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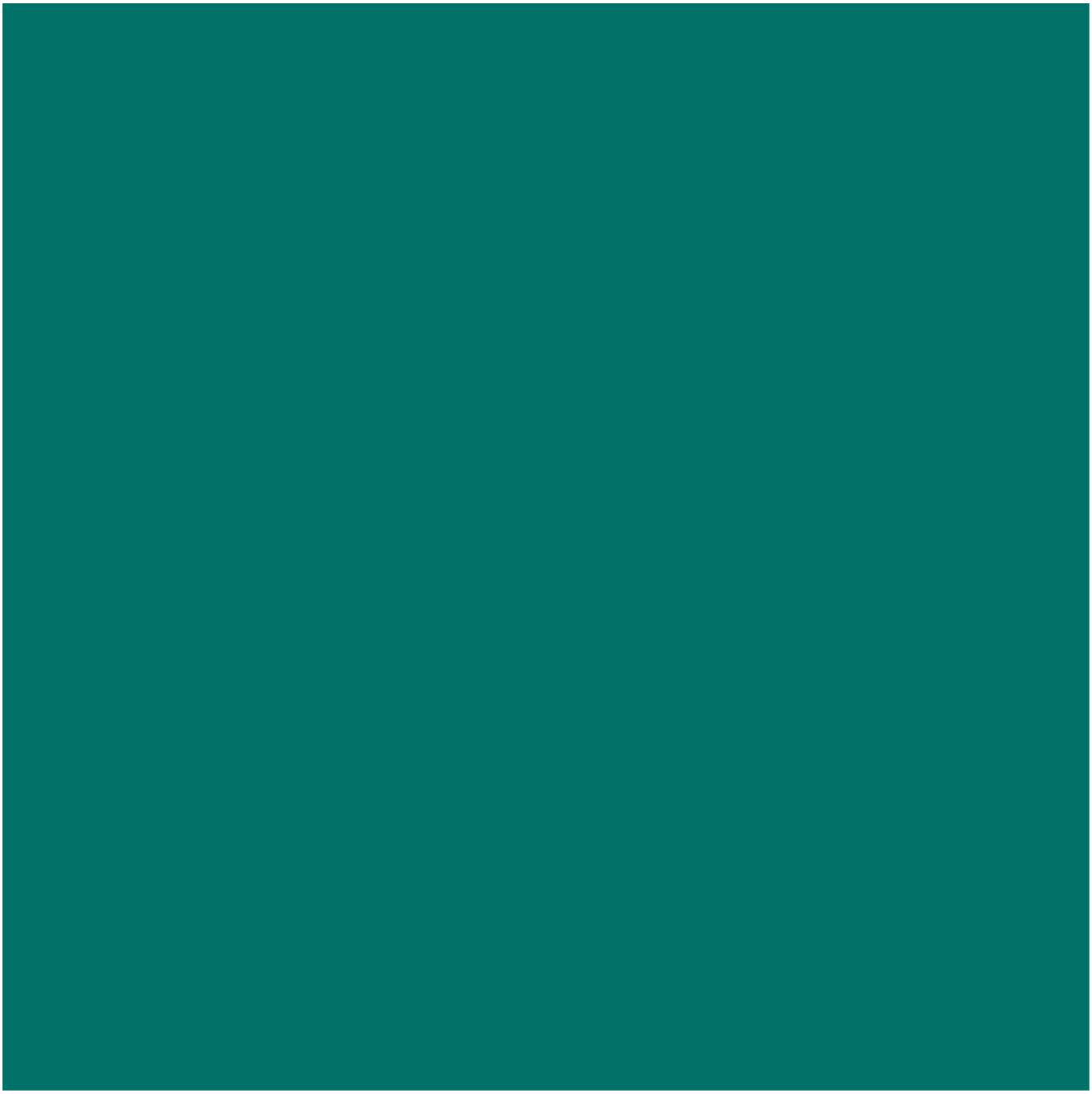
Determinants of Poverty in LAO PDR



Foreword

This study on Laos is part of a series of annual studies, undertaken by various Swedish universities and academic research institutes in collaboration with Sida. The main purpose of these studies is to enhance our knowledge and understanding of current economic development processes and challenges in Sweden's main partner countries for development co-operation. It is also hoped that they will have a broader academic interest and that the collaboration will serve to strenghen the Swedish academic resource base in the field of development economics.

This report has been prepared by Magnus Andersson, Anders Engvall and Ari Kokko at the Stockholm School of Asian Studies at Stockholm School of Economics. It analyses the determinants of poverty Lao PDR through econometric modelling of household level consuption based on comprehensive primary date from the Lao Expenditure and Consumption Survey 2002/2003. It also provides a unique mapping of poverty broken down on regions as well as on main ethnic groups. The analysis identifies five crucial areas for reducing poverty: (i) reducing the number of dependents in households, (ii) investment in education, not least for girls, (iii) promotion of entrepreneurship, (iv) raising agricultural productivity, and (v) improvement of the infrastructure.

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Content

Introduction

In October 2003, the National Assembly of Lao PDR authorized the country's Government to implement the National Growth and Poverty Eradication Strategy (NGPES), which constitutes the Government's overall development framework (Government of Lao PDR, 2003). With the NGPES, the Government made a commitment to focus economic and social policies towards poverty alleviation.

Understanding poverty is of key importance for designing an effective poverty reduction strategy. Numerous efforts have been made to analyze the character of and the roots of poverty in Lao PDR (see for example ADB, NSC & SPC, 2001, Kakwani et al, 2002, and Luther, 2000). The bulk of existing studies are based on qualitative sources and aggregate statistics. This report is the result of an effort to analyze the determinants of poverty using econometric modelling of household level consumption, drawing on a detailed new micro-level dataset, the Lao Expenditure and Consumption Survey 2002/2003.1 This survey, known as LECS3 provides detailed data for studying the determinants of poverty in the country.

LECS3 is a comprehensive socio-economic survey of the living standards of households in all provinces of Lao PDR. The survey was carried out by the National Statistical Centre (NSC) with donor support. Its principal purpose was to facilitate a quantitative poverty analysis and to develop a poverty profile for the country. The 2002/03 LECS follows two previous surveys conducted in 1992/93 and 1997/98. A set of social and economic indicators based on LECS3 were published in early 2004 (NSC, 2004) with additional detailed data presented in Richter et al. (2005). These publications provide detailed poverty data that can be used to relate poverty status to a range of household and individual characteristics. The present report is centred on an econometric model that extends the earlier studies by focusing on multiple regression analysis of the determinants of poverty. This approach acknowledges the complex relationships leading to poverty and examines how a particular variable affects poverty conditional on the level of other potential determinants and control variables. The objective is to allow a more comprehensive discussion of the patterns and causes of poverty in Lao PDR. This report follows earlier efforts to use analyse LECS data using multiple regression

[1] We are grateful to the National Statistics Centre, Lao PDR, and in particular Deputy Director General Phonesaly Souksavath, for making the LECS3 dataset available.

analysis, albeit with important differences. Kakwani et. al (2002) analysed LECS2 highlighting a large number of determinants of poverty. Warr (2005) studied the impact of roads on poverty using both LECS2 and LECS3 data, finding a positive effect of road access on household level consumption.

The regression model used to assess the determinants of poverty in Lao PDR permits inferences to be made about the direction and strength of the relationship between a set of independent variables and the dependent variable. However, it should be noted that the model cannot prove causality. Before the econometric exercise, we will therefore discuss the causes of poverty from a theoretical perspective, and use the econometric results to assess whether there is support for the various theoretical hypotheses. Thanks to the comprehensive information provided in the survey, there are also possibilities for some more explorative analysis, where we test the impact of variables with more uncertain theoretical effects.

A further objective of this analysis is to provide means to assess the likely impact on the incidence of poverty in Lao PDR of specific policies seeking to improve the welfare of the population. This is of particular interest to policy makers, both domestic and in the donor community.

