Agriculture, Markets, and Poverty: 
A Comparative Analysis of Lao PDR and Cambodia

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ABSTRACT

Lao PDR and Cambodia have been transitioning to a market-oriented policy regime. Both are agrarian economies with agriculture contributing about one-third of the gross domestic product (GDP). This study assessed their prospects of achieving the first Millennium Development Goal (MDG 1, extreme poverty eradication) and the centrality of agricultural growth in achieving this goal. As these are macro relationships, richer insights on determinants of poverty were obtained by detailed analyses of recent household surveys in these countries. 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, focusing on barriers between large and smallholders (e.g., 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.

INTRODUCTION

Both Lao PDR and Cambodia have been transitioning to a market-oriented policy regime. Compared with other developing countries in the Southeast Asia region, they have performed well in recent years. The growth rate of Lao PDR’s annual gross domestic product (GDP) was just under 7 percent between 2000 and 2009 (World Bank 2011). Cambodia’s performance in 1997–2008 was also impressive (Guimbert 2009). In fact, Cambodia is one of only 46 countries among 194 countries that achieved 7 percent annual growth on the average for 14 consecutive years. This is unusual by post-conflict standards. The two countries are agrarian economies with agriculture contributing about one-third of the GDP. A vast majority depend on agriculture as the main source of livelihood. Recent poverty rates are high; about one-third of the population is poor and most of the poor live in rural areas.

This paper first analyzes agriculture’s contribution to GDP growth. This is followed
by an analysis of the prospects of achieving the first Millennium Development Goal (MDG 1: extreme poverty eradication) and the centrality of agricultural growth in achieving this goal. As these are macro relationships, more in-depth insights on the determinants of poverty were obtained by detailed analyses of recent household surveys in Lao PDR 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 the integration of farmers (especially smallholders) into markets, focusing on barriers between large and smallholders (e.g., transaction costs). Finally, insights from a broad policy perspective are offered.

**AGRICULTURE AND GDP**

**Lao PDR**

A model is posited, in which GDP is related to its own lagged value, an instrumented measure of agricultural value added and a dummy variable for the period 2000–2008. With this specification, the long-run effect of agricultural growth rate on GDP can be estimated. 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 2000–2008 aims to capture the effects of significant policy changes and other changes in the economic environment that cannot be captured with the available data. This regression was estimated using annual observations over the period 1990–2008.

While GDP is tracked closely by its own lagged value, agricultural value added 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 percent growth in agricultural value added will result in a 1.59 percent GDP growth. The dummy for 2000–2008 has a statistically significant but small negative effect.

**Cambodia**

The link between GDP and agricultural value added was analyzed (Gaiha and Azam 2011). The paucity of time series data on public and private investment, infrastructure, and stocks of human capital, however, constrained the analysis of GDP determinants. The specification that best fitted the data 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. Data were obtained from the World Development Indicators (World Bank 2010a). The relationship specified above was estimated using ordinary least squares (OLS).

The elasticity of GDP with respect to agricultural value added is high (0.76), implying that a 1 percent higher agricultural value added is likely to result in a 0.76 percent higher GDP.

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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. This means 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.
In short, the short-run elasticities of GDP with respect to agricultural value added are high in both Lao PDR and Cambodia. Moreover, the long-run elasticity for Lao PDR is more than twice as large as the short-run elasticity. So even though the share of agriculture in GDP has declined in both countries, agriculture’s role in stimulating overall growth rate remains important.

**PROSPECTS OF ACHIEVING MDG 1**

**Lao PDR**

**Incidence of poverty**

A recent Lao government report (MOP 2010) offers a comprehensive review of poverty based on the four Lao Expenditure and Consumption Surveys (LECS 4). The key findings are distilled here, followed by an 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 USD 1.25 (PPP 2005) per day (for convenience of exposition, this is subsequently referred to as “the dollar poverty line”).

