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Agriculture, Markets and Poverty
- A Comparative Analysis of
Laos and Cambodia *

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Abstract

Laos and Cambodia have been transitioning to a market-oriented policy regime. Both are agrarian economies with agriculture contributing about one-third of the GDP. We assess prospects of achieving MDG1 and centrality of agricultural growth in achieving this goal. As these are macro relationships, richer insights into determinants of poverty are obtained by detailed analyses of recent household surveys in Laos and Cambodia. Some of these insights relate to access to markets, returns to crops, education, land size, non-farm activities, ethnic affiliation, and rural infrastructure, with unavoidable variation due to differences in the coverage of the household surveys used. Another major theme studied for Cambodia is integration of farmers - especially smallholders - into markets. The focus is on barriers between large and smallholders-for example, transaction costs. An accelerated transition to a more market-oriented policy regime may promote not just a more efficient agriculture but also a more equitable outcome.

Key words: agriculture, poverty, MDG1, smallholders, markets, transaction costs, Laos and Cambodia

JEL classification: N 55, H 53, I 32.

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Introduction

Both Laos and Cambodia have been transitioning to a market-oriented policy regime. They have performed well - compared to other developing countries in the Southeast Asia region - in recent years. Laos' annual GDP growth rate was just under 7 per cent between 2000-2009 (World Bank, 2011). Cambodia's performance was impressive too in the decade 1997-2008 (Guimbert, 2009). In fact, Cambodia is one of only 46 countries among 194 countries with a long time-series that achieved 7 per cent annual growth on average for 14 consecutive years. This is unusual by post-conflict standard.

Both are agrarian economies with agriculture contributing about one-third of the GDP. A vast majority depend on agriculture as the main source of their livelihood and contribution of agriculture to GDP growth remains high. Recent poverty rates are high- about one-third of the population is poor, while most of the poor live in rural areas.

Scheme

First, we analyse agriculture's contribution to GDP growth. This is followed by an analysis of prospects of achieving MDG1 and centrality of agricultural growth in achieving this goal. As these are macro relationships, richer insights into determinants of poverty are obtained by detailed analyses of recent household surveys in Laos and Cambodia. Some of these insights relate to access to markets, returns to crops, education, land size, non-farm activities, ethnic affiliation, and rural infrastructure, with unavoidable variation due to differences in the coverage of the household surveys used. Another major theme studied for Cambodia is integration of farmers - especially smallholders - into markets. The focus is on barriers between large and smallholders-for example, transaction costs. Finally, concluding observations from a broad policy perspective are offered.

Agriculture and GDP

(a) Laos

We posit a model in which GDP is related to its own lagged value, an instrumented measure of agricultural value added and a dummy variable for the period 2000-08. This specification allows us to estimate the long-run effect of agricultural growth rate on GDP. As the value of agricultural production is obtained through instrumented values of the three components (i.e. values of crop production, forestry, and livestock and fishery), the coefficient estimate of

agricultural production indicates its short-run effect on GDP. A dummy variable for 2000-08 aims to capture the effects of significant policy changes and other changes in the economic environment that cannot be captured with the data available to us. This regression is estimated using annual observations over the period 1990 to 2008[2].

While GDP is tracked closely by its own lagged value, agricultural value added also contributes substantially to it. While the short-run elasticity is about 0.67, the long-run elasticity is considerably larger (1.59). This implies that a 1 per cent growth in agricultural value added will result in 1.59 per cent GDP growth[3]. The dummy for 2000-08 has a statistically significant but small negative effect.

(b) Cambodia

We analysed the link between GDP and agricultural value added (Gaiha and Azam, 2011). Paucity of time series data on public and private investment, infrastructure and stocks of human capital constrained our analysis of determinants of GDP. The specification that fitted the data best had log GDP (at 2000 constant US dollars) as the dependent variable, and an instrumented measure of log agricultural GDP as an explanatory variable along with (lagged) log of workers in the economy.

The data were obtained from World Development Indicators (World Bank, 2010a) and the relationship specified above was estimated using OLS.

The elasticity of GDP with respect to agricultural value added is high (0.76), implying that a one per cent higher agricultural value added is likely to result in a 0.76 per cent higher GDP.

In sum, the shor-run elasticities of GDP with respect to agricultural value added are high in both Laos and Cambodia. As reported, the long-run elasticity for Laos is more than twice as large as the short-run elasticity. So even though the share of agriculture in GDP has reduced in both countries, its role in stimulating overall growth rate remains important.

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[2] For details of data used and regression results, see Gaiha and Annim (2010).
[3] The larger long-run elasticity is based on the steady state assumption. What it really means is that agricultural growth acceleration takes time to percolate to the rest of the economy through employment and output adjustments before reaching a steady state equilibrium.