In developing the present model, attention has been paid to three factors deemed to be of particular interest for understanding poverty in Lao PDR: geographic variations, ethnicity and economic growth. Each of these creates particular challenges concerning data availability and econometric method. Geographic variations are studied through inclusion of provincial variables in welfare regressions, as well as through separate regressions for different geographic areas. The impact of ethnic factors is studied through inclusion of ethnic variables, separate regressions for different ethnic groups, and decomposition of ethnic effects. However, exploring the effects of economic growth is more challenging, since the available data set only contains observations from a single survey. To analyze the effects of economic growth on poverty, macro economic developments since the last LECS are studied and related to the changes in poverty incidence and structure.

Since the chosen econometric method can have a strong influence on the results, the report includes a detailed analysis of the methodology and how the empirical model of poverty determinants is related to the reality in Lao PDR. Per capita consumption (total household consumption divided by the number of household members), rather than income, is used as the basic measure of individual welfare or poverty in this report. The consumption measure includes food and non-food goods and services, whether purchased, home-produced, or received as a gift or payment in kind.

The econometric model of poverty determinants includes demographic data such as age and sex of household members, education levels, landholding, village characteristics and access to public goods. As a test of sensitivity to underlying assumptions, alternative regression models are also examined.

The analysis identifies five principal elements of a poverty reduction strategy for Lao PDR. These include (1) reduced numbers of dependents in households, (2) investments in (female) education, (3) efforts to stimulate entrepreneurship, (4) adoption of measures to raise agricultural productivity, and (5) improved infrastructure. In addition, it is clear that stable macroeconomic development is a precondition for generating growth and alleviating poverty,

The report begins with a macroeconomic overview covering significant changes to the Lao economy since the first LECS. This is followed by an analysis of the broad trends of poverty incidence and inequality. A stylized model of consumption generation is outlined in a theoretical discussion. The following sections discuss the econometric model; the dependent and independent variables; estimation issues raised; and the regression results are presented and discussed. After this, geographic and ethnic aspects of poverty are analyzed in detail. The final section summarizes and discusses the results.

Macroeconomic developments

This section provides a brief description and analysis of macroeconomic developments in Lao PDR as framework for the microeconomic analysis of poverty that follows in later sections. The focus is on the period since the first Living Standard and Expenditure Survey. This period covers the Asian financial crisis and other significant macroeconomic changes that are likely to have an impact on poverty.

Long-term changes in poverty incidence are closely linked to macroeconomic developments. It is undisputable that broad economic growth will lead to lower poverty, as long as there is not rapidly worsening income distribution. Cross country surveys relying on micro data show that the poor typically share in the benefits of rising affluence, while also suffering from economic contraction (Ravallion, 2001). Still, measured consumption of the poor might grow less rapidly than national consumption (Deaton, 2003).

During the period from the LECS1 in 1992/93 to LECS2 in 1997/98, Lao PDR experienced constantly high economic growth rates. Undoubtedly this contributed to a considerable fall in poverty rates. As shown in Table 1 below, the rate of economic growth has slowed down during the following period up to LECS3 in 2002/03. The period since LECS2 is also associated with continued structural change as the agricultural sector's share in national GDP further declined as value added in industry expanded and the service sector had a largely constant share.

Table 1: Lao PDR Macroeconomic Indicators, 1992–2004.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003*	2004*
GDP Growth	7.0	5.9	7.7	7.5	6.9	6.9	4.0	7.3	5.8	5.7	5.7	5.3	6.0
Economic Structure													
Agriculture (% of GDP)	58.0	56.3	56.6	54.3	52.2	52.2	51.8	52.2	51.8	50.6	49.9	48.0	47.2
Industry (% of GDP)	16.7	17.4	17.8	18.8	20.6	20.8	21.9	22	22.6	23.4	24.5	26.0	26.6
Services (% of GDP)	25.3	26.3	25.6	26.9	27.2	27.0	26.3	25.8	25.5	25.8	25.0	25.0	26.2
Consumer Price Inflation	-	-	-	-	13.0	27.5	87.4	134.0	27.1	7.8	10.8	15.6	11.4
Exchange Rate Kip/USD	716	717	718	819	926	1 260	3 296	7 106	7 846	8 871	10 109	10 567	10 551
Balance of Payments (M$)													
Current Account	-52	-41	-97	-124	-225	-185	-56	-59	-25	-66	-98	-116	-
Trade Balance	-133	-191	-264	-276	-368	-331	-216	-212	-218	-209	-230	-217	-
Exports (merchandise)	133	240	300	313	321	317	337	342	345	334	340	401	-
Imports (merchandise)	-219	-432	-564	-589	-690	-648	-553	-554	-562	-542	-570	-618	-
Service Balance	-20	35	35	27	25	28	71	99	132	125	131	95	-
Income Balance		3	-2	-7	-6	-22	-34	-45	-75	-67	-70	-81	-
Transfers	54	113	134	131	125	140	123	99	136	85	71	87	-
Capital Account	64	54	84	139	294	155	38	62	69	65	153	135	-
Medium & Long-term Loans	73	70	65	82	138	161	86	93	63	66	127	89	-
Foreign Investments	9	66	60	95	176	104	56	52	31	24	60	69	-
Other	-18	-81	-40	-39	-20	-110	-103	-83	-25	-25	-34	-23	-
Overall Balance of Payments	12	14	-12	15	69	-30	-18	3	44	-1	55	20	-

Source: ADB (2002) & (2005), Government of Lao PDR (2004).

Since LECS2 Lao PDR has also witnessed a period of very high inflation and an associated rapid decline in the Kip exchange rate. This price shock, coinciding with the Asian financial crisis, might have hurt poor households that are less capable to adjust to rapid inflation.

The Asian crisis and the domestic price shock had far reaching effects on foreign economic relations as cross-border trade and investment flows were disrupted. Foreign investment flows declined rapidly during the 1997/98 to 2002/03 period. Yet, the declining exchange rate served to improve the Lao PDR trade balance: imports fell in 1997 and 1998, while the value of exports remained more or less stable. It is reasonable to expect that the macroeconomic turbulence caused by the Asian crisis mostly affect the internationally integrated parts of the Lao economy, with some secondary effects on income, consumption, and poverty levels in the household sector. Although a slight slowdown in overall economic growth can be observed, it is likely that the impact has varied across provinces depending on how integrated they were in the international economy before the crisis. For example, households in Vientiane and other provinces along the Mekong River may have been more dependent on developments in the Thai market than households in more remote parts of the country. Consequently, the decline in Thai demand immediately after the crisis probably had more severe effects in Vientiane and the Mekong Valley provinces than in the northern and eastern parts of the country. The high rate of inflation may also have had asymmetric effects on different population groups, since it is uncommon that the prices of individual products increase at a homogenous rate in a high-inflation economy.

One notable change in the Lao PDR economic surroundings is the rise of China as a regional and global growth centre. Vietnam to the east has also experienced rapid economic progress. This may have economic implications for regional development within Lao PDR. Traditionally, the Mekong Valley has been the centre of economic activity, benefiting from favourable conditions for agriculture as well as trade and economic integration with Thailand. The northern part bordering China and eastern sections of the country adjacent to Vietnam has generally lagged in economic development and has been largely barred from outside trade and integration. However this might change as the Chinese and Vietnamese economies expand and as improved infrastructure opens up opportunities for economic exchange.

In summary, the macroeconomic picture remains mixed. During the first years of the period after the previous living standard survey, Lao PDR experienced the disruptions of the Asian financial crisis and a domestic price shock. Yet the economy has continued its expansion, albeit at a somewhat slower rate. The country has seen a continued structural transformation with declining share of the production coming from the agricultural sector. A significant change in the external economic relations is the continued rapid emergence of the Chinese economy in the north and the Vietnamese in the east. There is reason to keep these changes in mind when studying the changes in poverty and inequality as well as when discussing the determinants of poverty in Lao PDR.