Less than a third (27.6%) of the country’s population is poor in terms of consumption expenditure, based on the national poverty line of 1.5961.9 Lao kip (LAK) (USD 1 = LAK 7,937.42). When the dollar poverty line is used, more than a third of the population is considered poor. On the other hand, the incidence of food poverty (food expenditure < 2,100 calories per capita per day) is slightly lower; about one of every four households is poor in terms of food expenditure (MOP 2010).

**Poverty, growth, and MDG 1**

The implications of the different agricultural and GDP growth rates are analyzed as regards to the goal of reducing by half by 2015 the dollar poverty in 1990. As four estimates of this measure are available (for 1992/93, 1997/98, 2002/03, and 2007/08), the elasticities of poverty were computed with respect to GDP and agricultural value added (Table 1). Note that they vary over time.

The procedure by Besley and Burgess (2003), shown by equation (1), was used to compute the growth rates of GDP and agricultural value added required to halve the poverty index \( g_{\text{half}} \) in 25 years 1990–2015. \( \eta \) 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

### Table 1. Poverty elasticity, growth rates, and MDG 1

<table>
<thead>
<tr>
<th>Year</th>
<th>H (%)</th>
<th>LogH</th>
<th>LogGDP</th>
<th>LogAgr</th>
<th>Pov. Elas. (GDP)</th>
<th>Pov. Elas. (Agr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>55.68</td>
<td>4.02</td>
<td>20.77</td>
<td>20.25</td>
<td>0.3596</td>
<td>0.5853</td>
</tr>
<tr>
<td>1997</td>
<td>49.32</td>
<td>3.90</td>
<td>21.10</td>
<td>20.45</td>
<td>-0.4121</td>
<td>-0.5521</td>
</tr>
<tr>
<td>2002</td>
<td>43.96</td>
<td>3.78</td>
<td>21.39</td>
<td>20.66</td>
<td>-0.5993</td>
<td>-0.9719</td>
</tr>
<tr>
<td>2006</td>
<td>37.44</td>
<td>3.62</td>
<td>21.65</td>
<td>20.83</td>
<td>-0.5793</td>
<td>-0.9719</td>
</tr>
<tr>
<td>Average</td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td> </td>
<td>-0.4570</td>
</tr>
</tbody>
</table>

\[
g_{\text{half}} = 0.0616 \\
\text{Required growth rate} = 6.16\% (6.70\%) (4.31\%)
\]

*Note: 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).*
of agricultural growth in reducing poverty. This is corroborated by the elasticities obtained from large cross-sections of developing countries.\(^4\)

\[
g_{\text{half}} = \frac{\log\left(\frac{1}{2}\right)}{25n} \quad (1)
\]

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 the simulations. Thus, if the trend growth rates are maintained over time, then Lao PDR is on track in achieving MDG 1 by 2015. In short, the prospects of achieving MDG 1 are likely high.

**Cambodia**

**Incidence of poverty**

Cambodia has grown rapidly, sustaining its growth over an extended period of time. GDP per capita nearly tripled during 1994–2008, from USD 248 to USD 739.

As expected, the headcount poverty index markedly declined from 47 percent in 1993 to 35 percent in 2004 to 30 percent in 2007, a reduction of 17 percentage points over a period of 13 years.\(^5\) Despite these decreases, however, a little under one-third of the population still lives below the poverty line.

The headcount poverty index relative to the food poverty line also decreased but only slightly, from 19.7 percent in 2004 to 18 percent, 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 percent of the rural population was poor in 2007, compared with about 22 percent for other urban and just under 1 percent for Phnom Penh. In general, the vast majority (92.3%) of the poor belong to the rural category. The share of rural poor rose even more in the period 2004–2007, from 91.7 percent to 92.3 percent.