Prospects of Achieving MDG 1

(a) Laos

(i) Incidence of Poverty

A recent Lao Government report (MOP, 2010) offers a comprehensive review of poverty based on the four Lao Consumption Expenditure Surveys (LECS). A distillation of the key findings is given here, followed by our analysis of determinants of poverty based on LECS 4. Three sets of poverty estimates are obtained from the total poverty line, food poverty line and the World Bank poverty line of $1.25 (PPP 2005) per day (for convenience of exposition, this is referred to as "the dollar poverty line" as follows).

Under a third (27.6) of the Lao PDR population is poor in terms of consumption expenditure, using 159,611.9 KIP as the national poverty line. Using the 'dollar' poverty line, more than a third of the Lao PDR population is poor. The incidence of food poverty (food expenditure <2100 calories per capita per day) is slightly lower and shows that about one out of 4 households is poor in terms of food expenditure (MOP, 2010).

(ii) Poverty, Growth and MDG1

Here we analyse the implications of different agricultural and GDP growth rates for halving of the dollar poverty in 1990 by 2015. As we have access to four estimates of this measure

Table 1

Poverty Elasticity, Growth Rates and MDG1

Year	H(%)	LogH	LogGDP	LogAgr	Pov. Elas.(GDP)	Pov. Elas. (Agr)
1992	55.68	4.02	20.77	20.25	.	.
1997	49.32	3.90	21.10	20.45	-0.3596	-0.5853
2002	43.96	3.78	21.39	20.66	-0.4121	-0.5521
2006	37.44	3.62	21.65	20.83	-0.5993	-0.9719
Average					**-0.4570**	**-0.7031**

g_{half}	0.0616	0.0396
Required Growth Rate[1]	6.16% (6.70%)	3.96% (4.31 %)

1. The required growth rates are computed on the assumption of a gap of 25 years (1990-2015). To allow for a shorter gap of 23 years (as the base poverty index is available for 1992), alternative growth rates are computed (shown in parentheses). For details, see Gaiha and Annim (2010).

(for 1992/93, 1997/98, 2002/3 and 2007/8), we compute the elasticities of poverty with respect to GDP and agricultural value added. Note that they vary over time. These elasticities are given in Table 1.

We have used the procedure by Besley and Burgess (2003), shown by equation (1), to compute the growth rates of GDP and agricultural value added required to halve the poverty index (g $_{half}$) in 25 years (i.e. over the period 1990-2015). η denotes poverty elasticity with respect to GDP (or agricultural value added). It is interesting to note that the poverty-agricultural value added elasticities (in absolute value) are greater than the poverty-GDP elasticity, confirming the more important role of agricultural growth in reducing poverty. In fact, this is also corroborated by the elasticities obtained from large cross-sections of developing countries[4].

$$g_{half} = \frac{\log\left(\frac{1}{2}\right)}{25\eta} \quad \ldots\ldots\ldots(1)$$

As may be noted from the results (regardless of whether the gap is 25 years or 22 years)**,** the required rates of GDP and agricultural value added are lower than the feasible range predicted by our simulations. So, if the trend growth rates are maintained over time, Lao PDR is on track to achieving the MDG1 by 2015. In brief, the prospects of achieving MDG 1 are highly likely.

Prospects of Achieving MDG 1 in Cambodia

(b) Cambodia

(i) Incidence of Poverty

Cambodia grew rapidly and sustained it over an extended period of time. GDP per capita nearly tripled during 1994-2008 (rising from $248 to $739).

As expected, there was a marked reduction in the headcount index of poverty-from 47 per cent in 1993 to 30 per cent in 2007, a reduction of about 17 percentage points over a period of 13 years[5].Over the more recent period, 2004-2007, the headcount index reduced from 35 per cent to 30 per cent - a reduction of 5 percentage points. So, despite the marked reduction, a little under one-third of the population lives below the poverty line.

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[4] For details, see Imai et al. (2011).

[5] The poverty line comprises two components: the cost of a food consumption bundle required to obtain 2100 calories per person per day; and the minimum consumption level required to meet basic non-food needs (clothing, housing, health care, education, among others). This poverty line is calculated separately for different regions with different consumption patterns and price levels. The average national poverty line for 2007 was 2470 Riels per capita or about $0.61 (at an exchange rate of R 4062 in 2007). For an elaborate and meticulous review of the methodology, see World Bank (2009) and Knowles (2009). For a more detailed discussion, see Gaiha and Azam (2011).

The headcount poverty index relative to the food poverty line also decreased, but only from 19.7 per cent in 2004 to 18 per cent, due largely to rapid food price inflation (World Bank, 2009).

The headcount index, relative to both the overall poverty line and the food poverty line, decreased in each region (i.e. Phnom Penh, Other Urban and Rural). This finding applies equally to the poverty gap and squared poverty gap indices.

