Determinants of Rural Poverty in Cambodia

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Abstract:

Despite of much progress made regarding poverty reduction during the past poverty remain pervasive in Cambodia, particularly in rural areas. This paper examines the determinants of rural poverty in Cambodia for a panel of 827 households surveyed in 2001, 2004 and 2008. Fixed effect estimation is applied for this panel regression analysis. The primary result suggests that dependency ratio or shock have negative and statistically significant effect on food consumption expenditure. On the other hand, value of durable assets and livestock, irrigated and non-irrigated agricultural land, access to micro finance institute service and access to common pulled resources are found to exert positive and statistically significant effects on per capita food consumption expenditure. Policies which aim at reducing household size, curbing with shocks, encouraging ownership of productive assets, investing in irrigation and improving access to micro credit and common pulled resources, will exert positive effect for reducing rural poverty in Cambodia.

Key words: poverty determinants, agricultural land, MFI, shock, CPR, fixed effect.

1. Introduction

Cambodia is one of the poorest countries in the region with poverty head count rates at around 32 percent (World Bank 2009). The country is still struggling with a legacy of conflict and destruction that has left the country weak and vulnerable on many fronts: social and physical infrastructure, health and education, governance and institutions, and knowledge and technology. Despite these critical shortcomings, the

country has made tremendous progress over the last decade. The greatest achievement has been a return to political stability and a hugely improved law and order situation, enabling the country to reap rich peace dividends. In addition, the country has emerged out of the post-conflict reconstruction stage and has now entered into a new phase of economic development characterized by open economic policies, a focus on private sector led development and far-reaching macroeconomic reforms.

One of the highest priorities of the Royal Government of Cambodia (RGC) has been to reduce poverty, especially in rural areas. Through the successful implementation of the action plan spelt out in the "Vision and Financial Sector Development Plan 2001-2010" which has been updated into the "Financial Sector Strategy 2006-2015" and the "Public Financial Management Reform Program", the RGC has achieved not only macroeconomic stability but also impressive growth over the last decade, averaging around 10 percent per year. These achievements have enabled RGC to reduce the poverty levels significantly.

The first survey of poverty headcount in Cambodia was carried out in 1993/94. It covered only part of the country because of lack of access due to security conditions in some parts of the country. The results of the most recently completed Cambodia Socio-Economic Survey carried out in 2007, show that poverty headcount index within parts of the country that were covered by the 1993/94 survey has declined from 39 percent in 1993/94 to 28.0 percent in 2004, and to 24.7 percent in 2007 (World Bank 2009). In the rural areas in these parts of the country, the poverty headcount has declined from 43.1 percent in 1993/94 to 33.7 percent in 2004 and to 30.6 percent in 2007 (World Bank 2009).

At present, data covering the whole country are available for the years 2004 and 2007. These data show that poverty headcount index for the whole country relative to the overall poverty line fell from 34.7 percent in 2004 to 30.1 percent in 2007, a significant decline of 4.6 percentage points from 2004 to 2007 representing a reduction of more than 1 percentage point per year. Similarly, the results show that poverty headcount has declined at all sub-national levels: in Phnom Penh from 4.6 percent in 2004 to 0.8 percent in 2007, in other urban areas from 25.8 percent to 21.9 percent, and in rural areas from 39.1 percent to 34.7 percent. The decline in poverty during the period 2004-2007 reflects substantial and statistically significant growth in real per capita household consumption – the measure of living standards commonly used. The

rise in consumption is reported to be both apparent and statistically significant in the two poorest quintiles. Among the poorest and next poorest quintiles consumption increased in real terms by 10.7 and 11.5 percent respectively (World Bank 2009).

While there is evidence that poverty headcount has been reduced and while poverty reduction has been widely recognized as top priority on the government development agenda, little quantitative work has been done to explain determinants of poverty due to the lack of reliable data. Recent development in collecting repeated data set from nine rural villages by Cambodia Development Resource Institute (CDRI) provides rich information to allow empirical analysis on the subject.

This paper attempts to answer the question of how a particular variable affects poverty conditional on the level of other potential determinants of poverty. It is worth noting that early literatures on poverty determinants in Cambodia are based on either qualitative research or poverty profiles which are limited by the bivariate nature of their informational content and which can sometimes be misleading because of their unconditional nature. This paper attempts to provide a quantitative analysis of the determinants of poverty which goes beyond the poverty profile of assessing mere correlation of the characteristics of a household. The results of this analytical exercise should be of particular interest to policy makers since it provides a means to assess the likely impact on welfare in rural Cambodia of a range of specific government policies.

The rest of the paper is structured as follows. Section 2 reviews early literatures on poverty situation and poverty reduction strategy in Cambodia. Section 3 discusses how data are collected and how panel data are constructed. Section 4 analyzes how certain factors including household characteristics, asset and livestock, agricultural land size, access to common pooled resources, and shocks affect poverty which is proxied by per capita consumption expenditure. It also scrutinizes the factors that made households shooting stars and falling stones during 2001-2008. The last section will provide some policy recommendation to reduce poverty in the rural villages.

2. Literature Review

As discussed early poverty reduction is on top of development agenda of Cambodia's government. However, many literatures argue that in order to be policy-relevant by helping to develop antipoverty programs and monitoring and

evaluating progress poverty analysis needs to provide reliable and timely answer to four following critical questions:

- What is the extent of poverty?
- Who are the poor?
- Why are they poor?
- What happens to poverty if policy 'X' is implemented?