**Poverty, Growth, and MDG 1**

The implications of the different agricultural and GDP growth rates are analyzed as regards the goal of reducing the 1990 dollar poverty by half by the year 2015. With the available four estimates of this measure (for 1993, 1997, 2004, and 2007), the elasticities of poverty with respect to GDP and agricultural value added were computed. A similar exercise was carried out for food poverty estimates. These elasticities are given in 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 1993–1997 is > 1, implying a more than proportionate reduction in poverty in response to a 1 percent increase in GDP growth rate.\(^6\) This is followed by a steep reduction (down to 0.06) in the elasticity between 1997 and 2004. The elasticity rose sharply during 2004–2007 (0.44), implying a considerably

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4 For details, see Imai, Gaiha, and Thapa (2011).

5 The poverty line comprises two components: (1) the cost of a food consumption bundle required to obtain 2,100 calories per person per day and (2) the minimum consumption level required to meet basic non-food needs (clothing, housing, health care, education, etc.). It is calculated separately for different regions with different consumption patterns and price levels. The average national poverty line for 2007 was 2470 Cambodian riel per capita or about USD 0.61 (USD 1 = KHR 4,062 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).
more rapid poverty reduction in this period than in the previous. The overall poverty elasticity from 1993–2007 is moderately high (0.51).

Regarding the overall poverty-agricultural value added elasticities, these 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 1993–2007, the elasticity is 0.72, implying that a 1 percent faster agricultural value added growth is likely to reduce overall poverty by 0.72 percent. This corroborates the important role of agricultural growth in poverty reduction.

Food-poverty elasticities are consistently lower than overall poverty elasticities. The food poverty-GDP elasticity is higher in 1997–2004 than in 2004–2007; it is moderately high (0.31) over the entire period (1993–2007). 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 to agricultural value added in 1993–2007 is 0.76; it is 0.31 with respect to GDP. This suggests that agricultural growth matters a great deal in both overall and food poverty. World Bank (2006, 2010b) has a less optimistic assessment. A limitation is that World Bank’s assessments do not consider the centrality of agriculture in GDP growth.

As regards the prospects of achieving MDG 1, the analysis suggests that GDP is likely to grow at a little over 8 percent annually (the trend growth rate observed during 1993–2007) and agricultural value added at 3.7 percent per annum (Table 3). The required GDP growth rate consistent with MDG 1 is slightly lower (6.14%), assuming that the time span used for simulation is 22 years (1993–2015). This implies that Cambodia is on track to achieving the goal of halving poverty by 2015. However, agriculture must grow annually at a slightly faster rate of 4.3 percent. Annual GDP growth must also accelerate to 10 percent. This is not surprising given the lower food poverty-GDP elasticity. As Cambodia has grown at 10 percent or more each year in 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 indicated by recent macro figures: GDP growth of 0.09 percent in 2009 and 5.96 percent in 2010 (World Bank 2012).

Growth rate of agricultural value added (4.1%) required to reduce food poverty by half is slightly higher than the trend growth rate (3.7%). Indeed, if the analysis of agriculture’s intensification is valid, subject to the caveat that the contributions of seeds and irrigation are imprecise, then an increase of 2 percent in each of the three inputs (fertilizer, machinery, and labor) is likely to translate into a growth rate of about 5 percent and a much faster GDP growth rate.\textsuperscript{7}

In short, contrary to other assessments, there are grounds for optimism in achieving MDG 1.\textsuperscript{8}

DETERMINANTS OF POVERTY

Lao PDR

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 (i.e., GDP growth

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\textsuperscript{6} For ease of comparison, (absolute) elasticities are used.

\textsuperscript{7} For details, see Gaiha and Azam (2011).