Growth, poverty, and inequality

Thanks to the availability of aggregated poverty data at the regional and provincial levels from LECS3 as well as earlier surveys, it is possible to examine some changes and trends in poverty over time. The definition of "poor individuals" is based on real household consumption, employing a methodology presented in Richter et al (2005). A household is characterized as poor if its average per capita consumption falls below a total consumption line allowing a sufficient calorie requirement plus a basket of non-food goods and services.

Table 2 summarizes data on the share of poor individuals in percent of total population across regions and provinces. Overall, it can be seen that the incidence of poverty has fallen since LECS1, although the rate of progress slowed down during the second period. In 2002/03, 33.5 percent of the survey population was characterized as poor, compared with a poverty rate of 39 percent in 1997/98 and 46 percent in 1992/93. However, overall reduction in poverty during the second period hides substantial differences across provinces and regions. Poverty has continued to fall rapidly in many of the Northern provinces, which were clearly in the weakest position in 1997/98. By contrast, poverty has increased in some regions that were in a stronger position five years ago. The highest poverty increases are found in Vientiane municipality and some of the surrounding provinces. This pattern seems to confirm the hypothesis that the Asian crisis mainly hurt those parts of the country that were relatively well integrated with the Thai economy.

Table 2: Percentage of Poor by Region and Province, 1992/93–2002/03.

Province	LECS1 1992/93	LECS2 1997/98	LECS3 2002/03	Change 92/93 to 97/98	Change 97/98 to 02/03
Northern Region	**51.6**	**47.3**	**37.9**	**-4.3**	**-9.3**
Oudomxay	45.8	66.1	45.1	20.3	-21.0
Luangnamtha	40.5	51.1	22.8	10.6	-28.3
Huaphanh	71.3	71.3	51.5	0.0	-19.8
Phongsaly	72.0	57.9	50.8	-14.1	-7.2
Luangprabang	58.5	40.8	39.5	-17.7	-1.4
Xayabury	22.4	17.7	25.0	-4.6	7.3
Bokeo	42.4	38.9	21.1	-3.4	-17.8
Central Region	**45.0**	**39.4**	**35.4**	**-5.6**	**-4.0**
Borikhamxay	16.6	27.9	28.7	11.3	0.8
Khammuane	47.1	44.5	33.7	-2.6	-10.8
Vientiane Province	30.7	27.8	19.0	-2.9	-8.8
Savannakhet	53.1	41.9	43.1	-11.2	1.2
Xiengkhuang	63.0	42.9	41.6	-20.2	-1.3
Xaysomboun SR	-	62.8	30.6	-	-32.1
Southern Region	**45.7**	**39.8**	**32.6**	**-5.9**	**-7.2**
Saravane	43.6	39.2	54.3	-4.4	15.1
Champasack	41.4	37.4	18.4	-4.0	-19.0
Sekong	67.0	49.7	41.8	-17.2	-7.9
Attapeu	60.5	48.0	44.0	-12.4	-4.0
Vientiane Municipality	**33.6**	**13.5**	**16.7**	**-20.0**	**3.2**
Lao PDR	**46.0**	**39.1**	**33.5**	**-6.9**	**-5.6**

Source: Authors' calculations based on LECS3.

Inequality has also changed since LECS1. While the period between LECS1 and LECS2 was characterized by increasing inequality (as is often the case in rapidly growing economies), there has been a small but distinct reduction in inequality since LECS2, see Table 3 below.

In comparison with other countries in Asia, Lao PDR does not exhibit very high levels of inequality in terms of Gini coefficients or quintile shares even after the increase in inequality that took place in the mid-1990s. For instance, the two comparable Vietnamese Living Standard Surveys in 1992/93 and 1997/98 recorded overall Gini coefficients of 0.33 and 0.35 (Glewwe, 2004). The most remarkable feature of Table 3 may, in fact, be the very equal income distribution of Lao PDR in the early 1990s.

Table 3: Inequality of Per Capita Real Consumption, 1992/93–2002/03.

	LECS1 1992/93	LECS2 1997/98	LECS3 2002/03	Change 92/93 to 97/98	Change 97/98 to 02/03
Gini	30.5	34.9	32.6	4.4	-2.3
Quintile Shares					
First	9.3	8.1	8.6	-1.2	0.5
Second	12.9	12.0	12.4	-0.9	0.4
Third	16.2	15.5	16.1	-0.6	0.5
Fourth	21.6	20.7	21.4	-0.9	0.6
Fifth	40.0	43.7	41.6	3.7	-2.0

Source: Authors' calculations based on LECS-data.

This development is closely related to the changes in poverty incidence discussed above: inequality might have declined as poverty has fallen most rapidly in those provinces that exhibited the highest levels of poverty in 1997/98. The table also shows changes in the income shares of the five quintiles. Between the first two surveys, the fifth (and richest) quintile increased its income share by about 4 percentage points while all other quintiles lost shares. Between LECS2 and LECS3, three of the four poorer quintiles increased their shares somewhat while the richest quintile lost.

Table 4 looks closer at some indicators of consumption and inequality levels for LECS3.The table distinguishes between regions, provinces, and major ethnic groups and provides a more detailed picture of how consumption and poverty are distributed in Lao PDR: at this level of aggregation, it is not possible to make detailed comparisons with the earlier

surveys. In addition to the share of the population living in poverty, the table presents data on real monthly consumption per capita, the Gini index, and the Theil index. The two latter indicators reflect inequality – the higher the coefficient, the more severe is inequality. The main differences between the two indices are that the Theil index puts a heavier weight on inequality at the bottom of the distribution. Moreover, the Theil index belongs to the group of so called General Entropy indicators, which have one particularly desirable characteristic: they are additively decomposable. This means that analyses of income distribution across different population groups can distinguish between the share of inequality that is due to differences within each population group and the share of inequality that stems from differences between population groups.

Table 4: Real Per Capita Consumption and Inequality across Regions, Provinces and Ethnic Families, 2002/03.

	Average Real Monthly Consumption (Kip)	Poverty Incidence	Gini Coefficient	Theil Index
Region				
Northern Region	154 829	37.9	0.31	0.19
Central Region	161 197	35.4	0.31	0.18
Southern Region	168 985	32.6	0.31	0.18
Vientiane Municipality	245 550	16.7	0.36	0.24
Inequality within regions as share of total inequality				0.94
Inequality between regions as share of total inequality				0.06
Province				
Oudomxay	132 044	45.1	0.25	0.11
Luangnamtha	171 283	22.8	0.25	0.11
Huaphanh	131 221	51.5	0.29	0.15
Phongsaly	119 857	50.8	0.22	0.09
Luangprabang	156 759	39.5	0.32	0.19
Xayabury	192 305	25.0	0.35	0.25
Bokeo	176 443	21.1	0.29	0.19
Borikhamxay	168 811	28.7	0.28	0.13
Khammuane	158 012	33.7	0.29	0.15
Vientiane Province	196 159	19.0	0.32	0.21
Savannakhet	150 745	43.1	0.31	0.18
Xiengkhuang	145 856	41.6	0.31	0.18
Xaysomboun SR	156 117	30.6	0.27	0.12
Saravane	127 424	54.3	0.27	0.15
Champasack	198 606	18.4	0.30	0.15
Sekong	143 010	41.8	0.31	0.19
Attapeu	139 886	44.0	0.29	0.16
Inequality within provinces as share of total inequality				0.90
Inequality between provinces as share of total inequality				0.10
Ethnic Families				
Tai-Kadai	191 480	25.1	0.33	0.20
Mon-Khmer	124 688	53.7	0.27	0.13
Tibeto-Burman	134 430	40.0	0.23	0.10
Hmong-Mien	136 762	45.8	0.29	0.15
Other	124 414	48.1	0.29	0.17
Inequality within ethnic families as share of total inequality				0.92
Inequality between ethnic families as share of total inequality				0.08

Source: Authors' calculations based on LECS3.