This literature review aims at providing the answers to those first three questions through examining poverty measurement and poverty profile from recent papers as well as the factors that causes poverty. The review also attempts to summarize efforts made by the government to reduce poverty.

The third question, which is the primary focus of this paper, will also mainly be solved quantitatively by analyzing determinants of poverty based on multivariate regression analysis. This paper is very important in the sense that the results of this econometric analysis on determinants of poverty will provide direction for poverty impact study of various policies. The last question will be explored through poverty impact evaluation of a set of specific policies.

2.1. Poverty Situation in Cambodia

Extent of Poverty

Based on figures released by Ministry of Planning (MOP) in 2006 and figures published by World Bank (WB) in 2009, the share of population who live under poverty line has been on a declining trend. Table 1 summarizes poverty estimates and estimated percentages of the poor according to region for calendar years 1993/94 2004 and 2007 based on figures published by those two institutions. Estimates are provided both for the food poverty line and the overall poverty line (i.e., the food poverty line plus the nonfood allowance). The poverty estimates indicate that the poverty headcount index relative to the overall poverty line for Cambodia decreased from 39 percent in 1993/94 to 34.8 percent in 2004 and to 30.1 percent in 2007. However, during the same period, the poverty headcount index relative to the food poverty line for Cambodia decreased only from 20 percent in 1993/94 to 19.7 percent in 2004 to 18 percent in 2007. The relatively rapid inflation in food prices during this period account for this difference (WB 2009). The results indicate that the poverty headcount index, relative to both the

overall poverty line and the food poverty line, decreased in every region were balanced regionally.

Table 1 also presents estimates of the percentage distribution of the poor population in 1993/94 2004 and 2007 according to various definitions of "poor" (i.e., relative to the food poverty line or relative to the overall poverty line and according to the headcount measure). These estimates indicate that the "poor" became even more heavily concentrated in Rural areas during this period (i.e., the Rural share increased from about 86 percent in 1993/94 to about 91 percent in 2004 and further to about 92 percent in 2007 for all cases). Therefore more focus should be given to the Rural area if poverty is to reduce more rapidly.

Table 1: Poverty Headcount by Region and Year

	Food poverty			Poverty		
	1993/94	2004	2007	1993/94	2004	2007
	Poverty headcount index (share of poor population)					
Phnom Penh	6.2	2.6	0.1	11.4	4.6	0.8
	(3.3)	(1.1)	(0.1)	(3.1)	(1.1)	(0.3)
Other Urban	19.6	14.2	12.7	36.6	24.7	21.9
	(10.8)	(7.8)	(7.3)	(10.3)	(7.8)	(7.5)
Rural	22.0	22.2	20.8	43.1	39.2	34.7
	(85.9)	(91.1)	(92.7)	(86.5)	(91.1)	(92.3)
Cambodia	20.0	19.7	18.0	39.0	34.7	30.1
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: MOP (2006) and WB (2009)

Poverty Profile

A poverty profile gives a simple but comprehensive poverty comparison, showing how poverty varies across sub-regions and sub-groups of population in the society. The most recent data on poverty in Cambodia revealed that about 30.1 percent of the Cambodian population lives below poverty line (WB 2009). The profile of Cambodia's poor is not very different from that of the poor in other low income countries. According to RGC (2006) the characteristics of poverty can be summarized as follows:

- Poverty, as well as food poverty, is much higher in rural areas than in Phnom Penh and other urban areas.

- Besides living in rural areas, the poor tend to have low levels of education, limited access to land and other productive assets, and are highly concentrated in low-paying, physically demanding and socially unattractive occupations.
- In both urban and rural areas, the poor have less access to modern amenities and services.
- They reside in houses of inferior quality with no or limited access to basic services like safe water and improved sanitation.
- The poor are more likely to reside in households with large membership sizes, have more children, and have a household head who is less educated.
- They also have much less access to public services.

More insights into the characteristics of the poor are available from qualitative surveys using participatory approaches to understand the nature of poverty. The Cambodia Participatory Poverty Assessment (PPA) funded by ADB (2001) collected a lot of information on the status of the rural and urban poor in Cambodia with respect to food access, land, animals, health, education, housing and so on. These are briefly summarized in Table 2 below.

Table 2: Characteristics of the Poor: Findings from the PPA in 2001

Characteristics	Extreme Poor	Poor	Lower Middle
Food	Persistent chronic hunger; food shortages up to 8 months	Food shortages: 3-6 months	Food shortages 3-4 months
Land	Little land	Less than 2 ha usually located in unfavorable locations	Less than 3 ha
Livestock	Perhaps one draft animal; no farm implements	Usually a pair of draft animals; some farm implements	Draft animals and farm implements
Income sources	Rice cultivation and access to common resources	Rely mainly on rice cultivation	Rice cultivation
Education	Cannot send all children to school	-	-
Healthcare	Vulnerable to any illness	-	-
Cultural obligations	Cannot meet	-	-
Housing	Thatch, very poor condition	Thatch; sometimes tiled roof and bamboo walls	Greater use of tiles and wood
Assets to credit	Chronically in debt; unable to borrow more; few utensils	Able to borrow money for rice cultivation; some utensils	Able to borrow money for rice cultivation; some utensils
Household size/ composition	Many small children; few workers	-	-
Vulnerability	Highly vulnerable to crisis and shocks	-	-

Source: ADB (2001)

Poverty Mobility Factors

While understanding extent and profile of poverty is important, it is also necessary for policy makers to know the factors that pushed some people out of poverty and the factors that drag others back into it. A Moving Out of Poverty study conducted in 2007 by CDRI provides rich information about those mobility factors.

