, 2008 and 2011. CDRI first collected significant information about the three villages in 1996–97 for a food security study. The results were published in Murshid (1998). However, the data were poorly recorded and are unlikely to be of much use for other studies. In order to examine the challenges of rural livelihood, in 2001 six additional villages were included in the sample. The nine villages were selected to represent livelihoods and coping strategies in four agro-climatic regions. The researchers chose the villages by initially consulting with provincial and district departments of agricultural and planning officials and briefing them on the study's requirements. The officials then helped to identify communes and villages that might meet the selection criteria. After selecting two or three villages in each region that met the criteria, the research team made personal visits to these villages.

Table 1: Characteristics of Survey Villages

| Village | District | Province | Basic selection criteria |
|---|---|---|---|
| **Tonle Sap plains** | | | |
| Andoung Trach | Sangkae | Battambang | Substantial amount of wet season rice grown in flooded Tonle Sap, high emigration |
| Krasang | Thma Koul | Battambang | Substantial amount of wet season rice grown in flooded Tonle Sap, high resettlement of returnees from border camps |
| Khsach Chi Ros | Kompong Svay | Kompong Thom | Floating rice plus substantial fishing in flooded Tonle Sap |
| **Mekong plains** | | | |
| Prek Kmeng | Lvea Aem | Kandal | Dry season rice and substantial fishing |
| Ba Baong | Peam Ro | Prey Veng | Substantial dry season rice |
| **Plateau** | | | |
| Kanhchor | Chhloung | Kratie | Dry season rice and substantial forest dependence |
| Dang Kdar | Santuk | Kompong Thom | Low yield wet season rice and substantial forest dependence |
| Trapeang Prei | Odongk | Kompong Speu | Low yield wet season rice and dependence on hiring out labour |
| **Coastal** | | | |
| Kompong Tnaot | Kampot | Kampot | Low yield wet season rice, coastal fishing and salt mining |

Source: Chan & Acharya (2002)

The villages were finally chosen based on a field assessment of which would best fit the criteria (Chan & Acharya 2002). CDRI revisited the same households in those nine villages for the *Moving Out of Poverty* study in 2004/05, the Poverty Dynamics Study in 2008 and the Global Financial Crisis and Vulnerability project in 2011.

Tables 1 and 2 present the key characteristics of each village and village sample size in 2001. Approximately 21 percent of the original 1005 households in the 2001 sample dropped out of the panel. The most common reason for attrition was migration. The estimated probit model showed that attrition was a more common occurrence for households in Krasang, Andoung Trach, Khsach Chi Ros, Dang Kdar and Trapeang Prei, for households whose heads had less education, for households with fewer children aged 7–14, fewer livestock and less agricultural land (Appendix 1).

Table 2: Sample Size

| | Number of households in 2001 | Sample size in 2001 | Final sample in 2011 | Dropped out | % Attrition |
|---|---|---|---|---|---|
| **Tonle Sap** | | | | | |
| Andoung Trach | 196 | 85 | 57 | 28 | 32.9 |
| Krasang | 228 | 120 | 83 | 37 | 30.8 |
| Khsach Chi Ros | 305 | 120 | 84 | 36 | 30.0 |
| **Mekong plain** | | | | | |
| Prek Kmeng | 339 | 120 | 105 | 15 | 12.5 |
| Ba Baong | 536 | 127 | 108 | 19 | 14.9 |
| **Plateau** | | | | | |
| Kanhchor | 278 | 120 | 104 | 16 | 13.3 |
| Dang Kdar | 306 | 125 | 97 | 28 | 22.4 |
| Trapeang Prei | 68 | 68 | 47 | 21 | 30.8 |
| **Coastal** | | | | | |
| Kompong Tnaot | 348 | 120 | 108 | 12 | 10.0 |
| All villages | 2,604 | 1,005 | 793 | 212 | 21.1 |

Source: CDRI rural household survey

The information collected in each round included household demographics, housing conditions, land ownership and transactions, credit markets, food and non-food consumption, non-land assets, livestock ownership, household income, agricultural production, production expenditure and wages and self-employment.

Tong (2011) notes that determining the change of the survey data for 2001, 2004/05 and 2008 has proven problematic. Inconsistencies have been introduced over time, and these are hard to remedy at this stage. The meaning of some questions has changed, whereas others have been combined or split to meet the purpose of the study in each round. Interviewer training and allocation could also impact on the measurement of household income and expenditure. In addition, the comparison of monetary indicators is only as valid as the deflator used. In this regard, CDRI has collected the prices of 106 food and non-food items to construct a village CPI since 2004/05. However, lack of data on commodity prices in 2001 requires assumptions regarding village inflation rates between 2001 and 2004/05. Fitzgerald and So (2007) simply assumed the inflation rate across all villages between 2001 and 2004/05 was around 18 percent—which is unlikely to be true for villages located in different regions. Tong (2011) also assumed that the inflation rate was approximately 17 percent. The quality of commodity price data is also poor. Therefore, real income and consumption data derived from the estimated village CPI have serious drawbacks.