Looking first at the pattern across regions, it can be seen that there are no great differences once Vientiane Municipality is treated separately. The Central region records the highest level of consumption – still the differences across provinces is less than 10 percent – and there are no great differences in the levels of inequality, irrespective of whether we use the Gini or Theil index. Vientiane municipality, on the other hand, records a nearly twice as high consumption level as any of the regions, as well as substantially higher inequality. Decomposing the Theil index, it is also interesting to see that more than nine-tenths of the aggregate inequality is due to the variation within each region, while less than one-tenth is due to differences between regions. In other words, the differences between rich and poor in each individual region are larger than the differences in the averages between regions. This finding is similar to

results obtained when comparing inequality across regions in the Philippines, where within region inequality has a share of more than 80% (Balisacan, 2003).

Turning to the comparison between provinces, it is not surprising that Vientiane province records the highest average consumption level and the lowest incidence of poverty. It may be more surprising that Champasack has emerged as the second strongest province, both in terms of consumption and poverty incidence, considering that it held a less distinguished position in the earlier surveys. Trade and economic integration could be part of the explanation. The effect of economic integration (or rather the lack of it) could also explain that relatively isolated Phongsaly and Huaphanh are the weakest provinces. Generally speaking, incomes are distributed more evenly in the poor provinces than in the richer provinces, with one apparent exception: Sekong. Even though the differences in average consumption levels are quite substantial, ranging from 119,000 Kip per month in Phongsaly to 198,000 in Champasack province, most of the inequality in the sample is still explained by the inequality within each province. Only 10 percent of total inequality is due to the variation between provinces.

The last part of Table 4 presents some comparisons across ethnic families: we will focus to some extent on the role of ethnicity in the discussion that follows in the remainder of this paper, given the attention it has received in earlier analyses of growth, poverty, and inequality in Lao PDR. The majority group, the Tai-Kadai, records an average consumption level that is more than 40 percent higher than that of any of the other population groups, but it is interesting to note that the variation and inequality within the ethnic groups still accounts for 92 percent of the total inequality in the sample. In particular, there is substantial inequality within the Tai-Kadai group. Similar indicators have been calculated from the Vietnamese Living Standard Surveys undertaken in 1992/93 and 1997/98. It is interesting to note that the differences between ethnic groups in Vietnam account for just about the same share – about 10 percent – of total inequality in both of those surveys (Glewwe et al. 2000).

The differences between the categories in Table 4 suggest that some of the poverty and inequality in Lao PDR is related to the characteristics of regions, provinces, and ethnic groups. However, given that the categories overlap to some extent, it is not clear whether it is ethnic origin or geographic conditions in different locations that determine poverty. Moreover, most of the aggregate inequality is explained by other factors than geographic location and ethnic origin: our results suggest that only 10–14 percent of inequality is due to differences between regions, provinces, or ethnic groups. Hence, it is highly motivated to examine in more detail – theoretically as well as empirically – what the determinants of consumption (or poverty) in Lao PDR are.

Determinants of income, consumption, and poverty

It is common in the empirical development literature to explore determinants of poverty by relating measures of income, consumption, or poverty to various individual, household, and community characteristics in a multiple regression framework. This way, researchers are potentially able to distinguish the specific impact of each poverty determinant chosen for the analysis: these insights, in turn, can be used to identify the main determinants of consumption and to draw conclusions about possible policy interventions to alleviate poverty. However, although the methods used in this kind of poverty analysis are becoming standard, there are a number of theoretical issues that deserve attention before we proceed to a quantitative analysis of the situation in Lao PDR. These concern the theoretical justification for the choice of dependent and independent variables, the econometric estimation method and the interpretation of the results.

Theoretical Considerations

Beginning with the design of the empirical model, the first choice when analysing determinants of welfare is the choice of basic unit of analysis. In developing countries where agriculture and small scale business are principal sources of income and where consumption is shared among adults and dependents in the households, the household is a reasonable choice as the unit of analysis.

One obvious data issue concerns the choice of dependent variable. The choice between income and consumption measures is discussed in the next section. A further challenge is to motivate which variables to include in the analysis of household welfare: what are the potential determinants of poverty? The fact that a certain variable is available in the data set seldom provides sufficient justification for including it in the model. In principle, the choice of variables can only be done by outlining a theoretical model for how household income, consumption, or poverty is determined. Growth and production theory provide a useful starting point for the analysis. From these theories, it is clear that the income and consumption potential of households and individuals are related to their production capacity. This, in turn, depends on their access to various production factors – labour, capital, technology, and land – as well as the quality of these production factors. The role of human capital – in the form of education and experience – has often been emphasized as a

particularly important determinant of income or production (Mincer, 1958 and Schultz, 1988). The environment in which the household or individual operates influences the outcome of the production process in many ways. The degree and nature of competition varies between locations, and affects the prices in the market. Institutions and public policy also influence the conditions for economic activity, and may vary between locations. Similarly, the amount and quality of public infrastructure is important. These standard production and growth determinants define a basic model that may then be adjusted according to the specific research issues at hand, as well as data considerations.

As noted above household income and consumption are shared among the members of the household, data are often collected at the level of the household, and it may not be possible to separate the precise consumption or income shares of each individual household member. This introduces a need to account for additional household characteristics, such as household size or the share of working age adults relative to dependent children and elders. Other population characteristics may also be important. For example, to the extent that the income earning possibilities of different population groups vary for other reasons than their access to production factors – e.g. discrimination of women or minority groups – it may be necessary to control for these characteristics as well. The wealth of different population groups may also differ systematically, so that some groups have a larger capacity to consume from saved income. In this context, it should be noted that there is a distinction between the direct and indirect effects of variables like gender and ethnic origin. The direct effect refers to a situation when a member of a specific population group (e.g. a minority) records a lower consumption level than a member of the control group (the majority) with the same characteristics regarding other inputs into the production process (e.g. education, access to capital equipment, or geographic location). Even if there is no direct effect of this kind, the specific population group may still have systematically lower income if there is an indirect effect influencing inputs into the production process or the returns from these inputs obtained by the minority group.

It is important to distinguish between these two kinds of effects, because the policy prescriptions and the prospects for improvements may be quite different. For example, there is a difference between a situation where minorities earn lower incomes because they are of a certain ethnicity (direct effect) and one where their incomes are lower because they have lower levels of education or receive lower returns on their education (indirect effects). In the former case, it may be impossible to improve the earnings of the minority without fundamental changes in values and attitudes, which may be very complicated and time consuming; in the latter case, providing more resources for minority education may improve the situation. However, while the direct effects can be readily observed from the results of multiple regression models, identifying indirect effects is more complex.

Another data issue is related to the gap between theoretical concepts like capital, technology, and infrastructure, on the one hand, and the empirical data available to the researcher, on the other hand. While it may be simple to define e.g. technology in theory, it is typically much more difficult to measure it with accuracy. In many cases, it is therefore necessary to make the best of the available data and settle for imperfect proxy variables.

The Dependent Variable

There are in principle three alternative dependent variables for a quantitative analysis of poverty. These are measures of consumption expenditure, income, and indicators of whether a household is poor. In this paper, we mainly use consumption expenditure per capita (measured as total household consumption divided by the number of household members) as the poverty or welfare measure. The following paragraphs discuss the strengths and shortcomings of this specific measure.

Both consumption expenditure and income can be justified as a measure of welfare, since both measure an individual's ability to obtain goods and services: in many cases, the measures should produce fairly similar results. Both measures also have some weaknesses, since they fail to incorporate some important aspects of individual welfare, such as consumption of commodities supplied by, or subsidized by, the public sector (for example, schools, health services, and roads) and several dimensions of the quality of life (consumption of leisure and the ability to lead a long and healthy life). Our decision to use a consumption-based rather than an income-based measure of individual welfare in this study is motivated by several considerations.