Table 3 show how many percentages of households from a given quintile (per capita consumption expenditure quintile) are still in the same quintile over the next period and how many have moved into each other quintile. Following Haughton et all 2001 which was cited in World Bank 2008, the concept of shooting stars (the green cells in three tables below) and falling stones (the pink cells in three tables below) are employed to refer to those households that can afford to moved up and moved down by 2 quintiles respectively. Table 3 shows high degree of mobility; of 827 households only 269 (33 percent). Households that were in one of the bottom three quintiles in the first period and also in one of the bottom two quintiles in the next period are considered to be persistently poor

Table 3: Transition Matrix of Panel Household 2001-2004

	1	2	3	4	5	Total
1	65	44	30	13	14	166
2	43	36	41	30	15	165
3	25	32	45	38	26	166
4	18	34	26	50	37	165
5	15	19	24	34	73	165
Total	166	165	166	165	165	827

Source: CDRI's household survey 2001, 2004 and 2008 in 9 villages

According to the CDRI's MOP study various factors explain the shooting star phenomenon. This includes new or a multiplicity of income sources, employment conditions, personal and family conditions, improved agricultural production, community security, better administration, and services from national and local government. However, the study found that the most cited primary factors are new or a multiplicity of income sources (33 percent), followed by improved employment conditions and security (27 percent), and improved agriculture production (19 percent) (Ingrid and So 2007). In general, the positive movement is explained exclusively by economic factors.

Determinant factors for negative movement are also spelled out in the same study. These include personal and family conditions, health problems and crises, worsening employment security and opportunities, and bad agriculture production. The most raised factors is, personal and family conditions account for 25 percent, followed by health problem and crises for 25 percent, worsening employment security and opportunities for 17 percent, and bad agriculture production for 10 percent (Ingrid and So 2007). It notes importantly that the negative movement is explained primarily by personal and family conditions and crises, followed by economic factors.

Finally the study identified also the reasons which prevented some households from moving up. The stagnation is largely explained by the lack of employment security and opportunities, personal and family conditions, and health problems and crises. According to the findings, the common reason for stagnation is the lack of employment security and opportunities (54 percent), followed by personal and family conditions (19 percent), and health problems and crises (15 percent) (Ingrid and So 2007). Among the personal and family conditions, aging is a significant source for stagnation, accounting for about 9 percent of the first factor.

2.2. Poverty Reduction Strategies

National Poverty Reduction Strategy (NPRS) prepared by the government listed many priority actions to reduce poverty. These actions including maintaining macroeconomic stability; improving rural livelihoods; expanding job opportunities; improving capabilities; strengthening institutions and improving governance; reducing vulnerability and strengthening social inclusion; promoting gender equity; and priority focus on population (RGC 2002). Each action can be explained as follow.

Macroeconomic Stability

Achieving macroeconomic stability with high economic growth requires serious actions in implementing the reform programs and supporting policies. This includes no monetisation of fiscal deficit, sound financial system oversight, deepening banking reform, improvements in revenue, spending increase for social and economic sector, sound budget and treasury management, improving the investment climate, civil service reform, and legal and judicial reforms (RGC 2002).

Improve Rural Livelihood

A stable macroeconomic environment and sound financial sector policies are important, but these will not guarantee improvements in livelihoods in the countryside, where the vast majority of Cambodia's poor live (RGC 2002). The NPRS sets out the existing constraints and policy agenda in a series of key areas, with the overall objective of increasing incomes of Cambodians living in rural areas: land, water, agriculture, forestry and fisheries and transport. Improvements in these areas will contribute to improvements in other aspects of poverty, through better access to basic services, for example (RGC 2002). There are also important links between actions in other areas, including decentralisation and rural livelihoods. Improved rural livelihoods depend also on reduced poverty in other dimensions. Poor health, poor education, lack of agriculture infrastructure, and low productivity are mentioned to lead rural people to poverty (RGC 2002).

Expanding Job Opportunity

The poor work long hours for low returns; productivity is low and there is limited security. The generation of jobs and improved conditions of work are keys to reducing poverty (RGC 2002). The Royal Government's policies are intended to improve work opportunities specifically through facilitating private sector development, expanding exports and expanding tourism (RGC 2002). The extent to which these policies will be effective is closely related to success in improving the capabilities (education, skills and health) of the Cambodian people, as well as efforts to improve governance and transparency (RGC 2002).

Improving Capabilities

The NPRS highlights the priorities that will particularly affect poor Cambodians in education, health and nutrition. First action to improve capability is to achieve *Education For All*, that is completion of nine-year basic education for all, the education sector will address simultaneously supply, demand and quality, and efficiency constraints, focusing especially on the poorest and the groups at risk. Education policy will facilitate economic growth through increasing equitable access to quality and relevant post-basic education, and sustain institutional development towards pro-poor sector planning and management (RGC 2002). Secondly the Health Policy Statement 2003-2007 seeks to provide high quality, evidence-based health services, with equity, and no discrimination by gender, age, place of residence, or ability to pay, that are pro-poor, and are based on trust between providers and users (RGC 2002). Thirdly to

address the specific causes of malnutrition, the focus will be on prevention of malnutrition at the early years of life, with interventions starting before birth and focus on the first two years in life. It is also necessary to improve nutritional status of women in childbearing age and pregnant women for their health and in relation to prevent intra-uterine growth retardation (RGC 2002).