Asking people about their durable assets, access to utilities and household characteristics often provides more accurate information than do income and expenditure because these items have been accumulated over time and often have less likelihood of measurement errors.[3] In this paper, we will measure transient and chronic poverty based on the combination of durable assets, utilities and household characteristics as our welfare indicators. We will construct an asset or wealth index to incorporate a number of such proxies into a single variable. The most popular method is to assign weights to observed variables and sum them. In the early 20th century, Pearson (1901) and Hotelling (1933) developed principal component analysis (PCA) for the similar purpose of aggregating information (cited in Kolenikov & Angeles 2004).

One of the most influential poverty analyses using PCA to construct a wealth index was that by Filmer and Pritchett (1998). They suggested aggregating several binary asset ownership variables into a single dimension. As noted by Kolenikov & Angeles (2004), PCA is suitable only for continuous data because it was developed for samples from multivariate normal distribution and most of the theoretical results were derived under the normality assumption. However, an alternative approach to the analysis of discrete data, polychoric PCA, was well developed by Pearson and Pearson (1922) and Olsson (1979). Polychoric PCA uses maximum likelihood, similar to an ordered probit regression, to estimate the correlation between the unobserved normally distributed continuous variables from their discrete version, and has a number of advantages over PCA.

Polychoric PCA coefficients are more accurate than those estimated with PCA because the ordering of the categories is taken into account. For example, the quality of house construction or different educational level of the household head might be recorded on a 1-4 or 1-5 scale. Binary data, i.e. variables that can take one of only two values, such as gender or ownership of a car, can be viewed as a special case of ordinal data. Kolenikov and Angeles (2004) demonstrate that Filmer and Prichett's (1998) simple procedure of splitting ordinal data into binary variables introduces a large amount of distortion into the correlation matrix because the variables are automatically perfectly negatively correlated with each other. In addition, the ordinal information is lost because PCA treats every variable the same. Polychoric PCA solves these problems by assigning each value of a discrete variable and ensuring that the coefficients of an ordinal variable follow the order of its values. It will be used for this study.

Yaqub (2000) notes that there are two approaches to measuring chronic and transient poverty from panel data: "spell" and "component". In the spell approach (Baulch & McCulloch 1998; Gaiha & Deolalikar 1993), the chronically poor are identified by the number or length of poverty spells they experience—so that all poor households are classified as either chronic or transient. The component approach defines transient poverty as the contribution of consumption variability over time to the expected consumption poverty, with what remains being the measure of chronic poverty (Jalan & Ravallion 1998). Building on Baulch and McCulloch (1998) and Gaiha and Deolalikar (1993), we propose a five-tier system for the study:

- always poor: wealth index in each period below the poverty line;
- one period poor: wealth index falls below the poverty line in one of the years;
- two period poor: wealth index falls below the poverty line in two of the years;

3 However, non-monetary data may fail to describe short-term shocks to households.

- three period poor: wealth index falls below the poverty line in three of the years;
- never poor: wealth index in all periods above the poverty line.

These categories can be further aggregated into the chronically poor (always poor), the transiently poor (one, two and three period poor) and the non-poor. We will use this approach to identify chronic and transient poverty.

We use a quantitative approach (multinomial logistic regression model and ordered logistic regression model) to identify the factors explaining total, transient and chronic household poverty, with a special focus on five factors: wealth, demography, human capital, social capital and natural resources. The negative relationship between household wealth and poverty has been discussed widely in the literature (World Bank 1996; Jalan & Ravallion 1998). In particular, wealthier households are less likely to experience chronic poverty since they are capable of smoothing consumption over time even in the absence of large amounts of credit. In addition, they are in a better position to maintain their consumption against their assets, especially after shocks (Chronic Poverty Research Centre 2004).

Other things being equal, increased household size i.e. dependency ratio is likely to place extra burdens on a household's assets and resources and would generally be expected to be positively related to chronic poverty (McCulloch & Baulch 2000; Jalan & Ravallion 1998). Hence, household wealth and demographic factors i.e. characteristics of household size can be expected to be important determinants of chronic poverty. But demographic factors may hide complexity in some cases. For example, in peasant agriculture, large household size may be a benefit, enabling the family to overcome labour shortages at critical periods. The positive relationship between education and income is also well established. Therefore, investment in education is seen as a central poverty reduction strategy in many countries. However, it is not clear whether education is a significant determinant of transient poverty. Jalan and Ravallion (1998), for example, report that educational levels of household members do not have a statistically significant association with transient poverty in China. Unlike wealth, a household's human capital is one of the potential determinants of poverty that can be influenced significantly by government intervention.