First, income can be interpreted as a measure of welfare opportunity, whereas consumption can be interpreted as a measure of welfare achievement (Atkinson 1989). Since not all income is consumed, nor is all consumption financed out of income, the two measures typically differ. Consumption is arguably a more appropriate indicator if we are concerned with realized, rather than potential, welfare.

Second, consumption typically fluctuates less than income. Individuals rely on savings, credit, and transfers to smooth the effects of fluctuations in income on their consumption. In particular, it is common that temporary increases in income are not consumed immediately, but rather spread out over longer time periods. It can therefore be argued that consumption provides a more accurate and less volatile measure of an individual's permanent income and welfare over time.

Third, some researchers and policymakers hold the belief that survey respondents are more willing to reveal their consumption behaviour than their income. This may be a particular concern in high-tax countries, where part of income may emanate from the informal sector, but may also affect countries like Lao PDR, where some taxation is based on lump sums negotiated between the tax payer and the tax collector.

Fourth, a relatively large proportion of the labour force in developing countries is engaged in self employed activities where it is particularly difficult to measure income accurately. Similarly, many individuals are engaged in multiple income generating activities in a given year, and the process of recalling and aggregating income from different sources is a potential source of data errors.

While consistent with standard practice, the use of per capita normalization of consumption still involves a number of assumptions that may affect welfare comparisons. For instance, as a welfare measure, per capita normalization effectively implies equal requirements, in monetary terms, for each household member, regardless of age, sex, or other characteristics. However, in the case of food requirements, it is arguable that children's requirements are less than those of adults; the opposite may be true for other goods and services, such as education. Thus consumption is sometimes expressed in adult equivalent units (AEU), whereby children are counted as fractions of adults. A wide range of

adult equivalence scales exist, and none are completely satisfactory because they require strong identifying assumptions (see Deaton and Case 1988). Even if such adjustments are made, it is still possible that the distribution of income within the household differs from what is assumed. There is, for instance, a risk that women and children are given even lower shares of total household consumption than what their physical needs mandate. Hence, it is possible that there are households with some members who actually live in poverty even if aggregate household income would be sufficient to allow each member to reach a sufficient consumption level. It is in the light of these practical difficulties in compensating for differences in requirements between adults and dependents that straight per capita normalization is used in the analysis.

Another problem is that per capita normalization conceals the presence of economies of scale in household size, e.g. the prospect that it is less expensive for two persons to live together than it is for them to live separately. While there is evidence that economies of scale exist, varying largely with consumption patterns within the household, it seems clear that the scale effects are not homogenous across household sizes (Lanjouw and Ravallion 1995; Lipton and Ravallion 1995; Deaton and Paxson 1998). Efforts to adjust for economies of scale would risk introducing biases. This further motivates a straight per capita normalization. Still, some caution is in place since this model builds on a unitary view of the household. This may fail to capture significant intra household differences (Alderman et al, 1995).

An alternative consumption based poverty measure would be a binary variable based on some commonly agreed poverty line, indicating whether or not an individual belongs to a poor household. However this approach would discard a lot of the available information: using a continuous variable like consumption expenditure per capita exploits more of the information in the data set, since it takes into account consumption differences below as well as above the poverty line. An added advantage is that the properties of models focusing on continuous variables are more robust than those for binary variables.

The measure of per capita consumption expenditure used in this study includes the total value of consumption of food and non-food items (including purchases, home produced items, and gifts received), as well as imputed use values for owner-occupied housing and household durable goods. The only significant omission from the consumption measure is consumption of commodities supplied by the public sector free of charge, or the subsidized element in such commodities. For example, an all-weather road, or a public market, or a public water tap presumably enhances the well-being of the people who use those facilities. As is true of almost all household surveys, the LECS3 data do not permit monetary measurement of those benefits, and they are therefore not included in the consumption measure. Furthermore, for those households that operate their own business, the consumption measure excludes expenditures that are explicitly identified as inputs in the household business. It should be noted that the consumption measure is expressed in real terms, meaning that price differences between regions and survey months have been controlled for.[2]

As has been highlighted in this discussion, the choice of per capita household consumption as dependent variable is not obvious. Appleton (2001) compares different choices of dependent variable, finding some

[2] We are grateful to Kaspar Richter of the World Bank for providing the real consumption expenditure data.

effects on the results. To test the sensitivity of the results to the choice of dependent variable, regressions with alternative specification will also be tested and compared.

Stylized Model

Summarizing this brief discussion of theoretical considerations, Figure 1 presents a stylized model of the determinants of consumption expenditure per capita. At the core of the model are the factors of production that the household can use to generate income and thus consumption capacity. The productivity of these factors is influenced by environmental characteristics that may vary between geographic locations. Since consumption expenditure is measured at the household level but we are interested in the determinants of per capita consumption levels, there is also a need to adjust the model for various demographic characteristics, such as the size of the household and the dependency ratio.

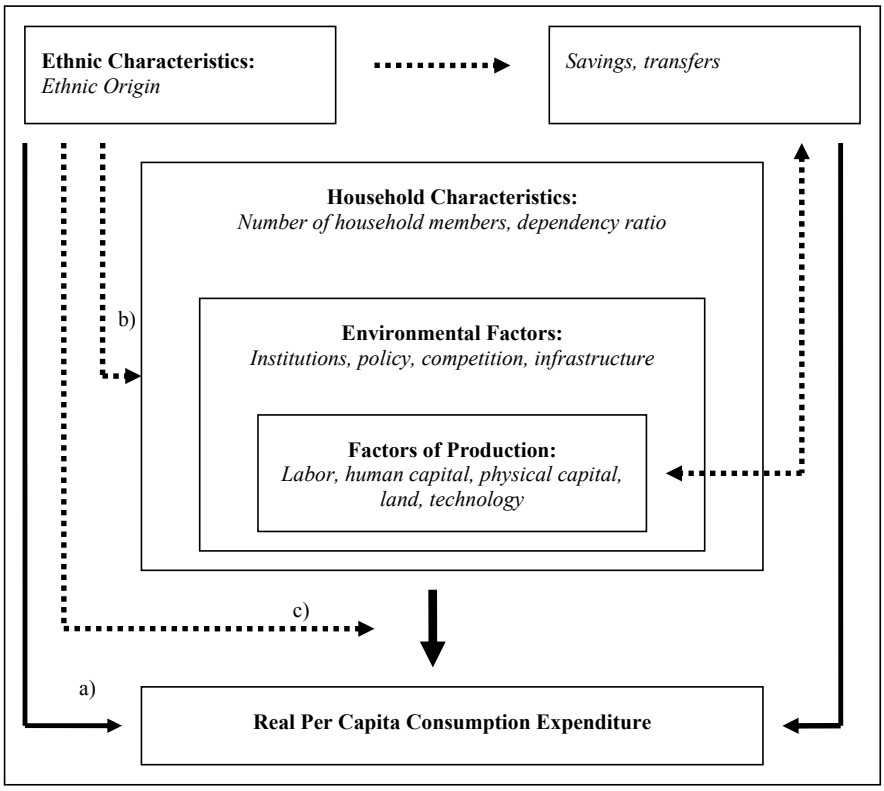

Figure 1: Stylized Model of Determinants of Per Capita Consumption.

In addition to production factors, environmental factors, and household characteristics, Figure 1 also shows the potential effects of ethnicity or other population characteristics. On the one hand, it is possible that ethnic origin has a direct impact on consumption, illustrated by the solid arrow a) from population characteristics to real consumption expenditure per capita. On the other hand, it is also possible that ethnic origin is significant because of indirect effects that leave minority households with lower levels of production factors, environmental factors or less favourable household characteristics (illustrated with the dotted arrow b). A third channel of ethnic effect on consumption would influence the return that minorities obtain on their endowments (dotted line c). These effects will be further analyzed in a later section.