Improving Good Governance

The RGC is committed to implementation of the Governance Action Plan (GAP), a rolling strategic framework that provides a consistent and transparent approach to coordinate efforts in eight priority areas including Legal and Judicial Reform, Administrative Reform and Deconcentration, Decentralization and Local Governance, Public Finance Reform, Anti-corruption, Gender Equity, Demobilization and Reform of the Armed Forces, and Reform of Natural Resources Management (Land, Forestry and Fisheries) (RGC 2002). The fight against corruption is crucial to reducing poverty. Cambodia will face difficult challenges to meet its objectives. Competition for investments is fierce among countries and industries. Cambodia controls few of the parameters for success. The only one it controls and that can make a significant dent in poverty is the pursuit of good governance and the fight against corruption. The government has elected to approach corruption with a holistic set of measures that address root causes. Increasing the risks associated with corrupt practices is an integral part of a strategy. But codes, rules and laws cannot do it alone. Effective and fair enforcement mechanisms are the necessary complement to any legal framework. The government is actively building such capability while it is putting the finishing touch to what would become an enforceable legal framework (RGC 2002).

Reducing Vulnerability and Strengthening Social Inclusion

Increasing environmental sustainability and improving natural resource management is a key dimension in reducing vulnerability (RGC 2002). Priority issues are disaster management – especially in the face of floods; land mine clearance, a legacy of long years of war; vulnerability of the disabled, those affected by HIV/AIDS, orphans, street and abandoned children, and the homeless; food security; and safety net programs, limited by budget and capacity constraints (RGC 2002).

Promoting Gender Equity

Since 65 percent of agricultural labor and 75 percent of fisheries production are in the hands of women, poverty cannot be reduced unless policies and programs equitably

address the situation of Cambodian women (RGC 2002). The priorities include to reduce gender-based disparities and improve gender equity in health, education, control over agricultural resources, socio-economic and political empowerment and legal protection; to ensure that women and girls receive full legal protection, as well as legal education concerning their rights and benefits such as access to land titles and natural resources; to promote gender mainstreaming in all government departments; to collaborate with Ministry of Health for health, Ministry of Education for education, and Ministry of Agriculture, Ministry of Water Resource and Ministry of Rural Development for agriculture and rural income generation; to address legal barriers to women's equal rights; and to direct gender education and awareness at key government officials at all levels (RGC 2002). Political parties are encouraged to place women on party lists in positions, which will allow them an equitable chance with men of being elected to parliament. Affirmative action policies will be adopted in the recruitment and promotion of women into decision-making positions in the public service. It will ensure that in all consultative processes, and in monitoring and evaluation teams, there will be an equal number of women and men (RGC 2002).

Priority Focus on Population

The NPRS recognizes the central, critical and crosscutting role of population as is reflected in three primary programs with priority focus on specially targeted reproductive health and family planning services for the poor by the Ministry of Health; increasing primary education enrolment for the poor by the Ministry of Education; and creating rural employment opportunities for the poor by the Rural Development sector Ministries (RGC 2002).

2.3. Summing up

Despite some progress in reducing poverty in Cambodia since 1993/94, the poverty issue remains pervasive reflecting in the high poverty headcount which is estimated at 30.1 percent in 2007; that is, 30.1 percent of the Cambodian population is estimated to have been living under the national poverty line and about 20 percent or one in five Cambodians lived under the food poverty line. Poverty was considerably higher in rural areas (34.7 percent) than urban areas (0.8 percent in Phnom Penh and 21.9 percent in other urban areas). In 2007 about 92.3 percent of the poor lived in rural areas. Thus it is safe to conclude that poverty in Cambodia is overwhelmingly a rural phenomenon. Though poverty has been reduced the mobility of households is high. Factors that explains upward movement includes new or a multiplicity of income sources,

employment conditions, personal and family conditions, improved agricultural production, community security, better administration, and services from national and local government. The common reasons which causes households fall back into poverty or which prevented some households from moving include personal and family conditions, and health problems and crises and the lack of employment security and opportunities. As can be seen from the review early poverty literatures in Cambodia are only based on qualitative studies or poverty profile which describes the pattern of poverty but is not principally concerned with explaining its causes. While there may be certain contexts where unconditional poverty profiles are relevant to a policy decision (Ravallion 1996), they are usually limited by the bivariate nature of their informational content and which can sometimes be misleading because of their unconditional nature (Datt and Jolliffe 1999). This indicates there is a need to fill the gap by studying the determinants of poverty which goes beyond the poverty profile of assessing mere correlation of the characteristics of a household.

3. Data

Data analysis will be based on the household survey on 827 households conducted by CDRI for 2001, 2004 and 2008 in nine rural villages as shown in Table 4. Three of these villages namely Trapeang Prey, Babaong and Prek Kmeng were first surveyed in 1996/7 and then resurveyed in 2001, along with the other six villages which were surveyed for the first time in 2001. All nine villages were resurveyed in 2004, including 890 of the original 1005 households. However, only 827 households of the original sample were included in the survey in 2008. The panel data set is constructed within 827 households over the 3 rounds of surveys 2001, 2004 and 2008. Table 4 describes the size of the panel sample in each study village. It also describes the characteristics of each selected village. The nine villages were purposively selected to represent the four agro-climatic zones in Cambodia: the Tonle Sap region, the Mekong Plain, the Plateau and the Coastal region since 2001.