About 35 per cent of the rural population was poor in 2007, as compared with about 22 per cent of other urban and just under 1 per cent of Phnom Penh. Among the total poor, a vast majority (92.3 per cent) were rural. In fact, the share of rural poor rose slightly over the period 2004-07 (from 91.7 per cent to 92.3 per cent).

(ii)   Poverty, Growth and MDG1

Here we analyse the implications of different agricultural and GDP growth rates for halving of the dollar poverty in 1990 by 2015. As we have access to four estimates of this measure (for 1993, 1997, 2004 and 2007), we first compute the elasticities of poverty with respect to GDP and agricultural value added. A similar exercise is carried out for food poverty estimates. These elasticities are given in Table 2.

As may be noted from Table 2, the overall and food poverty elasticities vary with GDP and agricultural value added and over time.

Overall poverty elasticity with respect to GDP in 1993-97 was more than 1, implying a more than proportionate reduction in poverty in response to a one percent increase in GDP growth rate[6]. This was followed by a sharp reduction in the elasticity between 1997-2004 (down to 0.06). The elasticity rose sharply during 2004-2007 (0.44), implying considerably more rapid poverty reduction in this period compared with the previous. The overall poverty elasticity for the entire period 1993-2007 was moderately high (0.51).

Let us now turn to the overall poverty-agricultural value added elasticities.

These elasticities are considerably larger than the corresponding ones with respect to GDP in each sub-period as well as over the entire period, 1993-2007. For this period, the elasticity is 0.72, implying that a 1 percent faster Agricultural Value Added growth is likely to translate into a 0.72 per cent reduction in overall poverty. This corroborates the important role of agricultural growth in poverty reduction.

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[6] For ease of comparison, (absolute) elasticities are used.

Food-poverty elasticities are consistently lower than overall poverty elasticities.

The food poverty-GDP elasticity was higher in 1997-2004 than in the subsequent period, 2004-2007. However, over the period 1993-2007, it was moderately high (0.31). As in the case of overall poverty, food poverty elasticities with respect to agricultural Value Added are consistently much greater than those with respect to GDP. The elasticity with respect Agricultural Value Added in 1993-2007 was (0.76), as compared with (0.31) with respect to GDP. This suggests that agricultural growth matters a great deal in both overall and food. See also World Bank (2006, 2010b) for a less optimistic assessment. A limitation is that these do not take into account centrality of agriculture in GDP growth.

Let us now examine the prospects of achieving MDG 1, based on the results in Table 3.

Our analysis suggests that GDP is likely to grow at a little over 8 per cent annually (the trend growth rate observed during 1993-2007), and Agricultural Value Added at 3.7 per cent per annum. The required GDP growth rate consistent with MDG1 is slightly lower (6.14 per cent), assuming that the time span used for simulation is 22 years from 1993 to 2015. This implies that Cambodia is on track to achieving the goal of halving poverty by 2015. However, agriculture must grow at a slightly faster rate (4.3 per cent per annum).

Turning to the feasibility of halving food poverty by 2015, GDP growth must accelerate to 10 per cent per annum. This is not surprising given the lower food poverty-GDP elasticity. As Cambodia has grown at 10 per cent or more per annum each year during 2004-2007, this growth acceleration is not daunting. Recent assessments suggest that the economy is stabilizing after the precipitous decline in growth rate in 2009 as suggested by recent macro figures, that is, 0.09% of GDP growth in 2009 and 5.96 % in 2010 (World Bank, 2012).,

Growth rate of Agricultural Value Added required to reduce food poverty by half is slightly higher (4.1 per cent) than the trend growth rate (3.7 per cent). Indeed, if our analysis of agriculture's intensification has any validity, subject to the caveat that the contributions of seeds and irrigation are imprecise, an increase of two per cent in each of the three inputs (fertilizer, machinery and labour) is likely to translate into a growth rate of about 5 per cent, and a much faster GDP growth rate[7]. In sum, contrary to other assessments, there are grounds for optimism in achieving MDG 1[8].

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[7] For details, see Gaiha and Azam (2011).
[8] See also World Bank (2006, 2010b) for a less optimistic assessment. A limitation is that these do not take into account centrality of agriculture in GDP growth.

Table 2 Poverty Elasticities with respect to GDP and Agricultural Value Added

Year	Overall Poverty (%)	Food Poverty (%)	Log of GDP	Log of Agr. VA	Log of Overall Poverty	Log of Food Poverty	Overall Poverty Elasticity to GDP	Overall Poverty Elasticity to Ag. VA	Food Poverty Elasticity to GDP	Food Poverty Elasticity to Ag. VA
1993	47	24	21.516	20.735	3.850	3.178	-1.027	-1.379		
1997	36.1	NA	21.773	20.926	3.586	NA	-0.0646	-0.216	-0.347	-1.162
2004	34.8	19.7	22.341	21.096	3.549	2.980	-0.447	-0.584	-0.278	-0.363
2007	30.1	18	22.665	21.344	3.404	2.890	-0.513	-0.726	-0.313	-0.763

Source: Poverty estimates are from MOP (2010). GDP and Agricultural Value Added are predicted from our models. The overall and food

poverty elasticities are computed by the authors. For details, see Gaiha and Azam (2011).