Similarly, access to savings and other sources of non-production income may have direct effects (in terms of higher consumption potential) as well as indirect effects (in terms of better access to capital and other production factors). To complicate the issue further, it should be recognized that there is probably a cumulative two-way relationship between income from production activities and savings potential: the households that are able to generate much income are probably also able to save and may use the savings for investments that enhance their production capacity. Conversely, poor households may be caught in a poverty trap, where their incomes are too low to allow them to set aside money for investments that could raise output.

Although this theoretical model of real per capita consumption is highly stylized, it is important to emphasize its importance for the interpretation of the results from the regression analysis based on the LECS3 data. Without access to long time series, it is impossible to prove causality with econometric techniques. The results from regression estimations can at best prove that there are significant relations between variables, but hypotheses about causal links must be drawn from theory. Hence, the objective of the empirical analysis is to test whether empirical data are consistent with the theoretical hypotheses summarized in Figure 1.

Data, Empirical Model, and Variables

Data

The primary data source for this study of the determinants of poverty in Lao PDR is the 2002/03 Lao Expenditure and Consumption Survey. The LECS3 is a comprehensive socioeconomic survey of the living standards of households in all provinces of Lao PDR (NSC, 2004). LECS3 provides information on 8092 households from all 18 provinces in Lao PDR. However, our results are based on the 8048 households for which we had access to village level data. Despite the loss of about 0.5% of the observations, estimates of descriptive statistics are consistent with those using the full sample (see for example Richter et. al., 2005).

While LECS3 provides a unique and valuable source of information for poverty analysis, it should be noted that there are some weaknesses in the data set. One problem is that the coverage and stratification of the LECS samples has changed over time, which means that it is difficult to construct data panels on the basis of the existing three surveys. This creates problems to follow developments over time at a disaggregated level. This is exacerbated by the scarcity of reliable information on variables like production, growth, and structural change from other sources. Hence, it is not possible to trace the micro level poverty effects of growth with any great accuracy. Given the focus on production capacity in the theoretical framework for this analysis, it is clear that this type of information, preferably over time, would be highly valuable.

Empirical Model

Combining the theoretical discussion above with the data available from LECS3, it is possible to formulate an empirical model for testing the determinants of poverty in Lao PDR. As illustrated in Figure 1, it will include real per capita consumption expenditure as the dependent variable. In line with most similar studies, we use it in semi-logarithmic form. This introduces some non-linearity into the model, and typically improves goodness of fit measures in comparison with similar estimations based on the absolute value of consumption. The explanatory variables fall into five groups identified in Figure 1 above: factors of production, household characteristics, environmental factors, ethnic characteristics, and geographic characteristics. This yields a regression equation of the form:

$$\ln(C/cap) = \alpha + \beta V + \gamma W + \delta X + \theta Y + \eta Z + \varepsilon \quad (1)$$

where C is the dependent consumption variable V, W, X, Y, and Z and are vectors of factors of production, household characteristics, environmental factors, ethnic characteristics and geographic characteristics, α the constant, and β, γ, δ, θ, and η are the corresponding vectors of coefficients, and ε is a normally distributed random error term. Most variables are measured at the household level: the environmental and geographic variables are defined at the village or province level. This formulation is attractive since it has a relatively straight forward functional form while being consistent with established models for household welfare presented by for example Glewwe (1991).

The following paragraphs outline the specific variables included in the five groups of explanatory variables. The choice of variables has been guided by an effort to avoid highly correlated variables that would introduce multicollinearity. This is necessary to make it possible to distinguish the individual contribution of each factor.

Factors of Production

The variables in this category are intended to reflect the production capacity of the individual household, and include measures for the inputs of land, physical capital, technology, human capital, and labour. While each of these poses various challenges, it is particularly difficult to capture the impact of labour inputs, and we will therefore discuss labour and household characteristics separately. The choice of variables has also been governed by an effort to minimize the danger of including variables that are simultaneously determined with welfare. This excludes variables directly measuring savings and many types of assets determined directly by current income.

The household's area of *land* holdings is a very important factor for determining consumption capacity in agricultural societies. We include variables for the area of four categories of land: irrigated farmland, un-irrigated farmland, land used for animal grazing and forest land. These categories account for expected differences in productivity. The variable does not control for land quality within the categories; yield measures could be calculated from the LECS3 data but including these would introduce identification problems as yield is closely associated with household consumption.

– The log area of the household's irrigated farm land, un-irrigated farm land, land used for grazing, and forest land (owned and/or operated by household).

Including variables for household *physical capital* poses some challenges. Most measures of capital would create problems of identification. Still, ownership of farm animals is included under the assumption that cattle, buffaloes, and pigs are exogenously determined. This assumption can be reasonable since farm animals tend to be raised within household subsistence agriculture and not bought from external sources.

– Farm animals: cattle; buffaloes; and pigs.

Apart from the physical input of labour, it is also important to account for *human capital*, which is related to the education level of the household's adult members. The education level of children, young adults and the household's expenditures on education are not taken into account here,

as these variables cannot be considered exogenous. The investments in schooling undertaken today do not determine the present welfare level of the household, but are instead dependent on the household's present welfare: it is mainly households with relatively high incomes that can afford to invest substantially in education. It should be noted that education may affect economic welfare in many different ways. For example it may influence both returns within economic activities and access to such activities. In addition education may limit fertility and thus reduce the number of dependent children. So, education may raise income, increase access to non-farm employment, improve the ability to set up a household business and improve productivity in farming. The LECS3 data included a wide variety of variables related to household education. In the regression model the maximum educational attainment of any adult household member is included, as this has been shown to be the best indictor for education in developing countries (Jolliffe, 2002). We also include variables to explore the impact literacy among men and women. The prior hypothesis is that female education has a different return than male education.

Hence, we include three measures of educational attainment in the household, based on the hypothesis that human capital (as measured by formal education and literacy) contributes positively to higher living standards. These are:

- Maximum education level attained by any adult (aged 18 to 59 years) in the household. This is a categorical variable where the categories and values are: Pre-primary (0), Primary (1), Lower Secondary (2), Upper Secondary (3), Vocational Training (4), University or Institute (5).
- Male and female literate adult (18 years or older) household members.

Variables related to *technology* are intended to capture the choice of activity (agriculture or business) as well as the household choice of agricultural methods. A potentially important technology difference is that between households relying solely on physical labour and those using machinery. Another technology choice is whether or not chemical fertilizers are used to improve returns. Furthermore, while agriculture is the vastly dominant activity in the sample households, it is not the only one. In Lao PDR, a household business is often the major alternative to subsistence agriculture. We therefore include variables to indicate whether the household use agricultural machinery, chemical fertilizers and whether it runs a business.

- An agricultural mechanization variable indicating if the household has access to a tractor.
- Chemical fertilizer usage variable to control for the farming technology used.
- Household business variable.

Table 5: Variables and Definitions.