Table 4: Sample size and villages characteristics

Village	Total households	Sample households	Characteristics
Tonle Sap			
Tuol Krasaing	196	86	wet season rice and migration work
Andong Trach	234	61	wet season rice
Khsach Chiros	339	87	dry season rice and fishing
Mekong Plain			
Prek Khmeng	343	110	dry season rice and fishing
Babaong	543	110	dry season rice
Plateau			
Kanhchor	267	106	dry season rice and forestry resources
Dang Kdar	420	107	wet season rice and forestry resources
Trapeng Prey	75	51	wet season rice and labour sale
Coastal			
Kompong Thnoat	363	109	wet season rice and fishing
Total	2780	827	

Source: Chan and Acharya (2002)

4. Model of Poverty Determinants and Fixed Effect Estimation

4.1. Model of Poverty Determinants

A model used for regression analysis is a multiple regression equation adopted from a typical poverty model which is suggested in World Bank's Handbook of Poverty Analysis by Haughton and Khandker, which has been widely used in previous poverty studies in other countries (Engvall & Kokko 2007; Finnie and Sweetman 2003; Shinkai 2006). Haughton and Khandker (2008) provides a detailed explanation on causes or correlates of poverty according to regional-level characteristics, community level characteristics and household and individual level characteristics. The regional-level characteristics include vulnerability to flooding or typhoons, remoteness, quality of governance, property rights and their enforcement. The community level characteristics include the availability of infrastructure (roads, water, and electricity) and services (health, education), proximity to markets, and social relationships. For household and individual characteristics it further disaggregates into demographic (gender of head, dependency ration, age structure), economic (employment status, property owned) and social (health and nutritional status, education, shelter).

By far the most widespread technique used to identify the contributions of those different variables to poverty is regression analysis which is divided into two main types of analysis (Haughton and Khandker 2008). The first type attempts to explain the level of per capita expenditure or income as a function of variables which are considered as causes or correlated of poverty discussed above. The second type attempts to explain whether a household is poor or not, using a logit or probit regression. In the later case the independent variables are the same variables used in the first type but the dependent variable is binary, usually taking on a value of 1 if the family is poor and zero otherwise.

The main problem is that when logit or probit regression is used only the information of whether a household is poor or not is known but the more informative information such as how poor the household given by per capita consumption or income is thrown away (World Bank 2008). For this reason, because the data on per capita food consumption is available, the first type of regression model is chosen and it will be applied for the analysis. The first type will be used to scrutinize factors which contribute to poverty proxied by log of per capita food consumption expenditure. A panel data regression analysis with fixed effect estimation method will be employed to explore the effect of a set of independent variables includes dependency ratio, log of per capita asset and livestock, size of wet season and dry season rice field, use of loan from Micro Finance Institutes (MFI) in 2001, shock and access to Common Pooled Resources (CPR). The regression model to detect poverty determinants can be summarized as in the following equation:

$$lpf_{it} = \mathbb{x}_{it}\beta + \mu_i + \varepsilon_{it} \qquad (1)$$

Where lpf is a per capital food consumption expenditure,

$\mathbb{X}$ a matrix of independent or explanatory variables,

μ is an unobserved fixed effect, and

ε is a white noise error term.

The relationship of those variables and the expected sign of coefficients of those variables and dependent variable as well as descriptive statistics are given in Table 5.

Table 5: Variable Definition, Expected Sign and Descriptive Statistics

Variable	Definition	Sign		Mean	Std. Dev.	Min	Max	Observations
Dependent								
lpf	log of per capita food expenditure		overall	9.4	0.5	7.7	11.7	N = 2481
			between		0.4	8.2	11.0	n = 827
			within		0.4	7.7	11.4	T = 3
Independents								
dpr	dependency ratio	-	overall	1.8	1.5	0.0	8.0	N = 2481
			between		1.2	0.0	6.0	n = 827
			within		1.0	-2.2	6.2	T = 3
lpca	log of per capita asset and livestock	+	overall	12.4	1.7	5.1	16.8	N = 2419
			between		1.4	6.9	14.9	n = 826
			within		1.0	7.6	15.9	T = 3
non-irrigated	non-irrigated agricultural land	+	overall	0.6	1.0	0.0	10.0	N = 2481
			between		0.9	0.0	7.9	n = 827
			within		0.5	-3.6	4.6	T = 3
irrigated	irrigated agricultural land	+	overall	0.4	0.9	0.0	8.0	N = 2481
			between		0.8	0.0	5.5	n = 827
			within		0.5	-2.1	4.4	T = 3
mfi	MFI users	+	overall	0.1	0.3	0.0	1.0	N = 2481
			between		0.2	0.0	1.0	n = 827
			within		0.2	-0.5	0.8	T = 3
shock	Shock	-	overall	0.6	0.5	0.0	1.0	N = 2481
			between		0.3	0.0	1.0	n = 827
			within		0.4	-0.1	1.3	T = 3
ac_cpr	Access to Common Pooled Resources (CPR)	+	overall	1.0	0.2	0.0	1.0	N = 2481
			between		0.2	0.0	1.0	n = 827
			within		0.2	0.3	1.6	T = 3

Source: CDRI's household survey 2001, 2004 and 2008 in 9 villages

Independent or Explanatory Variables

As mentioned earlier, a number of variables will be used to explain poverty as indicated in Model 1. These include dependency ratio, log of per capita asset and livestock, size of wet season and dry season rice field, MFI loan users in 2001, shock and access to CPR. The basic concepts of these variables and their relationships to the welfare are briefly explained below.