Politics and the availability and accessibility of the natural resources have also been identified as causes of poverty in the literature (Hulme *et al.* 2001). Bad governance can lead to bad policies, which create a discouraging environment for saving, investment, risk-taking and employment creation, and it is often associated with political instability, repression and violent conflict (Hulme & Shepherd 2003). The poor depend heavily on common property resources for both productive inputs and consumption goods. Cavendish (1999) reveals that environmental resources are higher than cash income (non-environmental income) in rural Zimbabwe; in terms of budget share, these account for 35 percent of total income—just less than that of the largest item i.e. subsistence consumption. But we are not aware of any published studies that focus on a specific set of these factors and examine the ways they interact to explain the incidence and nature of chronic poverty in Cambodia.

# 4

# Construction of the Wealth Index and Measuring Poverty

The wealth index is estimated from the selected variables of the panel data. Because the questionnaire was revised in each round, only variables collected in all rounds and capturing the same meaning are included. Table 3 presents these variables with the categories for each variable and their weights. These variables can be divided into ownership of durable assets, access to utilities and housing structure.

The estimated weight rises with the possession of durable assets and increasing access to utilities and quality of housing. For example, the weight of having no radio is negative while that of having a radio is positive. The household index score is a welfare measurement. However, the index is not adjusted for household size[4] because polychoric PCA (or PCA) techniques used to calculate the asset indices do not have units and would therefore be unsuitable for interpreting variables on a per capita basis.

To look into the dynamic of living standards, it is crucial to have an absolute poverty line. Tong (2011) used the poverty rate estimated by consumption data with the national survey (CSES 2003/04) as the benchmark for poverty. But poverty analysis is very sensitive to changes in the poverty line. Hence, we choose two poverty lines for this study: the 40th percentile, which is in line with the national rural poverty rate in 2003/04, and a higher line set at the 60th percentile because some regions have a higher poverty rate than the national level and wealth index does not discriminate well at very low level.

Table 3: Variables and Weights Obtained from Polychoric PCA

| Variable | Categories | |
|---|---|---|
| Radio | Does not own a radio | -0.094 |
| | Owns a radio | 0.198 |
| TV | Does not own a TV | -0.245 |
| | Owns a TV | 0.235 |
| Bicycle | Does not own a bicycle | -0.332 |
| | Owns a bicycle | 0.178 |
| Motor-cycle | Does not own a motorcycle | -0.199 |
| | Owns a motorcycle | 0.446 |
| Animal cart | Does not own an animal cart | -0.078 |
| | Owns an animal cart | 0.224 |
| Sewing machine | Does not own a sewing machine | -0.051 |
| | Owns a sewing machine | 0.558 |
| Boat | Does not own a boat | 0.022 |
| | Owns a boat | -0.023 |
| Plough/harrow | Does not own a plough/harrow | -0.082 |
| | Owns a plough/harrow | 0.140 |

4 Larger households tend to have more people working and generate more income than smaller households. This implies that larger households may have advantage in accumulating assets so that they look wealthier, but those assets have to be shared among a greater number of people (Moser & Felton 2009).

| | | |
|---|---|---|
| Water pump | Does not own a water pump | -0.098 |
| | Owns a water pump | 0.364 |
| Rice mill | Does not own a rice mill | -0.035 |
| | Owns a rice mill | 0.727 |
| House | Thatch house | -0.400 |
| | Wooden house (tin roof) | -0.030 |
| | Wooden house (tiled roof) | 0.343 |
| | Concrete | 0.955 |
| Drinking water | Other | -0.026 |
| | River/pond/steam | -0.004 |
| | Protected dug well | 0.010 |
| | Piped in dwelling/tubed-piped well | 0.019 |
| Toilet | Does not own a toilet | -0.094 |
| | Owns a toilet | 0.547 |
| Cooking fuel | Firewood collected | -0.037 |
| | Firewood bought | 0.397 |
| | Charcoal | 0.541 |
| | Gas | 0.692 |

Note: Inverse probability weight is applied.
Source: CDRI rural household survey

# 5

# Descriptive Analysis and Empirical Results

The national poverty rate, estimated by consumption, declined from 47 percent in 1993/94 to 30 percent in 2007—an average of about 1 percent per year (World Bank 2009). The kernel density distribution for a wealth index constructed by polychoric PCA for four rounds at the selected nine villages shows a similar trend. The distribution of the wealth index in 2001 and 2004 was highly skewed to the right (indicating a small number of non-poor) but roughly normally distributed in 2008 and 2011 (Figure 1). The wealth index distribution has gradually shifted to the right—implying the improvement of welfare.

Figure 1: Wealth Index Density Estimates


Note: Inverse probability weight is applied.
Source: CDRI rural household survey

Using the 40th percentile of the asset index as the poverty line, we find that the proportion of poor households declined significantly over these periods, from 36.7 percent in 2001 to 23 percent in 2004, to 9.8 percent in 2008 and 9.3 percent in 2011. Fifty-six percent of the households were never poor, and only 4 percent were poor in all rounds (Appendix 3). When a higher poverty line (60th percentile) is adopted, the proportion of poor households declined at a slower pace except in 2011, when it dropped faster. Never poor households are reduced to 37.3 percent, while always poor households increase to 10.2 percent. In either case, transient poverty accounts for more than 84 percent of the total poor households. This has reconfirmed the study by Tong (2011) that tackling rural poverty in Cambodia requires a clear understanding of transient poverty.