\textsuperscript{8} See also World Bank (2006, 2010b) for a less optimistic assessment. A limitation is that World Bank’s assessments do not consider the centrality of agriculture in GDP growth.
Table 2. Poverty elasticities with respect to gross domestic product (GDP) and agricultural value added (Ag. VA)

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall poverty (%)</th>
<th>Food poverty (%)</th>
<th>Log of GDP</th>
<th>Log of Ag. VA</th>
<th>Log of overall poverty</th>
<th>Log of food poverty</th>
<th>Overall poverty elasticity to GDP</th>
<th>Overall poverty elasticity to Ag. VA</th>
<th>Food poverty elasticity to GDP</th>
<th>Food poverty elasticity to Ag. VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>47.0</td>
<td>24.0</td>
<td>21.516</td>
<td>20.735</td>
<td>3.850</td>
<td>3.178</td>
<td>-1.0270</td>
<td>-1.379</td>
<td>-0.347</td>
<td>-1.162</td>
</tr>
<tr>
<td>1997</td>
<td>36.1</td>
<td>NA</td>
<td>21.773</td>
<td>20.926</td>
<td>3.586</td>
<td>NA</td>
<td>-0.0646</td>
<td>-0.216</td>
<td>-0.347</td>
<td>-0.363</td>
</tr>
<tr>
<td>2004</td>
<td>34.8</td>
<td>19.7</td>
<td>22.341</td>
<td>21.096</td>
<td>3.549</td>
<td>2.980</td>
<td>-0.4470</td>
<td>-0.584</td>
<td>-0.278</td>
<td>-0.363</td>
</tr>
<tr>
<td>2007</td>
<td>30.1</td>
<td>18.0</td>
<td>22.665</td>
<td>21.344</td>
<td>3.404</td>
<td>2.890</td>
<td>-0.5130</td>
<td>-0.726</td>
<td>-0.313</td>
<td>-0.763</td>
</tr>
</tbody>
</table>

Source: Poverty estimates are from MOP (2010). GDP and agricultural value added are predicted from the authors’ 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 MDG 1

<table>
<thead>
<tr>
<th>Growth rate</th>
<th>Annual GDP growth rate</th>
<th>Annual agricultural value added growth rate</th>
<th>Annual GDP growth rate</th>
<th>Annual agricultural value added growth rate</th>
<th>Year</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual growth</td>
<td>0.081</td>
<td>0.037</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Growth1</td>
<td>0.061</td>
<td>0.043</td>
<td>0.100</td>
<td>0.041</td>
<td>22 years</td>
<td>(1993–2015)</td>
</tr>
<tr>
<td>Required Growth2</td>
<td>0.054025*</td>
<td>0.03817*</td>
<td>0.088508+</td>
<td>0.036</td>
<td>25 years</td>
<td>(1990–2015)</td>
</tr>
</tbody>
</table>

Note: Actual growth rates were 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, $\beta$ is the annual growth rate. Required growth rates were computed using the formula in Besley and Burgess (2003), as given in the section on Lao PDR. The results are based on assumptions of 22 and 25 years. For details, see Gaiha and Azam (2011).
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, ethnic affiliation, and access to credit, among others.

The analysis based on a recent household survey (LECS IV 2007/08) 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. Although the service and industrial sectors have contributed more to GDP growth in Lao PDR in the past few years, most of the poor households still depend on agriculture.

**Data and methodology**

The most recent (fourth) round of the LECS (LECS IV) was used to estimate two separate sets of equations: (1) effect of returns on crops harvested (per capita) 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 were also used.

The Lao Statistics Bureau (LSB) has collected data on household composition, consumption expenditure, health, occupation, and village-level characteristics every five years since 1992. The datasets are nationally representative and capture information from all the provinces. 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, the health component of the LECS IV explored issues on both health status and healthcare-seeking behavior, whereas the third round only covered health status. With a response rate of 99.9 percent, LECS IV has data from 8,296 households in 518 villages.

Two types of econometric estimation techniques (probit and instrumental variable [IV] probit) were used. 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 USD 1.25 [PPP 2005]). Explanatory variables include returns on crops harvested, village price of crops sold, age of household head, a Gini coefficient district level consumption expenditure inequality, and education of household head.