Dependency ratio is a household variable indicating the ratio between the dependent part usually includes all household's members under the age of 15 and over the age of 64 and the productive part makes up all household's members in between, ages 15 – 64. In general, when the dependency ratio increases, it is expected that the per capita food consumption expenditure will decrease. Thus the sign of the household size coefficient is expected to be negative.

Variable *lpc* is the logarithm of the total value of all durable assets and livestock owned by a household. Asset which consists of a wide range of durable goods as well as livestock as described in earlier section is a good indicator showing the potential claims of a household and is highly and positively correlated with income level. Therefore lpc will also be positively related with per capita food consumption expenditure.

Non-irrigated and irrigated agricultural land are considered to be the most valuable asset for farmers and the size of land owned by households is often used as household welfare indicator. The better off households generally possess larger agricultural land and hence they are able to produce and consume more than the worse off ones. Here both types of rice fields are included in the regression model to check the effect of irrigation on per capita food consumption can be different. Per capita food consumption expenditure would then be expected to be positively associated with these independent variables.

MFI loan users is a dummy variable taking on value 1 if a household borrowed loans from MFIs in 2001 and 0 otherwise. Many existing literatures found that MFIs play an important role in rural poverty reduction through providing loans to households with low interest rate to conduct economic activities that would generate income. If this hypothesis is true, it is expected that this variable would exert a positive relationship with per capita food consumption expenditure.

Shock is also a binary variable taking value 1 if a household reported facing shock during the past 6 months and 0 otherwise. As can be seen from section 4.7 there are various kinds of shock defined by those rural households. These include "death of family member", "illness of family member", "natural disaster such as flood and drought", "thievery", and "job loss of family member". Households facing those shocks would experience a decrease in per capita food consumption expenditure. It is therefore expected that shock will have a negative coefficient sigh.

Access to CPR is a binary variable indicating whether a household has access to common pooled resources or not. It takes value 1 if they do and 0 otherwise. The Moving Out of Poverty Study of CDRI found that collection and gathering of a wide range of forestry and aquatic products from the forests and common pool resources are particularly important for livelihood and coping strategies. In earlier section it is found that access to forestry resources clearly decline while the trend of access to aquatic resources is mixed. The decline in access to those resources may be an issue for the poorest quintile who relatively rely on more collecting vegetables, firewood, and fishing for their daily consumption. In this regards, access to CPR is expected to have a positive relationship with per capita food consumption expenditure.

4.2. Fixed Effect Estimation

Repeated surveys of the same sample of households by CDRI have enabled to set up a panel data for regression analysis. Panel data is argued to provide a lot of advantages compared to cross sectional data. A more significant reason of using panel data is it may control for unobserved characteristics (heterogeneity) which is an important issue in econometrics (Haughton and Khandker 2008). The use of current panel data set is expected to help drop out the effects of unobserved factors.

Fixed versus Random Effects

When should fixed effects estimation be used rather than random effects estimation or vice versa? In principle, random effects is more attractive because observed characteristics that remain constant for each household are retained in the regression model while in fixed effects estimation, they have to be dropped. Statistically, fixed effects are always a reasonable thing to do with panel data as they always give consistent results but they may not be the most efficient model to run. Random effects will give better p-values as they are a more efficient estimator, so random effects should be run if it is statistically justifiable to do so (Albert 2008).

The generally accepted way of choosing between fixed and random effects is running a Hausman test. The Hausman test checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results. The Hausman test tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. If the p-value is large then use random effects

is preferred and if the p-value is significant then fixed effects should be used (Albert 2008).

Hausman test is performed to see if the unobserved fixed effect is best treated as a fixed or random effect. It test a null hypothesis that random effects estimation gives consistent and efficient coefficients versus alternative hypothesis that random effects coefficients would be inconsistent. The result of the test is given in Table 7 shows that the p-value is highly significant at 1 percent critical level suggesting that the random effect model is strongly rejected. Hence fixed effects estimation will be applied in the panel data regression analysis.

5. Regression Results and Policy Implications

5.1. Regression Results

Table 6 presents the results of regression analysis on panel data set based on fixed effect estimation and random effect estimation. From Hausman test given in Table 7, however, fixed effect method is more plausible in econometric sense. Therefore the following interpretation is primarily based on the results from fixed effect estimation.

As can be seen from Table 6, the results obtained from fixed effect method conformed well to expectation. Dependency ratio is statistically significant at a 1 percent level and its coefficient suggests that a 1 percentage point increase in dependence ratio will decrease per capita food consumption expenditure by 6 percent. This result is strongly underpinned by earlier studies on other countries which found that there are negative welfare effects for larger households (Deaton and Paxson 1998; Ellis and Bahiigwa 2003; Woolard and Klasen 2005).

For log of per capita asset and livestock variable, it is found that its coefficient have positive sign and statistically significant at 1 percent level. The value of coefficient indicates that a 1 percent increase in the value of per capita asset and livestock would result in 12 percent increase of per capita food consumption. This could imply that policies to encourage investment in capital asset such as motorbike bike water pump and cell phone and policies to encourage raising livestock such as cow buffalo and chicken would also lead to higher per capita food consumption.