Table 3 Actual and Required Growth Rates of Agriculture and GDP to Achieve MDG1

Growth Rates	Annual GDP Growth Rates	Annual Agricultural Value Added Growth Rates	Annual GDP Growth Rates	Annual Agricultural Value Added Growth Rates	Years	Period
Actual growth	0.081	0.037				
Required Growth1	0.061	0.043	0.100	0.041	22 years	(1993-2015)
Required Growth2	0.054025*	0.03817*	0.088508+	0.036	25 years	(1990-2015)

Actual growth rates are obtained from fitting the equation, $y_t = \alpha \beta^t$, to the GDP and agricultural value added over the period 1993-2007. Given this specification,

β is the annual growth rate. Required growth rates are computed using the formula in Besley and Burgess (2003), as given in the section on Laos.

Our results are based on assumptions of 22 and 25 years. For details, see Gaiha and Azam (2011).

Determinants of Poverty

(a) Laos

In view of the complex channels through which poverty reduction is achieved, simplistic extrapolation of past experience focusing only on one or two macro variables, such as GDP growth or inflation could be misleading. An attempt is made here to elaborate these channels with agriculture at the centre stage. Attention is given to market access, crop returns, producers' prices, education, size of landholding, non-farm activities, and ethnic affiliation, access to credit, among others.

Our analysis based on a recent household survey (LECSIV, 2007/8) throws new light on the determinants of household poverty in Lao PDR, with emphasis on returns on *all* crops as well as glutinous rice, producer prices and access to credit.[9] Although in the past few years, the service and industrial sectors have contributed more to GDP growth in Lao PDR, most of the poor households still depend on agriculture.

(i)   Data and Methodology

We have used the most recent (fourth) round of the LECS (LECS IV) in estimating two separate sets of equations; (1) effect of returns on crops harvested (per capita)[10], and (2) effect of returns on glutinous rice harvested (per capita) on different dimensions of household poverty measures. Among other explanatory variables, producer prices and access to credit at the village level are also used.

The Lao Statistics Bureau (LSB) has collected data on household composition, consumption expenditure, health, occupation and village-level characteristics in every five years since 1992. The datasets are nationally representative and capture information from all the provinces in Lao PDR. The fourth round (conducted in 2007/08) is not only more comprehensive and detailed in topics, but also larger in sample size than earlier surveys. For instance, during the fourth round, the health component of the LECS survey explored issues on both health status and healthcare-seeking behaviour, compared to the third round which only covered health status. With a response rate of 99.9 per cent, the fourth round survey has the data for 8,296 households in 518 villages.

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[9] For details, see two companion studies, Gaiha and Annim (2010), and Annim and Gaiha (2012).

[10] To avoid repetition, per capita is omitted in subsequent discussion.

Two types of econometric estimation techniques (Probit and IV Probit) are used here[11]. The choice of a Probit (Maximum Likelihood Estimation) technique is informed by the measurement of the dependent variable, poverty - a binary outcome - relevant explanatory variables, and key hypotheses for empirical validation.

In these models, poverty is based on consumption expenditure, food expenditure and 'dollar' poverty cut-off (below a cut-off of $1.25 PPP 2005). Explanatory variables include returns on crops harvested, village price of crops sold, age of the head of household, a Gini coefficient district level consumption expenditure inequality, education of household head, categorised into primary or below, lower secondary, upper secondary and vocational or university education. The reference category for household head's education is primary or lower level of education. Demographic characteristics include number of adult members in a household and number of kids less than 5 years in the household. Household income diversification is captured by the number of adults in non-agricultural employment. Access to credit is linked to availability of a credit bank in the village. Altitude of land is categorised into lowland, midland and upland, with low land as the reference group. Burglary is a village level variable that captures the degree to which burglary is a concern. This is coded as major and minor and no major concern is the reference group. Urban residence is a dummy with urban residence coded as 1 and 0 otherwise. A household head's ethnic group is categorised into Lao-Tai, MonKhmer, ChineTibet and HmongIuMien. The base category for ethnic group is Lao-Tai. Region is categorised into four locations, namely, Vientiane main (national capital), North (Phongsaly, Luangnamtha, Oudumxay, Bokeo, Luangprabang, Huaphanh and Xayabury), Central (Xiengkhuang, Vientiane, Borikhamxay, Khammuane and Savannakhet) and South (Saravane, Sekong, Champasack and Attapeu). Vientiane is used as the base region for the econometric estimation. Landholding of the household and is categorised into small (< 2.5 hectares), medium ($2.5 >=$ landholding<5) and large ($>=5$ hectares). The reference category for landholding is small landholding.