Table 4: Household Demographics (at Initial Period) and Poverty Status

| | Always poor | 3 period poor | 2 period poor | 1 period poor | Never poor | Total |
|---|---|---|---|---|---|---|
| **40th percentile poverty line** | | | | | | |
| HH size | 4.66 | 5.10 | 6.00 | 6.04 | 6.39 | 6.13 |
| Children aged 0-6 | 1.06 | 0.85 | 1.08 | 0.99 | 0.90 | 0.95 |
| Children aged 7-14 | 0.91 | 1.52 | 1.73 | 1.53 | 1.56 | 1.54 |
| Males aged 15-64 | 1.13 | 1.09 | 1.31 | 1.49 | 1.86 | 1.64 |
| Females aged 15-64 | 1.43 | 1.53 | 1.69 | 1.79 | 1.77 | 1.74 |
| Adults over 64 | 0.13 | 0.12 | 0.19 | 0.23 | 0.31 | 0.26 |
| HH head gender (1=male) | 0.64 | 0.63 | 0.79 | 0.84 | 0.84 | 0.81 |
| HH head age | 41.63 | 43.42 | 42.13 | 43.90 | 44.22 | 43.74 |
| HH head marital (1=married) | 0.65 | 0.71 | 0.85 | 0.84 | 0.89 | 0.86 |
| HH head education | 2.20 | 3.04 | 3.34 | 3.81 | 4.23 | 3.88 |
| HH head occupation (1=agriculture) | 0.44 | 0.51 | 0.54 | 0.50 | 0.45 | 0.48 |
| Social capital (1=1-2 persons) | 0.36 | 0.39 | 0.48 | 0.47 | 0.40 | 0.42 |
| Social capital (1=3-4 persons) | 0.14 | 0.16 | 0.14 | 0.16 | 0.26 | 0.21 |
| Social capital (1=more than 5 persons) | 0.05 | 0.00 | 0.10 | 0.10 | 0.14 | 0.11 |
| Agricultural land per capita (ha) | 0.09 | 0.15 | 0.21 | 0.18 | 0.29 | 0.24 |
| Non-land assets (‘0000 riels) | 3.51 | 3.99 | 4.85 | 5.32 | 20.21 | 13.48 |
| Livestock per capita (‘0000 riels) | 4.47 | 12.51 | 13.28 | 15.86 | 23.86 | 19.40 |
| Common property resources (1=access) | 0.89 | 0.78 | 0.87 | 0.91 | 0.83 | 0.85 |
| Health expenditure (‘0000 riels) | 22.64 | 43.13 | 33.55 | 32.44 | 32.21 | 32.47 |
| **60th percentile poverty line** | | | | | | |
| HH size | 5.05 | 5.79 | 5.89 | 6.22 | 6.58 | 6.13 |
| Children aged 0-6 | 0.98 | 1.06 | 0.99 | 1.01 | 0.84 | 0.95 |
| Children aged 7-14 | 1.18 | 1.40 | 1.66 | 1.61 | 1.59 | 1.54 |
| Males aged 15-64 | 1.11 | 1.34 | 1.42 | 1.64 | 1.99 | 1.64 |
| Females aged 15-64 | 1.67 | 1.81 | 1.55 | 1.73 | 1.83 | 1.74 |
| Adults over 64 | 0.11 | 0.19 | 0.27 | 0.24 | 0.32 | 0.26 |
| HH head gender (1=male) | 0.63 | 0.79 | 0.83 | 0.86 | 0.84 | 0.81 |
| HH head age | 43.56 | 43.77 | 42.60 | 42.99 | 44.81 | 43.74 |
| HH head marital (1=married) | 0.67 | 0.83 | 0.85 | 0.87 | 0.91 | 0.86 |
| HH head education | 2.40 | 3.21 | 4.05 | 3.64 | 4.55 | 3.88 |
| HH head occupation (1=agriculture) | 0.44 | 0.54 | 0.55 | 0.52 | 0.41 | 0.48 |
| Social capital (1=1-2 persons) | 0.46 | 0.42 | 0.51 | 0.39 | 0.39 | 0.42 |
| Social capital (1=3-4 persons) | 0.16 | 0.13 | 0.16 | 0.22 | 0.27 | 0.21 |
| Social capital (1=more than 5 persons) | 0.02 | 0.05 | 0.11 | 0.13 | 0.15 | 0.11 |
| Agricultural land per capita (ha) | 0.12 | 0.18 | 0.21 | 0.21 | 0.32 | 0.24 |
| Non-land assets (‘0000 riels) | 3.12 | 4.76 | 5.82 | 8.50 | 25.72 | 13.48 |
| Livestock per capita (‘0000 riels) | 7.19 | 15.46 | 18.01 | 18.60 | 25.10 | 19.40 |
| Common property resources (1=access) | 0.84 | 0.95 | 0.86 | 0.88 | 0.81 | 0.85 |
| Health expenditure (‘0000 riels) | 30.17 | 40.16 | 27.85 | 36.72 | 30.35 | 32.47 |