Both non-irrigated agricultural land and irrigated agricultural land are found to be statistically significant and have positive signs as expected. Their coefficients suggest

that one hectare of additional land would increase per capita food consumption by 4.2 percent and 4.1 percent respectively. The finding is further supported by that of Engvall & Kokko (2007) which studied on land and human development in Cambodia and which found the positive effects of land regarding poverty reduction. It is worth noting that this finding is really encouraging in the sense that irrigation only would help enable farmers to perform double cropping per year and could increase household food consumption about 4.3 percent. From literature review, the extreme poor, the poor and the lower middle are those who have little land and heavily rely on rice cultivation for livelihood (ADB 2001). Therefore policies to distribute land to the poor and to invest in irrigation system could significantly improve rural livelihood and could dramatically reduce poverty in the rural area. The poverty effect of irrigation development will further be explored in Paper 5 of this dissertation along with the effect of other three main infrastructure variables which have been mentioned in the Rectangular Strategy of the government.

The effect of MFI on per capita food consumption can be seen from Table 6. The sign of variable MFI users in 2001 is positive and significant at 5 percent level. The coefficient suggests that those households that used microfinance service in 2001 could improve their per capita food consumption by around 8 percent. This finding is further enhanced by similar studies which analyzed the effect of microfinance on welfare and poverty reduction in other countries (Khandker 1998; Pitt and Khandker 1998; Chen and Snodgrass 2001; Khandker 2003 as cited in Weiss et al 2003). This is pretty an encouraging result and implies the need to expand MFI in Cambodia for poverty alleviation purpose. However, while MFI is claimed to improve welfare of average people little is known whether its impacts reach the poorest of the poor. ADB (2001) showed that the chronic poor who were already heavily in debt could not borrow more. Paper 6 will aim to capture the poverty impact and the role of microfinance in reducing rural poverty in rural Cambodia.

Shock is found to have a significant and negative effect on per capita food consumption expenditure as expected (Table 6). It is negatively related per capita food consumption expenditure and statistically significant at 1 percent level. The coefficient implies that households facing shock during the past 6 months would experience in reduction of per capita food consumption expenditure by around 8 percent. Shocks sometimes have more profound effect on poverty. Illness is one of the common serious shocks among the poor. Previous studies often pointed out that the poor are often

vulnerable to illness which the cause of distress land sale and landlessness (ADB 2001; Ingrid and So 2007). That being said, improved access to better public healthcare would result in significant poverty reduction.

Lastly the variable access to CPR is positive and statistically significant at 1 percent level. Households that have access to common pooled resources could increase their per capita food consumption by around 11 percent. This suggests that common pooled resources which include especially forestry and aquatic resources play very crucial role for food security and poverty reduction. Early literatures showed that the poor are dependent on CPR as a source of income and livelihood in Cambodia (ADB 2001; Ingrid and So 2007). At the same time population increase, however, could put on natural resources. The relationship between CPR and poverty reduction deserves a careful study and analysis.

Table 6: Regression Results

log per capita food consumption	fixed effect	random effect
dependence ratio	-0.0609 ***	-0.0669 ***
	(0.0084)	(0.0064)
log of per capita asset and livestock	0.1193 ***	0.1013 ***
	(0.0085)	(0.0063)
non-irrigated agricultural land (ha)	0.0412 ***	-0.0183 *
	(0.0154)	(0.0101)
irrigated agricultural land (ha)	0.0427 **	0.0027
	(0.0173)	(0.0117)
MFI users in 2001	0.0784 **	0.0460
	(0.0332)	(0.0282)
shock	-0.0794 ***	-0.0466 **
	(0.0208)	(0.0186)
access to CPR	0.1096 **	-0.0645
	(0.0537)	(0.0441)
constant	8.9829 ***	9.2520 ***
	(0.0637)	(0.0501)
number of groups	826	826
number of observation	2419	2419
overall R-square	0.1376	0.1647

Table 7: Hausman Test

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
dependency ratio	-0.0609	-0.0669	0.0060	0.0055
log of per captia asset and livestock	0.1193	0.1013	0.0180	0.0058
wet season rice field (ha)	0.0412	-0.0183	0.0595	0.0115
dry season rice field (ha)	0.0427	0.0027	0.0400	0.0127
MFI users in 2001	0.0784	0.0460	0.0325	0.0176
shock	-0.0794	-0.0466	-0.0328	0.0093
access to CPR	0.1096	-0.0645	0.1741	0.0307

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 98.53
Prob>chi2 = 0.0000

5.2. Policy Implication

These findings have a set of policy implication to reduce poverty which can be summarized as in Table 8.

Reduce dependency ratio:

The findings from regression analysis of the current paper suggest that high dependency ration households tend to be poor as they are likely to consume less on food. This is in line with the findings of RGC (2006) which also indicates that the poor tends to have larger household size. This can be accounted for high total fertility rate as a legacy of civil war. Thus it is crucial to tackle this issue through introducing population policy which encourages households to have fewer children and through effectively and widely spreading the benefit of birth control and family planning to rural households.

Enhance asset and livestock accumulation:

Those policies to promote accumulation of productive durable assets especially agricultural equipment would accelerate poverty reduction. World Bank (2006) indicated that the poorest quintile households owned more assets compared to 10 years ago but unfortunately productive assets such as water pump were still scare. Similarly, the result of regression analysis suggest that livestock plays an important part in improving villagers' livelihood. Some kinds of livestock such as poultry and fish could be a source of daily nutrition for household consumption and some others such as cattle can also be used as draught animal in agricultural production in addition to revenue

generation. The challenge, however, is how to change such traditional ways of raising livestock of household consumption & draft animal to a strategy to increase income and reduce poverty. Choosing a better variety of livestock to raise and providing better animal health extension services better the livelihood of rural villagers.