Variable	Definition and Comment
Dependent Variables	
Cons. Per Capita	Real Per Capita Consumption
HH Consumption	Real Household Consumption
HH Poverty	1 if household is poor; 0 otherwise
Factors of Production	
Irrigated Land Area	Log household irrigated farmland holdings in hectares
Unirrigated Land Area	Log household unirrigated farmland holdings in hectares
Grazing Land Area	Log household grazing land holdings in hectares
Forest Land Area	Log household forest land holdings in hectares
Number of Cattle	Log number of cattle owned by household
Number of Buffalo	Log number of buffalo owned by household
Number of Pigs	Log number of pigs (local or commercial) held by household
Literate Female	1 if household has literate female adult; 0 otherwise
Literate Male	1 if household has literate male adult; 0 otherwise
Household Business	1 if household run a business; 0 otherwise
Max Education Index	0 if highest educational attainment in household is Pre-primary, 1 if Primary, 2 if Lower Secondary, 3 if Upper Secondary, 4 if Vocational Training, 5 if University or Institute
Agricultural Mechanisation	1 if household has access to tractor; 0 otherwise
Fertilizer Use	1 if household used chemical fertilizer during last planting season; 0 otherwise
Household Characteristics	
Dependency Ratio	Ratio of dependents, below 18 year and above 59, versus adults 18-59
Adults	Log number of adults in household
Male Head of Household	1 if Male Head of Household; 0 if Female Head of Household
Environmental Factors	
Access to Dry Season Road	1 if village accessible by truck during dry season; 0 otherwise
Access to All Season Road	1 if village accessible by truck during all seasons; 0 otherwise
Electricity Access	1 if village has access to electricity; 0 otherwise
Healthservice Access	1 if village has access to community health worker, medical practioner, nurse, hospital, or health post; 0 otherwise
Ethnic Characteristics	
Mon-Khmer	1 if head of household is Mon-Khmer; 0 otherwise
Tibeto-Burman	1 if head of household is Tibeto-Burman; 0 otherwise
Hmong-Mien	1 if head of household is Hmong-Mien; 0 otherwise
Other Ethnic	1 if head of household is Other Ethnic groups: 0 otherwise
Province Variables	
	1 if household is located in province; 0 otherwise
Border Variables	
Thai Border (Mekong)	1 if household is in district with Mekong River border to Thailand; 0 otherwise
Thai Border (Land)	1 if household is in district with land border to Thailand; 0 otherwise
China Border	1 if household is in district adjacent to China; 0 otherwise
Vietnam Border	1 if household is in district adjacent to Vietnam; 0 otherwise
Cambodia Border	1 if household is in district adjacent to Cambodia; 0 otherwise
Myanmar Border	1 if household is in district adjacent to Myanmar; 0 otherwise

Household Characteristics

Since the per capita consumption measure used as the dependent variable in the regressions is generated from information on household consumption, it is necessary to control for the size and composition of the household. This creates problems for the identification of the labour input variable: it is difficult to make a strict separation between the variables used to proxy the inputs of labour and the proxies for household size and composition. Hence, it is important to note that the demographic variables used in the analysis probably combine these two different effects, which presents some obvious challenges for the interpretation of results.

The data set includes detailed information regarding the size of the household and the distribution of household members across gender and age groups. Four age categories are distinguished: children under 10 years of age; youth aged 10–17; adults aged 18–59; and elders aged 60 and above. The number of productive age adults, the 18–59 age group, is the most direct measure of the household's labour input. We thus include the following variables to control for the labour input and the size and composition of the household:

- Number of adults aged 18–59.
- Dependency ratio, calculated by dividing the number of dependents with the total number of household members. Dependents are defined as children and youth under 18 and household members aged 60 or more.

Based on experience in numerous other countries (Lanjouw and Ravallion 1995; Deaton and Paxson 1998) we expect households with a higher dependency ratio to record lower per capita consumption. While the expected negative effect of the dependency ratio is easy to understand, it may appear paradoxical to expect a negative impact of a variable measuring the number of adults. However, it should be kept in mind that the dependent variable measures per capita consumption. While each additional working member of a family is likely to make a real contribution to the household's total production (and consumption capacity), their productivity is typically lower than that of the household head. Hence, average consumption is also likely to fall.

Gender is another factor that potentially affects household income. It is commonly observed that male and females have different opportunities for outside employment. A variable is included to control for the effect of the gender of the head of household.

– Gender, measured as the effect of the household head being male.

Environmental Factors

The environmental variables are intended to capture the effects of *infrastructure* on household income earning capability. Access to infrastructure has shown to have a beneficial effect on income generation and consumption among rural households in other Asian countries, a fact that is expected hold in Lao PDR as well (Ali & Pernia, 2003). The village level data of LECS3 offers a number of potential variables to reflect rural household access to infrastructure and services. Several variables for village access to infrastructure and services are used.

– Variables indicating whether the village can be accessed by motor vehicles during the dry season, or all year round.
– Village access to electricity. Electricity access could possibly be endogenous at the household level. However, this variable is defined at the village level, and it can be considered exogenous in that the decision to provide a village with electricity is external to the household.
– Village access to health services. A dummy variable indicating whether the village has a community health worker, medical practioner, nurse, hospital, or health post.

There are other environmental factors that cannot be directly operationalised. These are controlled for by including geographic variables.

Geographic Characteristics

Geographic variables are included to control for *local conditions* regarding institutions, policy, competition, and other local characteristics that cannot be directly measured through individual variables.

– Province variables for the 18 provinces of Lao PDR (see Table 15 in Appendix: Tables and Charts for a list of the provinces and Figure 2 for a map of Lao PDR).

As indicated above, there is reason to believe that different parts of Lao PDR have been affected by economic integration and trade in different ways. Border district variables are included to control for the effects of location adjacent to any of the five neighbouring countries Cambodia, China, Myanmar, Thailand, and Vietnam. Given the importance of the Mekong River for border trade with Thailand we differentiate between those districts that have a land or river border with Thailand.

– Variables indicating if the household is living in a district with a border to any of the five neighbouring countries.

Ethnic Characteristics

To control for possible effects of *ethnic origin* we have included ethnic variables. The LECS3 data set includes information about self-identified ethnic belonging to one of 49 ethnic groups or a residual "other" category. These 50 groups are aggregated into five variables corresponding to the main ethno-linguistic families in Lao PDR. The ethnic groups belonging to each ethnic family are described in Table 14 in the Appendix: Tables and Charts.

– Ethnic dummies indicating whether the head of the household has identified themselves as belonging to the main Tai-Kadai ethnic family, any of three minority groups Mon-Khmer, Tibeto-Burman or Hmong-Mien, or the residual other ethnic groups.

An alternative classification is commonly used in Lao PDR, where ethic groups are categorised according to the environment where they traditionally live. In this classification Tai-Kadai is called *Lao Loum* – Lao of the Valleys; Mon-Khmer *Lao Theung* – the Lao of the hillsides; and Tibeto-Burman and Hmong-Mien are called *Lao Soung* – Lao of the highlands. The relevance of this classification will be further discussed in the section studying ethnic determinants of poverty.

Variable Summary and Estimation Issues

Summary statistics for the dependent and explanatory variables are presented in Table 6 below. The large differences across households in different types of locations are noteworthy. For example, households in lowland and upland villages face widely different environments; those in lowland tend to have better access to roads, electricity and health services.

It should be noted that the chosen variables are not correlated with each other to any significant degree. An exception is the strong negative correlation between the variables denoting road access during the dry season only and all year road access. Table 5 in the Appendix provides a correlation matrix.

Table 6: Summary Statistics Explanatory Variables. Whole Country, by Type, and by Altitude.