Note: Inverse probability weight is applied.
Source: Calculated from CDRI rural household survey

Among the nine selected villages, Khsach Chi Ros has the largest proportion of always poor households, followed by Dang Kdar, regardless of poverty line. Transient poverty is extremely high in Khsach Chi Ros (55 percent of the sample), Prek Kmeng (51 percent) and Kompong Tnaot (42 percent) if the 40th percentile line is applied. The figures and ordering are different if the higher poverty line is adopted: Andoung Trach (65 percent), Khsach Chi Ros (61 percent) and Prek Kmeng (59 percent). However, it is obvious that different poverty statuses persist across Cambodia. This makes it essential to know the whereabouts of the location of chronic and transient poverty at national level as it would affect the targeting of anti-poverty policies.

Table 4 describes household characteristics in the initial period (2001). Always poor households are often associated with smaller household size, more children aged 0-6 years and fewer adults aged 15–64 than never poor households. The head of always poor households is more likely to be younger, less educated, female and single than that of never poor households. Always poor households have the least agricultural land, non-land assets and livestock. They are less connected with their community than other households.

For "spell" and "component" poverty measurement, we use an ordered logistic regression model and multinomial logistic regression model to examine the factors affecting the likelihood of a household being in either of the poverty groups. The explanatory variables are human capital, land, physical assets, social capital, common property resource accessibility and health shocks. The human capital variables are the number of children aged 0–6; adults aged over 64; adults aged 15–64; and the age, education, gender, main economic activity and marital status of the household head. Physical assets are both livestock and non-land assets. Social capital is defined as the number of people beyond close relatives who are willing and able to lend money (enough to cover consumption for the whole family for one week) on short notice. Common property resource accessibility comprises access to forests, rivers, lakes and sea. Health shock refers to an expenditure on health. We also include village dummies.

The dependent variable for ordered logistic regression takes the value 0, 1, 2, 3 and 4 for always poor, three period poor, two period poor, one period poor and never poor. For multinomial logistic regression, the dependent variable takes the value of 0, 1 and 2 for chronically poor, transiently poor and never poor. Tables 5 and 6 report the estimated coefficient (ordered logistic model), marginal effect (multinomial logistic model) and their statistical significance for all poverty measures.

The empirical analysis shows (Table 5) that an increased number of males and females aged 15–64 years, adults over 64 years, household head education, agricultural land and livestock decrease the probability of being always poor. Households which are connected with three or more people in the community are strongly associated with the likelihood of being poor for one period or never poor. However, we also find that the number of children aged 0-6 and household head characteristics such as main occupation in agriculture, marital status and gender are unlikely to decrease or increase the probability of being always poor.

Table 5: Ordered Logistic Estimation of Determinants of Poverty

| | 40th percentile poverty line | 60th percentile poverty line |
|---|---|---|
| Children aged 0-6 | -0.027 | -0.074 |
| Children aged 7-14 | 0.096 | 0.180** |
| Males aged 15-64 | 0.592*** | 0.637*** |
| Females aged 15-64 | 0.215** | 0.248** |
| Adults over 64 | 0.719*** | 0.733*** |
| HH head gender (1=male) | 0.110 | -0.092 |
| HH head age | -0.011 | -0.018** |
| HH head marital (1=married) | 0.306 | 0.555 |
| HH head education | 0.119*** | 0.131*** |
| HH head occupation (1=agriculture) | -0.129 | -0.291 |
| Social capital (1=1-2 persons) | 0.102 | 0.021 |
| Social capital (1=3-4 persons) | 0.903*** | 0.869*** |
| Social capital (1=more than 5 persons) | 0.792** | 0.851*** |
| Agricultural land per capita (ha) | 0.129*** | 0.168*** |
| Livestock per capita (log) | 0.136*** | 0.126*** |
| Common property resource (1=access) | -0.507* | -0.659** |
| Health expenditure (log) | -0.003 | -0.010 |
| Village2 | 0.040 | -0.343 |
| Village3 | -0.959** | -1.076*** |
| Village4 | -2.472*** | -2.288*** |
| Village5 | -1.059*** | -1.181*** |
| Village6 | -0.977*** | -0.965*** |
| Village7 | -1.730*** | -1.416*** |
| Village8 | -0.631* | -0.438 |
| Village9 | -0.334 | -0.492 |
| Number of observations | 793 | 793 |
| LR Chi2 | 268.92 | 258.31 |
| Prob>chi2 | 0.000 | 0.000 |
| Pseudo R-squared | 0.1509 | 0.1425 |

* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent. Inverse probability weight is applied.
Source: Calculated from CDRI rural household survey

Table 6 confirms that the number of children aged 7–14 years and female adults aged 15–64, household head education, agricultural land and livestock tend to lower the likelihood of being always poor. Households connected with five or more people in the community are negatively associated with the likelihood of being chronically poor. The table also reveals that the number of males aged 15–64, adults aged over 64, household head education, agricultural land and social capital increase the probability of being never poor. In addition, households with access to common property resources have reduced probability of being never poor and increased likelihood of being transiently poor. It seems that the number of males aged 15–64, household head education, social capital, agricultural land and livestock contribute significantly to reducing transient poverty.

Although this study does not attempt to replicate the empirical results generated by Tong (2011), it provides some critical feedback on how the results have been improved by using polychoric PCA and inverse probability weights. Using the same econometric method, i.e. multinomial logistic regression, Tong (2011) found that education of the household head would increase the probability of being transiently poor—which was unlikely to be the case. This kind of unexpected result is not found in our analysis.

Table 6: Multinomial Logistic Estimation of Determinants of Poverty

| | 40% percentile poverty line | | | 60% percentile poverty line | | |
|---|---|---|---|---|---|---|
| | Chronic poor | Transient poor | Never poor | Chronic poor | Transient poor | Never poor |
| Children aged 0-6 | 0.000 | 0.007 | -0.008 | 0.005 | 0.010 | -0.015 |
| Children aged 7-14 | -0.014*** | 0.004 | 0.011 | -0.018** | -0.003 | 0.021 |
| Males aged 15-64 | -0.007 | -0.105*** | 0.111*** | -0.038*** | -0.072*** | 0.111*** |
| Females aged 15-64 | -0.015* | -0.015 | 0.031 | -0.013 | -0.043** | 0.057*** |
| Adults over 64 | -0.019 | -0.112** | 0.131*** | -0.088*** | -0.034 | 0.122*** |
| HH head gender (1=male) | -0.001 | 0.028 | -0.027 | -0.036 | 0.117 | -0.081 |
| HH head age | 0.000 | 0.002 | -0.003 | 0.002 | 0.002 | -0.003* |
| HH head marital (1=married) | -0.030* | -0.055 | 0.085 | 0.002 | -0.130 | 0.127 |
| HH head education | -0.005** | -0.013* | 0.019*** | -0.012*** | -0.012* | 0.024*** |
| HH head occupation (1=agriculture) | 0.003 | 0.014 | -0.016 | 0.009 | 0.049 | -0.058 |
| Social capital (1=1-2 persons) | -0.012 | 0.000 | 0.011 | 0.004 | -0.010 | 0.006 |
| Social capital (1=3-4 persons) | -0.023 | -0.143** | 0.166*** | -0.038 | -0.114** | 0.152*** |
| Social capital (1=more than 5 persons) | -0.013 | -0.124* | 0.137** | -0.141** | 0.005 | 0.136** |
| Agricultural land per capita (ha) | -0.005*** | -0.015* | 0.020** | -0.012*** | -0.017* | 0.030*** |
| Livestock per capita (log) | -0.004*** | -0.028*** | 0.033*** | -0.011*** | -0.011* | 0.022*** |
| Common property resource (1=access) | 0.034* | 0.115** | -0.149*** | -0.004 | 0.164** | -0.159*** |
| Health expenditure (log) | 0.000 | 0.003 | -0.003 | -0.002 | 0.004 | -0.002 |
| Village2 | 0.010 | 0.025 | -0.034 | 0.039 | 0.096 | -0.135 |
| Village3 | 0.056 | 0.184* | -0.240** | 0.083 | 0.155 | -0.238** |
| Village4 | 0.118*** | 0.358*** | -0.477*** | 0.168*** | 0.272*** | -0.440*** |
| Village5 | 0.071* | 0.133* | -0.205*** | 0.141*** | 0.036 | -0.177** |
| Village6 | 0.066* | 0.139* | -0.206*** | 0.120** | 0.023 | -0.143** |
| Village7 | 0.080** | 0.245*** | -0.325*** | 0.111** | 0.121 | -0.232*** |
| Village8 | 0.022 | 0.115 | -0.137*** | 0.046 | 0.028 | -0.074 |
| Village9 | -0.355 | 0.351*** | 0.003 | 0.089 | 0.036 | -0.125* |
| Number of observations | 793 | | | 793 | | |
| LR Chi2 | 2484.11 | | | 248.43 | | |
| Prob>chi2 | 0.0000 | | | 0.0000 | | |
| Pseudo R-squared | 0.2188 | | | 0.2174 | | |

* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent. Inverse probability weight is applied.
Source: Calculated from CDRI rural household survey