Table 8: Effects of Poverty Determinant and Policy Implication

Variable	Effect on Per Capita Food Consumption	Policy Implication
Dependency Ratio	Negative	Reduce household size through birth control and family planning policy
Asset and Livestock	Positive	Promote ownership of capital asset and raising livestock through less tax on agricultural capital goods and agricultural extension services
Agricultural Land and Irrigation	Positive	Distribute idle social concession land to the poor and construct or rehabilitate irrigation system and improve management of water use for cultivation
Shock/Crisis	Negative	Reduce vulnerability of the poor through building social safety net especially improve healthcare system
Access to Micro Finance Institution	Positive	Facilitate access to credit for the poor through establishing formal rural credit and encourage MFI setup in the rural area
Access to Common Pooled Resources	Positive	Facilitate access to CPR for the poor through open access to the aquatic and forestry resources and creation of village association for CPR management.

Make agriculture land concession to the landless and improve irrigation system:

From the current study both non-irrigated agricultural land and irrigated agricultural land are found to have significant and positive effect on per capita food consumption. This is also enhanced by Engvall and Kokko (2007) which found the

positive effects of land on poverty reduction. As the extreme poor, the poor and the lower middle are those who have little land and heavily rely on rice cultivation for livelihood (ADB 2001), policies to distribute land to the poor could produce significantly positive effect on poverty reduction. Equally important, irrigation investment which allows farmers to perform two or three cropping per year could dramatically improve livelihood of rural farmers. From policy standpoint, however, it might be more convenient to build infrastructure rather than distribute the land. The poverty effect of irrigation infrastructure will further be explored in Paper 5 of this dissertation along with the effect of other three main infrastructure variables which have been mentioned in the Rectangular Strategy of the government.

Improve access to MFI:

The effect of MFI on per capita food consumption is found to be positive and significantly significant, suggesting that access to MFI would improve livelihood. This is in very well in line with a number of studies, which also found positive effect of MFI on poverty reduction in other countries (Khandker 1998; Pitt and Khandker 1998; Chen and Snodgrass 2001; Khandker (2003) as cited in Weiss et al 2003). The result from the current study supports the expansion of MFI to the rural areas, where the mass population of the poor live, in order to speed up poverty reduction. Despite this optimistic view regarding the role of MFI in reducing poverty however some evidence showed that the chronic poor who were already heavily in debt are constrained to access to new loans leading to a question whether MFI really reaches the poor. Paper 6 will explore the role of microfinance in reducing rural poverty in rural Cambodia and discuss whether the poorest of the poor really benefit from it.

Reduce vulnerability to shock:

In the current study shock is narrowly defined as having unpleasant experiences such as “serious illness”, “crop failure”, “animal death/stolen”, “family loss”, “land conflict” or natural disaster. The result of regression analysis indicates that shock is negative associated with per capita food consumption expenditure. Shock, however, sometimes have more profound effect as it can be the main cause of falling into poverty. Illness seems to be the most unpleasant shock suffered by many poor as it is the cause of distress land sale and landlessness (ADB 2001; Ingrid and So 2007). Reducing vulnerability to shock can rather be challenging. Even though providing high quality health services is recognized as one priority action to reducing poverty in the PRSP, many people remained suffer from illness and end up being landless. Moreover disaster

management, especially in the face of floods, has been another priority action of the government to reduce vulnerability of the poor but is said to be limited by budget and capacity constraints (RGC 2002).

Increase access for the poor to CPR:

The result of regression analysis showed that households that have access to common pooled resources could increase their per capita food consumption by around 11 percent. This suggests that common pooled resources which include especially forestry and aquatic resources play very crucial role for food security and poverty reduction. Early literatures showed that the poor are dependent on CPR as a source of income and livelihood in Cambodia (ADB 2001, and Ingrid and So 2007). At the same time there is evidence in many villages access to forestry resources has been reportedly more restricted to local villagers, after the forestry law and went into effect in 1998 (Ingrid and So 2007). As a priority action against poverty increasing environmental sustainability and improving natural resource management is recognized to be a key dimension in reducing vulnerability (RGC 2002). Since the relationship between access to CPR and poverty reduction seems to be enhancing each other, policies to restrict the access to CPR may deserve a more careful study and sound analysis.

6. Conclusion

Poverty in Cambodia is overwhelmingly a rural phenomenon. Existing literatures on poverty in Cambodia are purely qualitative or use poverty profile which is limited by bivariate nature of their informational content and which can be misleading. This indicates there is a need to fill the gap to carefully identify the determinants of poverty beyond the poverty profile of assessing mere correlation of the characteristics of a household. This paper aims to fill the gap by providing a new perspective to identify the determinants of rural poverty in Cambodia using regression analysis of a panel data set of 827 households surveyed in 2001, 2004 and 2008 by CDRI, with fixed effect estimation approach.

The results obtained from the fixed effect estimation regression analysis conformed perfectly well to expectation. Households with higher dependency ratio or experienced shock would decrease their per capita food consumption significantly. On the other hand households holding higher value of durable assets and livestock, having larger agricultural, using MFI service or accessing to CPR are found to have higher welfare in term of per capita food consumption expenditure. Effort to discourage large household

size, policy to stimulate ownership of capital asset, and policy to improve access to MFI service and CPR will speed up the poverty reduction process.

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