We further estimate Instrumental Variable Probit (IV Probit) equations in view of the potential endogeneity of some of our main explanatory variables. Our inclination towards endogeneity is premised on a plausible bi-causal relationship between household poverty and returns on all crops harvested, on one hand, and between household poverty and returns on glutinous rice harvested, on the other. Instruments used for the respective endogenous variables are availability of a rice bank in the village (for returns on all crops harvested) and

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[11] For details, see Annim and Gaiha (2012).

availability of a rice bank and the presence of farmers' association or a trade union in the village (for returns on glutinous rice harvested per capita).

Availability of a rice bank in the village as an instrument for both returns on crops harvested and glutinous rice harvested is appropriate as it is expected that it will have a negative effect on both the yield and price of crops harvested and sold by households. On the other hand, presence of a rice bank in the village is unlikely to have a direct effect on the poverty status of a household. In another specification, a second instrument (presence of either a farmers' association or a trade union in the village) is added to availability of a rice bank in village. The search for another variable that correlates with returns on glutinous rice harvested but not household poverty status was unavoidable because of the non-convergence of the IV Probit estimation. We opted for the presence of either a farmers' association or a trade union in the village because such organizations are instruments for knowledge transfer relating to production techniques and marketing. Hence, we expect a significant correlation between such organisations and returns on glutinous rice harvested[12].

(ii)   Main Findings

One of our major findings is that higher returns on *all* crops reduce poverty. This finding applies to all three poverty indices. A related finding is that higher returns on glutinous rice also reduce poverty.

Village characteristics matter too. We examined the effect of average village level producer prices of *all* crops and of glutinous rice, and presence of a credit bank in the village. On the effect of all crops' and glutinous rice prices, our analysis consistently showed a poverty reducing effect for all three poverty measures. In other words, the higher the crops' or glutinous rice prices, the higher is the revenue and the lower the risk of poverty. Presence of a credit bank in a village consistently reduced poverty regardless of the measure used. To illustrate, households resident in villages with easier access to credit were 26 per cent less likely to be poor than those in villages without access to a credit bank. This evidence reinforces the case for financial inclusion in the current wave of financial sector reforms in Lao PDR.

Returns on crops harvested as well as returns on glutinous rice - the latter was significant in probits but not in IV probits for different measures of poverty - reduced poverty, but the effects were small.

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[12] For details, see Annim and Gaiha (2012).

Other household characteristics that consistently showed a poverty reducing effect are head of household's level of education, number of adults employed in non-agricultural activities in the household, and land holdings. To illustrate, in the context of food poverty, households with medium landholdings (between 2-5 ha) were 35 per cent less likely to be poor while those with larger landholdings (>5 ha) were 65 per cent less likely to be poor than those with small holdings (<2 ha).

Households in the Southern region (that is, in the following provinces - Saravane, Sekong, Champasack and Attapeu) were less likely to be poor than those in Vientiane. Across the three poverty measures, the HmongIuMien group was less likely to be poor compared to the Lao-Tai. Both midland and the upland areas were more likely to be poor than the lowland areas. In fact households in the midland and upland areas were, respectively, 45 per cent and 44 per cent more likely to be poor than their counterparts in the lowland areas.

From a broader perspective, poverty reduces with higher crop returns and rice prices presumably because farmers are net sellers of food. As lack of credit is a major constraint in raising yields, switching to high value crops or expanding livestock, easier access to the credit reduces poverty substantially. Education is linked to better awareness of market prices and easier access to technological options and non-farm activities, both of which raise and stabilise household incomes. Furthermore, large land holdings yield larger marketable surplus and help exploit better economies of scale in marketing. Regional variations reflect not just agro-climatic variations, but also differences in access to markets and thus further influence poverty rates. As discussed below, some of these findings are similar to those obtained for Cambodia.

(b) Cambodia

Despite a marked reduction in the headcount index of poverty during 1993-2007, a little under one-third of the population lives below the poverty line. As a vast majority of the poor (about 92 per cent) live in rural areas, factors related to agriculture and rural areas (e.g. size of landholding, access to markets, security of land title, irrigation, electrification) are likely to be significant drivers of poverty.

(i)   Data and Methodology

We have analysed the determinants of poverty using the Cambodian Socio-Economic Survey -2007 (CSES, 2007). It is a standard LSMS type survey comprising data from 3598 households from 360 villages. These villages are in fact a subsample of the CSES-2004, but the households are not necessarily the same as in 2004. There are various modules containing detailed household and village characteristics[13].