Household head education is categorized as primary or below, lower secondary, upper secondary and vocational or university education, with primary or below as the reference category. Demographic characteristics include number of adult members in a household and number of children less than five years old 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 categorized as lowland, midland, and upland, with lowland as the reference group. Burglary is a village-level variable that captures the degree to which burglary is a concern. This is coded

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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.
11 For details, see Annim and Gaiha (2012).
as major and minor, with no major concern
as the reference group. Urban residence is
a dummy with urban residence coded as 1
and 0 otherwise. A household head’s ethnic
group is categorized as Lao-Tai, MonKhmer,
ChineTibet, and HmongIuMien. The base
category is Lao-Tai. Region is grouped into four
locations: 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 the base region for
the econometric estimation. Landholding of the
household is categorized as small (< 2.5 ha),
medium (≥ 2.5 ha but < 5 ha), and large (≥ 5 ha).
The reference category is small landholding.

Instrumental variable probit (IV probit)
equations were estimated in view of the potential
endogeneity of some of the main explanatory
variables. The inclination toward 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 availability of a rice bank
and 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 is
appropriate as an instrument for both returns on
crops harvested and glutinous rice harvested
because it is expected to 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) was added to the availability of a rice bank in the 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. Presence of either a farmers’ association or a trade union in the village was chosen because such organizations are instruments for knowledge transfer relating to production techniques and marketing. Hence, a significant correlation can be expected between such organizations and returns on glutinous rice harvested.12

Main findings

A major finding 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 also. The
effect of average village level producer prices
of all crops and glutinous rice and presence
of a credit bank in the village was examined.
As regards the effect of the prices of all crops
and glutinous rice, the analysis consistently
showed a poverty reducing effect for all three
poverty measures. Thus, the higher the crops’ or
glutinous rice’s 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 percent less
likely to be poor than those in villages without

12 For details, see Annim and Gaiha (2012).
and help exploit better economies of scale in marketing. Regional variations reflect not just agro-climatic variations, but also differences in access to markets, thus further influencing poverty rates. Some of these findings are similar to those obtained for Cambodia.

Cambodia

Despite a marked reduction in the headcount index of poverty during 1993–2007, a little under one-third of the population still lives below the poverty line. As the vast majority of the poor (about 92%) 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.

Data and methodology

The determinants of poverty were analyzed using the Cambodian Socio-Economic Survey 2007 (CSES 2007). CSES 2007 is a standard living standards measurement survey (LSMS) type, comprising data from 3,598 households in 360 villages. The villages are a subsample of the CSES 2004, but the households are not necessarily the same as in 2004. Its various modules contain detailed household and village characteristics.13

The analysis builds on extant analyses in Knowles (2009) and MOP (2010). The determinants of both overall poverty and food poverty were analyzed, taking into account age of household head, human capital endowments (educational attainment 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

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13 For details, see Azam, Imai, and Gaiha (2012).
Main findings

The probability (used interchangeably with risk) of being poor varies negatively with household heads’ 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.

There are considerably lower risks of poverty among small and large farmers relative to 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 yield-enhancing technologies. Educational attainments have large poverty-reducing effects. The higher the educational attainment of household heads, the lower the risk of poverty relative to the illiterate. For example, the (marginal) effect of lower secondary education is 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 microenterprises, the risk of being poor is considerably lower.

Irrigation is a usual key determinant of agricultural yields, particularly rice. This case is not different. The analysis showed that the higher the share of households with irrigated lands, the lower the risk of poverty. Somewhat surprisingly, however, the marginal effect is small. Similarly, the larger the proportion of households using electricity in a village, the lower the probability of being poor, but the effect is small.

As lack of market access constrains income-earning opportunities (e.g., remunerative prices for agricultural produce), access to an all-weather road was hypothesized to lower the risk of poverty. This was confirmed by the analysis: the (marginal) effect is large, pointing to the importance of expanding access to all-weather roads as a rural poverty reduction strategy. Moreover, there is a moderately high risk of poverty in villages that experienced a natural catastrophe/disaster. It is noted that the Cambodian economy, especially agriculture, is highly vulnerable to natural catastrophes (e.g., floods, droughts, and storms).