# 6

# Conclusion

Our analysis of poverty dynamics in nine villages in rural Cambodia using a wealth index constructed by polychoric principal component analysis has shown that households in the study villages, on average, experienced a significant improvement in the quality and quantity of their assets during 2001–11. One could conclude that poverty, as measured by household assets, declined over the study period. The study highlights that transient poverty remains high compared to chronic poverty—registering approximately 84 percent of the total poor households. This implies that unemployment and health insurance, income stabilisation programmes, micro-credit and temporary social safety nets are the most important policies to address poverty reduction. We used multinomial logit and ordered logit regression to analyse the determinants of chronically poor, transiently poor and never poor households, paying special attention to human capital, social capital, agricultural land, livestock and common property resources. In general, the findings suggest that the education of the household head, agricultural land, livestock and social capital play a critical role in reducing the likelihood of being always poor.

## Appendix 1: Attrition Bias

In a longitudinal study, it is common for some participants to drop out temporarily or permanently. If the drop-outs differ systematically from those who remain in the sample, the data set is no longer representative of the original sample. The result of the remaining sample may be seriously affected by attrition bias. However, if the attrition is not systematic—i.e. there are no unique characteristics among those who drop out—then there is no attrition bias, although the sample has decreased in size.

To verify differences between those who drop out and those who remain in the sample, a number of tests have been proposed, including attrition probits (Fitzgerald *et al.* 1998) and pooling tests (Becketti *et al.* 1988). Due to its simplicity, we follow the former approach.

Let variable $d_i = 1$ if $y_{i2}$ is not observed in period 2 and $d_i = 0$ otherwise. Suppose that $y_{i2}$ is not observed if the latent variable

$$d_i^* = \alpha X_{i1} + \beta Z_{i1} + \epsilon_i \geq 0 \qquad (1)$$

where $x_{i1}$ is a vector of potential variables that may explain or predict the attrition, $z_{i1}$ is additional instrumental variables that affect only attrition and $\epsilon_i$ is an error term.

Then the probability of attrition is a probit function given by

$$Prob(d_i = 1) = \emptyset(\alpha X_{i1}; \beta Z_{i1}) \qquad (2)$$

where $\emptyset(.)$ is the standard normal distribution function. A statistically significant coefficient for any of the variables indicates attrition bias. As shown in Table 7, four of the 22 variables in the attrition probit are statistically different from zero at 1 percent level, four variables at 5 percent level and one variable at 10 percent level. Those variables are agricultural land, livestock, the number of children aged 7-14, the education of household head and five village dummies.

Fitzgerald *et al.* (1988) and Wooldridge (2002) proposed a simple method known as inverse probability weights to correct for attrition bias. To estimate the inverse probability weights, equation (2) is re-specified as a probit model:

$$d_i = \alpha X_{i1} + \beta Z_{i1} + \epsilon_i \qquad (3)$$

Then a restricted version of the equation is re-estimated without additional instrumental variables $z_{i1}$:

$$d_i = \alpha X_{i1} + \vartheta_i \qquad (4)$$

The ratio of the predicted values from equation (4) and equation (3) give the inverse probability weights:

$$W_i = \frac{p^r}{p^u} \qquad (5)$$

This procedure gives more weight to households that have similar initial characteristics to households that subsequently drop out than to households with characteristics that are more likely to remain in the panel.

Table 7: Attrition Probit

| | Coefficients | Standard Error | Z | P>z |
|---|---|---|---|---|
| Agricultural land (log) | -0.059*** | 0.014 | -4.31 | 0.00 |
| Non-land assets (log) | -0.019 | 0.013 | -1.53 | 0.13 |
| Livestock (log) | -0.023** | 0.011 | -2.19 | 0.03 |
| Children aged 0-6 | 0.052 | 0.047 | 1.10 | 0.27 |
| Children aged 7-14 | -0.090** | 0.041 | -2.21 | 0.03 |
| Males aged 15-64 | -0.072 | 0.057 | -1.26 | 0.21 |
| Females aged 15-64 | -0.070 | 0.059 | -1.18 | 0.24 |
| Adults over 64 | -0.073 | 0.124 | -0.59 | 0.55 |
| HH head gender (1=male) | 0.318 | 0.218 | 1.46 | 0.14 |
| HH head age | 0.007 | 0.005 | 1.45 | 0.15 |
| HH head marital (1=married) | -0.196 | 0.215 | -0.91 | 0.36 |
| HH head education | -0.0316* | 0.019 | -1.70 | 0.09 |
| HH head occupation (1=agriculture) | -0.109 | 0.110 | -0.99 | 0.32 |
| Village1 | 0.558*** | 0.210 | 2.66 | 0.01 |
| Village2 | 0.721*** | 0.223 | 3.24 | 0.00 |
| Village3 | 0.655*** | 0.224 | 2.92 | 0.00 |
| Village4 | 0.900** | 0.205 | 4.40 | 0.00 |
| Village5 | 0.484** | 0.208 | 2.33 | 0.02 |
| Village7 | -0.060 | 0.231 | -0.26 | 0.80 |
| Village8 | -0.013 | 0.225 | -0.06 | 0.95 |
| Village9 | 0.298 | 0.215 | 1.38 | 0.17 |
| Constant | -0.325 | 0.320 | -1.01 | 0.31 |
| Number of observations | 1005 | | | |
| Wald chi2(21) | 108.81 | | | |
| Prob> chi2 | 0.0000 | | | |
| Pseudo R2 | 0.1215 | | | |

* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent. Robust t-statistic is reported.
Source: CDRI rural household survey

## Appendix 2: Poverty Rate 2001–11 (percentage of households)

| Village | 40 percentile poverty line | | | | 60 percentile poverty line | | | |
|---|---|---|---|---|---|---|---|---|
| | 2001 | 2004 | 2008 | 2011 | 2001 | 2004 | 2008 | 2011 |
| Krasang | 28.0 | 11.2 | 1.5 | 3.1 | 43.1 | 20.4 | 13.5 | 13.1 |
| Andoung Trach | 34.1 | 15.1 | 9.4 | 4.7 | 63.1 | 33.9 | 24.8 | 19.0 |
| Trapeang Prei | 29.5 | 23.7 | 4.9 | 9.4 | 58.7 | 40.9 | 9.5 | 11.8 |
| Khsach Chi Ros | 57.7 | 45.9 | 19.3 | 20.5 | 74.7 | 62.8 | 27.6 | 33.4 |
| Dang Kdar | 38.6 | 23.6 | 14.6 | 16.0 | 59.6 | 52.9 | 31.8 | 22.5 |
| Kompong Tnaot | 37.4 | 22.9 | 11.1 | 10.1 | 62.0 | 35.5 | 27.6 | 22.9 |
| Prek Kmeng | 49.7 | 35.8 | 13.9 | 14.0 | 61.2 | 54.3 | 25.0 | 19.9 |
| Kanhchor | 34.2 | 17.9 | 7.3 | 5.4 | 52.4 | 32.3 | 18.4 | 12.0 |
| Ba Baong | 16.5 | 9.2 | 3.8 | 2.5 | 35.2 | 20.0 | 11.6 | 9.8 |
| Total | 36.7 | 23.0 | 9.8 | 9.3 | 55.6 | 38.6 | 21.9 | 17.7 |

Note: Inverse probability weight is applied. Source: CDRI rural household survey

## Appendix 3: Poverty Status 2001–11 (percentage of households)

| | always poor | 3 period poor | 2 period poor | 1 period poor | never poor |
|---|---|---|---|---|---|
| **40th percentile poverty line** | | | | | |
| Krasang | 0.88 | 2.92 | 4.95 | 21.65 | 69.61 |
| Andoung Trach | 1.83 | 7.54 | 5.14 | 23.01 | 62.48 |
| Trapeang Prei | 3.58 | 3.40 | 8.71 | 25.57 | 58.74 |
| Khsach Chi Ros | 10.11 | 11.55 | 24.80 | 18.78 | 34.76 |
| Dang Kdar | 7.39 | 6.20 | 9.61 | 25.39 | 51.42 |
| Kompong Tnaot | 4.55 | 3.46 | 13.99 | 24.87 | 53.12 |
| Prek Kmeng | 6.60 | 7.72 | 20.42 | 23.01 | 42.25 |
| Kanhchor | 1.96 | 5.24 | 9.66 | 21.82 | 61.32 |
| Ba Baong | 0.00 | 2.00 | 4.99 | 15.96 | 77.05 |
| Total | 4.00 | 5.21 | 12.39 | 22.27 | 56.12 |
| **60th percentile poverty line** | | | | | |
| Krasang | 3.80 | 6.34 | 17.09 | 21.74 | 51.03 |
| Andoung Trach | 10.05 | 6.90 | 21.47 | 36.92 | 24.66 |
| Trapeang Prei | 9.51 | 2.33 | 22.34 | 31.22 | 34.60 |
| Khsach Chi Ros | 19.45 | 14.65 | 29.97 | 16.86 | 19.07 |
| Dang Kdar | 15.28 | 13.71 | 21.42 | 21.61 | 27.98 |
| Kompong Tnaot | 13.71 | 11.96 | 16.70 | 23.81 | 33.82 |
| Prek Kmeng | 11.18 | 14.00 | 28.11 | 17.37 | 29.34 |
| Kanhchor | 7.54 | 12.46 | 12.63 | 22.33 | 45.04 |
| Ba Baong | 4.62 | 4.70 | 7.34 | 29.33 | 54.00 |
| Total | 10.28 | 10.98 | 18.41 | 22.96 | 37.37 |

Note: Inverse probability weight is applied.
Source: CDRI rural household survey

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