Our analysis builds on extant analyses in Knowles (2009) and MOP (2010). We analyse determinants of both overall poverty and food poverty, taking into account age of household head, human capital endowments (educational attainments of household head), land owned, whether the sources of income are diversified, security of land title, location in terms of distance from an all-weather road, other rural infrastructure (e.g. proportion of households using electricity), and vulnerability to disasters. To assess their contribution, a probit specification is used[14].

(ii)   Main Findings

A selection of the results on determinants of overall poverty is given below.

Let us begin with the effects of household characteristics on overall poverty.

The probability (used interchangeably with risk) of being poor varies negatively with household heads's age but at a diminishing rate (the effect of age squared is statistically significant but numerically negligible). Large households are more likely to be poor but this probability decreases as households become larger. Male-headed households are less likely to be poor but the effect of gender is weakly significant. Khmer households have considerably lower risk of poverty relative to others. In fact, the effect of being a Khmer is quite large. Classifying households as landless or marginal farmers, small and large farmers, our results point to considerably lower risks of poverty among small and large farmers relative to the landless and marginal farmers. Security of land title has a significant role in lowering the risk of poverty. Presumably, this acts as an incentive to making longer-term investments in technology that enhance yields. Educational attainments have large poverty reducing effects. The higher the educational attainments of household heads, the lower is the risk of poverty relative to the illiterate. The (marginal) effect of lower secondary education is, for example,

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[13] For details, see Azam et al. (2012).
[14] For model specification, see Azam et al. (2012).

twice as large as that of primary education. Diversified sources of income act as a cushion against market and other shocks. If a household is involved in one or more micro-enterprises, the risk of being poor is considerably lower. Turning to irrigation-a key determinant of agricultural yields, particularly rice-the higher the share of households with irrigated lands, the lower is the risk of poverty. Somewhat surprisingly, the marginal effect is small. The larger the proportion of households using electricity in a village, the lower was the probability of being poor. The effect, however, is small. As lack of market access constrains income earning opportunities-for example, remunerative prices for agricultural produce-access to an all-weather road is hypothesised to lower the risk of poverty. This is confirmed by our analysis, and the (marginal) effect is large, pointing to the priority of expanding access to all-weather roads in rural poverty reduction strategy. As emphasised earlier, the Cambodian economy –especially agriculture-is highly vulnerable to natural catastrophes (e.g. floods, droughts and storms). Our analysis corroborates a moderately higher risk of poverty in villages that experienced a natural catastrophe/disaster.

In sum, our analysis builds on earlier work (World Bank, 2009, Knowles, 2009) by assessing the contribution of household and village characteristics to the risks of overall poverty. While demographic characteristics matter, land holding size, a land title certificate, educational attainments of household heads, and ethnic affiliation matter considerably more. Some village characteristics also matter a great deal, especially access to all-weather roads. From the perspective of vulnerability, two results are significant: (i) diversified households face lower risks of poverty; and (ii) in disaster-prone villages, the risk of being pushed into poverty, other things being given, is moderately high.

Markets and Smallholders

The last few decades have seen significant changes in agricultural markets on account of several factors such as reduced state intervention and deregulation, changing food basket, growing urbanisation and emergence of supermarkets, and globalization of agricultural trade. Increasing intensification and diversification of agriculture are dependent on integration with markets (relatively small domestic markets and much larger and rapidly growing regional and global) and ultimately on the development of value chains. But agro-ecological characteristics and cross-border trade matter a great deal.

Agricultural households operate both as producers and consumers. While many of them are 'net buyers' of food and sellers of labour, some are producers and others perform more than

one activity. All of them need access to markets in order to get high returns on their resources of land, labour and capital, including human capital. Rural households with assets, non-farm income, and occupying favourable locations (irrigated regions with good infrastructure) have better access to markets than those who do not have one or more of these characteristics. When output prices rise, the latter are not able to take advantage either because they do not have enough surpluses to sell or easy access to market. A major priority therefore is how to make agricultural activities profitable for smallholders and those located in unfavourable agro-climatic regions.

Our analysis contributes to the empirical literature by investigating the supply response of farm households under market failures due to transactions costs and heterogeneous endowments. We take Cambodia as a case, an overwhelmingly rural society characterized mainly by subsistence farming. In doing so, we have taken account of the interrelationships among market participation, production and sales decisions. We further investigate whether there are any systematic differences in behavioural responses between small and large holders in terms of market participation and sales decisions. This has strategic importance as this might call for differential policy interventions for these two sub-sets of farming community, to focus attention on policies to increase market participation of the smallholders.

(i)   Data and Methodology

As the results obtained from the Cambodian Socio-Economic Survey-CSES 2004-are more robust presumably because it is a much larger sample than CSES 2007, a selection of the results based on the former is given below[15].