In summary, the 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. Although demographic characteristics matter, land holding size, security of land title, educational attainment of household head, and ethnic affiliation were considerably more significant. Some village characteristics also matter a great deal, especially access to all-weather roads. From the perspective of vulnerability, two results are significant: (1) diversified households face lower risks of poverty; and (2) in disaster-prone villages, the risk of being pushed into poverty, other things being equal, is moderately high.

MARKETS AND SMALLHOLDERS

The past 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 urbanization 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 markets) 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. Although many of them are net buyers of food and sellers of labor, 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, labor, and capital, including human capital. Rural households with assets, non-farm income, and occupying favorable 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 for those located in unfavorable agro-climatic regions.

This study contributes to the empirical literature by investigating the supply response of farm households under market failures due to transactions costs and heterogeneous endowments. Taking Cambodia as a case, an overwhelmingly rural society characterized mainly by subsistence farming, the analysis considered the interrelationships among market participation, production, and sales decisions. Further, it investigated whether there are any systematic differences in behavioral responses between small and large holders in terms of market participation and sales decisions. This has strategic importance as the outcome may 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.

Data and methodology

As the results obtained from the Cambodian Socio-Economic Survey (CSES) 2004 are more robust (presumably due to its much larger sample than CSES 2007), a selection of the results based on it is given below.\textsuperscript{15}

The CSES 2004 is a standard type of the World Bank’s LSMS. It is the first multi-objective household survey undertaken in Cambodia. It is also the first household survey that covers the entire country. Data were collected over 15 months, from November 2003 through January 2005. A total of 14,842 households were interviewed in 900 villages.

The CSES 2004 collected data on household consumption using two data collection methods: recall questions similar to those used in previous surveys and a calendar month diary where all household economic transactions were recorded. Consequently, the CSES 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 data on daily time use of all household members, sources of household income, village data on land use, and access to community and social services (e.g., roads, electricity, water, markets, school, and health facilities). It also collected data on up to three prices of 93 food and non-food items from local markets.

\textsuperscript{15} Some key results, however, are replicated in CSES 2007. For details, see Azam, Imai, and Gaiha (2012).
The econometric model was estimated 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 were run for: total sales of all crops, sale value of marketed food crops, and sale value of marketed cash crops. Each regression has both a selection and a value component. The sample was then split into two parts: (1) a sample of smallholders having operational land less than or equal to one hectare and (2) a sample of large holders having operational land greater than one hectare. A regression was run for each of them.\[16\]

An exogenous set of regressors includes variables theoretically expected to affect quantities to be sold as well as market participation (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 Cambodia, which has a relatively less diversified agriculture. More than 90 percent of 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 were included in the model to capture the effect of household endowments: land per worker, ownership of agricultural implements (plow, 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 were expected to have positive effects on marketed surplus and participation.

Ethnicity was included in the model to reflect the case that higher mutual trust and common belief and understanding affect market participation through information sharing, thus reducing fixed transaction costs. Theoretically, older and more experienced household heads have more contacts, allowing trading opportunities to be discovered at lower costs. This may also reflect the increased trust gained through repeated exchanges 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 was included to take into account non-farm earning opportunities.

Village level median rice yield was included in the model for the 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 such as 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 equipment (cart, bicycle, or motorcycle), ownership of information/communication assets (radio, television, or telephone), village population density, and education of household head. By increasing travel time and transport cost, distance to market outlets (or bus stop, provincial capital) was 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 (e.g., ownership of transport equipment) were expected to have a positive influence on market participation as well as quantity sold. Access to communication/information networks

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16 A more detailed land size classification was ruled out because of the preponderance of farmers having less than 1 ha. For details, see Azam, Imai, and Gaiha (2012).
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 attainment of household head,\textsuperscript{17} and (log) of village population density. A better educated household head is assumed to be capable of higher level information processing and well-networked within the community. Similarly, in a densely populated close-knit 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.