The CSES – 2004 is a standard type of the World Bank's LSMS (Living Standards Measurement Survey) and is the first multi-objective household survey undertaken in Cambodia. Data were collected over a period of 15 months from November 2003 through January 2005. A total of 14842 households were interviewed in 900 villages during a 15 month period. The 2004 CSES is also the first household survey that covers the entire country.

The 2004 CSES collected data on household consumption using two different data collection methods, i.e., recall questions similar to those used in previous surveys and a calendar month diary in which all household economic transactions were recorded. Consequently, the CSES-

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[15] Note, however, that some key results are replicated with CSES-2007. For details, see Azam et al. (2012).

2004 survey teams spent more than one month in each surveyed village. In addition to the data on household consumption and a wide range of social indicators, the CSES collected the data on daily time use of all household members, the data on sources of household income, the village data on land use and access to community and social services (for examples, roads, electricity, water, markets, school and health facilities), and the data on up to three prices from local markets for 93 food and non-food items.

We estimate the econometric model using the framework of the standard Heckman sample selection model, where the values of sales of agricultural outputs as well as the choice between autarky and selling regime were determined jointly. Three sets of regressions are run for: (i) total sales of all crops, (ii) sales value of marketed food crops, and (iii) sales value of marketed cash crops. Each regression has both a selection and a value component. We then split the sample into two parts: (a) a sample of small holders having operational land less than or equal to one hectare, and (b) a sample of large holders having operational land greater than one hectare, and run each regression for them.[16]

Exogenous set of regressors include variables theoretically expected to affect quantities to be sold as well as whether to participate in the market or not, that is, to select the marketing regime. Price of paddy is the most natural candidate to be included in the model. Paddy is the single most important crop in relatively less diversified Cambodian agriculture. Over 90 per cent of the cultivable land is devoted to paddy production. Hence, price of paddy is expected to be the principal determinant of agricultural supply response in Cambodia.

Three variables are included in the model to capture the effect of household endowments: land per worker, ownership of agricultural implements (plough, hand tractor, tractor or water pump), and land title. Secure land ownership motivates farmers to invest in land development and maintain soil quality. All of these are expected to have positive effects on marketed surplus and participation.

Ethnicity is included in the model to reflect the case that higher mutual trust and common belief and understanding affect the market participation through information sharing, thus reducing the fixed transaction costs. Theoretically, older and more experienced household heads have greater contacts; allowing trading opportunities to be discovered at lower costs;

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[16] A more detailed land size classification was ruled out because of the preponderance of farmers below 1 ha. For details, see Azam et al. (2012).

and this may also reflect the increased trust gained through repeated exchange with the same party. Among the other background characteristics of a household, a dummy for households having any of its members employed in a paid job is included to take into account non-farm earning opportunities.

Village level *median* rice yield is included in the model with a three-pronged objective of capturing state of technology use, climatic condition, and past investment. A dummy for risky region seeks to capture production risks posed by natural disasters - excessive rain, flood or drought.

Transaction costs are important determinants of market participation as well as the amount traded.

Variables used to capture transactions costs are: distance to the nearest market, distance to the nearest bus-stop, distance to the provincial capital, ownership of transport equipments (cart, bi-cycle or motor-cycle), ownership of information/communication assets (radio, television or telephone), village population density, and education of head of household. By increasing travel time and transport cost, distance to market outlets (or bus-stop, provincial capital) is expected to have a negative effect not only on market participation but also on the amount traded. It is thus related to variable transaction cost (VTCs). The other VTCs - for example, ownership of transport equipments - are expected to have positive influence on market participation as well as quantity sold. Access to communication/information networks essentially mitigates the fixed transactions costs and is thus likely to facilitate market participation only. Other information variables included to capture fixed transactions costs are education of head of household,[17] and (log) of village population density. A better educated head of household is assumed to be capable of higher level of information processing and well-networked within the community. Similarly, in a densely populated close-nit society information flow is assumed to be faster and better than in a sparsely populated community. Both of these variables are expected to affect market participation positively.

(ii)   Main Findings

Subsistence/semi-subsistence households might exhibit differential supply response for a number of reasons: first, the assets, technologies and incentives available to the poor and the

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[17] Alternatively, education could be included as an endowment variable as well.

non-poor may differ. This is, for example, the case if smallholders find themselves unable to share in the market-based growth for lack of skill, labour or land. Or, second, the behavioural responses (controlling for assets, technologies and incentives) may vary between small and large land holders. This is, for example, the case of risk aversion or lack of skill/or ability preventing the poor from taking advantage of market opportunities (Heltberg and Tarp, 2002). If the poor/vulnerable are to be able to reap benefits of larger economic growth process, it is important that their degree of market integration is increased.

Hence it is vital to understand the factors underlying systematic differences in market integration for various crops across farm households.

As revealed by regression results, while price of paddy, rice yield capturing the state of technology use, among other factors, farm size and ownership of agricultural equipment have similar positive and significant marginal effects, there are notable differences between small and large holders' responses.[18] For smallholders it is the rice yield rather than the price of paddy which has the highest marginal effect. Similarly, ownership of agricultural implements is far more important to smallholders than to large holders. The implication is that the interventions which are meant to build smallholders' agricultural assets provide access to technology through better extension services, irrigation during dry season, among others are likely to manifest in terms of the increased production (both food and cash crops) and the greater market integration of smallholders. The dummy variable for risky region affects large holders' supply response more severely than small holders'. One of the major findings of this analysis is that for small/subsistence holders, transaction costs turn out to be one of the main barriers for generating marketed surplus of food crops. Variables capturing variable transaction costs, that is, distance to market, distance to bus stop, distance to provincial capital and ownership of transport equipments all have expected signs and significant marginal effects on supply response. But the same is not true for large holders. This has far reaching policy implications e.g. developing rural infrastructures such as road networks connecting markets and storage facilities and access to information networks would potentially pay high dividends in terms of increased food production, which results in higher marketed surplus and commercialisation. This could potentially ensure better nutritional status and food security of the poor and reduce vulnerability of small and subsistence farmers. Similarly, secure land ownership facilitates market integration of subsistence farmers. For the large holders group, land title does not have a statistically significant

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[18] For details, see Azam et al. (2012).

marginal effect. Large holders are likely to be powerful rural elites and would feel more assured of their possessions than smallholders. Subsistence households having alternative earning sources (these are mostly paid domestic workers as suggested by data) to meet their cash requirements produce food crops only for their own consumption, and not for sale. The intuition is that smallholders do not need to commit forced sale of part of their produce to meet their emergency/urgent obligation as they have alternative sources of cash.

In sum, comparison between the marginal effects of the small and large holders reveals substantial qualitative and quantitative differences between the two groups. By providing technical support/ extension services and resolving land issues and land redistribution, targeted support in the form of basic agricultural assets can have high payoffs in terms of poverty alleviation, reduced vulnerability and increased food security. Furthermore, targeted support helps the poor to participate in the growth process and to benefit from the opportunities opened up by the exchange economy. Having secure land title is important for poverty alleviation and reducing vulnerability through increased participation of smallholders and subsistence farmers in markets and commercial sales.

Concluding Observations

There are important differences between Laos and Cambodia. Some striking differences include : while Cambodiais more exposed to external risks and is already a member of WTO, Laos is landlocked and still in preparation for joining WTO. The similarities are that both are poor, agrarian economies and in a process of transition to a more market-oriented policy regime. Agriculture is dominated by smallholders who are prone to catastrophic and increasingly market risks, lack of human and financial capital, and rural infrastructure. Their integration into high value chains is rendered difficult by high transaction costs. Ethnic divisions are deep and impede collective action. Institutional quality is low given high levels of corruption and weak accountability mechanisms. While both Laos and Cambodia appear to be on track to achieving MDG1 on plausible assumptions of GDP and agricultural growth, with the latter playing a more decisive role in poverty reduction, there are severe constraints to acceleration of GDP and agricultural growth.

Supply chains or value chains offer both opportunities and obstacles. The main obstacle is that the value chain imposes prohibitive costs on smallholders who often live in areas with poor infrastructure, weak credit and input support, and outdated technology. An imperative for the government is to provide public goods (infrastructure, food safety standards and a favourable environment for enforcing contracts) and facilitate collaboration with forward-

looking private players in providing inputs and transferring technology to smallholders. Producers/ farmers associations would also help improve quality and marketing of produce.

Our analysis of integration of smallholders into markets in Cambodia is rich in insights into the barriers that come in their way.

For smallholders it is the rice yield rather than the price of paddy which has the highest marginal effect. Similarly, ownership of agricultural implements is far more important to smallholders than to large holders. The implication is that the interventions which are meant to build smallholders' agricultural assets provide access to technology through better extension services, irrigation during dry season, among others are likely to have higher payoff in terms of increased production (both food and cash crops) and greater market integration. Similarly, secure land ownership facilitates market integration of subsistence farmers. For large holders group land title does not have a significant effect. Large holders are more likely to be powerful rural elites and would feel more assured about their possession than smallholders.

A related but important point is that, for small/subsistence holders, transaction costs are one of the main barriers for generating marketed surplus of food crops. Variables capturing variable transaction costs, that is, distance to market, distance to bus stop, distance to provincial capital and ownership of transport equipments all have expected sign and significant effects on supply response. But the same is not true for large holders. Developing rural infrastructures such as road networks connecting markets and storage facilities and access to information networks would thus potentially pay high dividends in terms of increased food production resulting in higher marketed surplus and commercialisation- especially for small holders.

To conclude, an accelerated transition to a more market-oriented policy regime may promote not just a more efficient agriculture but also a more equitable outcome.

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