\textbf{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 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, labor, or land. Second, the behavioral responses (controlling for assets, technologies, and incentives) may vary between small and large landholders. 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 the benefits of larger economic growth processes, 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, although price of paddy, rice yield capturing the state of technology use, farm size, and ownership of agricultural equipment, among other factors, have similar positive and significant marginal effects, there are notable differences between small and large holders’ responses.\textsuperscript{18} For smallholders, it is rice yield rather than price of paddy that has the highest marginal effect. Similarly, ownership of agricultural implements is far more important to smallholders than to large holders. The implication is that interventions that are meant to build smallholders’ agricultural assets and provide access to technology through better extension services (e.g., irrigation during dry season) are likely to lead to increased production (both food and cash crops) and greater market integration of smallholders. The dummy variable for risky region affects large holders’ supply response more severely than smallholders’.

A major finding of this analysis is that transaction costs are main barriers to generating marketed surplus of food crops for smallholders. Variables capturing variable transaction costs (i.e., distance to market, distance to bus stop, distance to provincial capital, and ownership of transport equipment) 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. For instance, 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, resulting in higher marketed surplus and commercialization. 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

\textsuperscript{17} Alternatively, education could be included as an endowment variable as well.

\textsuperscript{18} For details, see Azam, Imai, and Gaiha (2012).
the large holders group, land title does not have a statistically significant 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 (as suggested by data, these are mostly paid domestic workers) to meet their cash requirements produce food crops for their own consumption only. This suggests that smallholders do not need to commit part of their produce to forced sale to meet their emergency/urgent obligation because they have alternative sources of cash.

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

CONCLUDING OBSERVATIONS

There are important differences between Lao PDR and Cambodia. For example, Cambodia is more exposed to external risks and is already a member of the World Trade Organization (WTO), whereas Lao PDR is landlocked and still preparing to join WTO.

On the other hand, they are similar in that both are poor, agrarian economies, and transitioning to a more market-oriented policy regime. In both countries, agriculture is dominated by smallholders who are prone to catastrophes and increasing market risks and are lacking in human and financial capital and rural infrastructure. High transaction costs hinder the smallholders’ integration into high value chains. Ethnic divisions are deep and impede collective action. Institutional quality is low given high levels of corruption and weak accountability mechanisms. Although both Lao PDR and Cambodia appear to be on track to achieving MDG 1 on plausible assumptions of GDP and agricultural growth, with the latter playing a more decisive role in poverty reduction, both countries face severe constraints to acceleration of GDP and agricultural growth.

Supply chains or value chains offer both opportunities and obstacles. The main obstacle is that value chains impose prohibitive costs on smallholders who often live in areas with poor infrastructure, weak credit and input support, and outdated technology. It is thus imperative for government to provide public goods (infrastructure, food safety standards, and favorable environment for enforcing contracts) and facilitate collaboration with forward-looking private players that can provide inputs and transfer technology to smallholders. Producers/farmer’s associations would also help improve quality and marketing of produce.

The analysis of integration of smallholders into markets in Cambodia provided rich insights into the barriers that come their way. For smallholders, it is rice yield rather than price of paddy that has the highest marginal effect. Similarly, ownership of agricultural implements is far more important to smallholders than to large holders. The implication is that interventions that are meant to build smallholders’ agricultural assets and provide access to technology through better extension services (e.g., irrigation during dry season) 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. Land title does not have a significant effect on the large holders’ group, however, 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 smallholders, transaction costs are one of the main barriers for generating marketed surplus of food crops. Also, variables capturing variable transaction costs (i.e., distance to market, distance to bus stop, distance to provincial capital, and ownership of transport equipment) all have the expected sign and significant effects on supply response. But the same is not true for large holders. Developing rural infrastructure 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 commercialization, especially for smallholders.

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.

REFERENCES