	Total Lao PDR		Urban		Rural Road		Rural No Road		Lowland		Upland		Mixed Altitude	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Observations	8048		1574		4211		2263		4122		2489		1437	
Consumption	149143	2825	220614	8687	133857	2870	97325.9	2920	168021	4158	118051	5576	129170	5671
Factors of Production														
Irrigated Land Area	0.05	0.01	0.05	0.02	0.06	0.01	0.04	0.02	0.08	0.01	0.01	0.00	0.03	0.01
Unirrigated Land Area	1.48	0.04	0.75	0.09	1.73	0.06	1.74	0.06	1.45	0.06	1.59	0.06	1.43	0.12
Grazing Land Area	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01
Forest Land Area	0.03	0.01	0.02	0.01	0.03	0.01	0.04	0.01	0.03	0.01	0.03	0.01	0.02	0.01
Number of Cattle	1.10	0.07	0.52	0.07	1.31	0.11	1.29	0.11	1.00	0.07	1.43	0.18	0.98	0.22
Number of Buffalo	1.02	0.04	0.35	0.05	1.21	0.06	1.38	0.09	0.99	0.05	1.15	0.10	0.95	0.09
Number of Pigs	0.85	0.03	0.27	0.03	0.92	0.04	1.45	0.09	0.63	0.04	1.43	0.09	0.79	0.07
Literate Female	0.64	0.01	0.86	0.02	0.64	0.02	0.38	0.02	0.75	0.01	0.43	0.03	0.60	0.03
Literate Male	0.83	0.01	0.91	0.01	0.85	0.01	0.66	0.02	0.87	0.01	0.73	0.02	0.82	0.02
Household Business	0.24	0.01	0.52	0.03	0.16	0.01	0.07	0.01	0.30	0.01	0.10	0.01	0.21	0.03
Max Education Index	2.01	0.03	2.95	0.07	1.83	0.04	1.29	0.04	2.32	0.04	1.48	0.06	1.72	0.08
Agricultural Mechanisation	0.18	0.01	0.13	0.02	0.24	0.01	0.11	0.02	0.22	0.01	0.12	0.02	0.16	0.02
Fertilizer Use	0.28	0.01	0.27	0.03	0.32	0.02	0.16	0.02	0.38	0.02	0.11	0.02	0.16	0.03
Household Characteristics														
Dependency Ratio	0.54	0.00	0.48	0.01	0.56	0.00	0.59	0.00	0.52	0.00	0.58	0.01	0.56	0.01
Adults	3.05	0.03	3.33	0.07	2.92	0.03	3.03	0.05	3.09	0.04	3.02	0.05	2.95	0.07
Male Head of Household	0.96	0.00	0.91	0.01	0.97	0.00	0.97	0.00	0.94	0.01	0.99	0.00	0.97	0.01
Environmental Factors														
Access to Dry Season Road	0.81	0.01	1.00	0.00	0.87	0.02	0.40	0.04	0.90	0.02	0.57	0.04	0.86	0.03
Access to All Season Road	0.68	0.02	0.99	0.01	0.70	0.03	0.23	0.03	0.80	0.02	0.41	0.04	0.66	0.05
Electricity Access	0.49	0.02	0.97	0.02	0.38	0.03	0.17	0.03	0.62	0.03	0.25	0.04	0.41	0.06
Healthservice Access	0.79	0.02	0.95	0.02	0.79	0.03	0.60	0.04	0.85	0.02	0.63	0.04	0.83	0.04

Source: Authors' calculations based on LECS3.

An estimation based on equation (1) can be seen as straightforward tests of the direct effect of the determinants included in the stylized model presented in Figure 1. Still, the estimation must take in consideration the nature of the LECS3 survey through which the data was gathered (Deaton, 1997). The estimation process therefore compensate for survey design effects. The LECS3 survey is stratified and clustered with 54 strata made up of 3 household types (urban and rural with or without road) in 18 provinces. The 450 villages form clusters or primary sampling units. The estimation procedure is adjusted to take this design into account when calculating standard errors.

The regression is weighted to provide a consistent estimate of the population regression function (See Kish and Frankel, 1974 for a discussion). Population weights are used to allow an interpretation of results as the population regression function. An exception is the alternative regression models (see Table 18), where household level values are used as the dependent variable; here household weights has been used.

Estimation Results

Table 7 below, presents the coefficient estimates of regressions models based on equation (1). In the first stage, the regressions include the factors of production, the household characteristics and the environmental factors. Geographic and ethnic aspects are left to later in-depth analyses. To allow for the possibility that households with different living conditions have different consumption generating processes, additional estimates for sub-populations are provided. The first dimension is urban and rural with or without road. A second dimension is altitude, providing separate estimates for households living in lowland, highland and midland areas.

A first comment concerns the fit of the model. The base case variants of the model are estimated with an R2 of 0.40 based on a sample of 8048 households. This can be compared to similar studies of poverty determinants in Egypt (Datt & Jolliffe 1999), Malawi (NEC, NSO & IFPRI, 2001) Mozambique (Datt, et al. 2000), and Vietnam (Minot & Baulch 2004). In Egypt, the R2 obtained for a rural model was 0.41, based on a sample of 1326 households, with somewhat higher explanatory power for urban households. In Malawi, an R2 of 0.33 was obtained with a sample of 6457. In the case of Mozambique, the R2 was in the range 0.50–0.54. The results for Vietnam indicated R2 values of around 0.55. The present study falls approximately in the middle of the range provided by these earlier studies, which must be considered a reasonable outcome.

The fit varies considerably between different types of household. The regression on urban households show a considerably lower R2, indicating that other factors than those in the model determine income in urban areas. This can be understood, given the agricultural nature of the household model used. Another observation is that there are small differences regarding the fit of models for households living on different altitudes. This indicates that the model is well adapted to households both in lowland, highland and mixed environment.

Since the dependent variable is in log form, the estimated regression coefficients measure the percentage change in per capita consumption within the household from a unit change in the independent variable 3.

[3] This holds for continuous variables only. As pointed out by Halvorsen & Palmquist (1980) caution is necessary when interpreting estimation results for dummy variables.

Table 7: Regression Results. Whole Country, by Type, and by Altitude.

	Total Lao PDR	Urban	Rural Road	Rural No Road	Lowland	Upland	Mixed Altitude
Dependent Variable	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita
Constant	12.480 ***	12.435 ***	12.632 ***	12.270 ***	12.494 ***	12.508 ***	12.368 ***
Factors of Production	(189.76)	(86.35)	(132.76)	(131.39)	(135.77)	(114.99)	(85.28)
Irrigated Land Area	-0.003	0.040	-0.029	0.045	0.022	-0.035	-0.023
	(-0.08)	(0.46)	(-0.78)	(0.53)	(0.38)	(-1.02)	(-0.75)
Unirrigated Land Area	0.034 ***	0.008	0.062 ***	0.047 **	-0.008	0.074 ***	0.120 ***
	(2.35)	(0.32)	(3.24)	(2.01)	(-0.49)	(3.09)	(3.58)
Grazing Land Area	0.079 **	0.015	0.109 ***	0.081 ***	0.072 *	0.229 ***	0.063
	(2.27)	(0.23)	(3.27)	(3.65)	(1.85)	(4.18)	(1.35)
Forest Land Area	0.009	0.087	-0.016	-0.007	0.054	-0.041	-0.011
	(0.27)	(1.12)	(-0.47)	(-0.08)	(1.20)	(-1.01)	(-0.18)
Number of Cattle	0.048 ***	0.093 **	0.034	0.109 ***	0.043 **	0.072 ***	0.042
	(2.76)	(2.26)	(1.51)	(3.81)	(2.32)	(3.22)	(0.69)
Number of Buffalo	0.011	-0.072	0.030	0.062 ***	-0.006	0.071 ***	0.080 ***
	(0.74)	(-1.63)	(1.63)	(2.39)	(-0.35)	(2.50)	(2.37)
Number of Pigs	0.015	0.004	0.032	-0.006	-0.010	0.038	-0.036
	(0.71)	(0.07)	(1.38)	(-0.15)	(-0.39)	(1.14)	(-0.62)
Literate Female	0.099 ***	0.218 ***	0.076 ***	0.058 *	0.113 ***	0.058 *	0.113 ***
	(5.36)	(3.67)	(3.42)	(1.77)	(4.69)	(1.79)	(3.43)
Literate Male	0.037 *	0.084	0.035	0.035	0.028	0.013	0.129 ***
	(1.86)	(1.47)	(1.29)	(1.21)	(1.06)	(0.35)	(3.34)
Household Business	0.294 ***	0.228 ***	0.242 ***	0.300 ***	0.299 ***	0.318 ***	0.204 ***
	(12.07)	(5.17)	(9.27)	(5.42)	(10.31)	(5.77)	(5.22)
Max Education Index	0.217 ***	0.218 ***	0.173 ***	0.116 ***	0.233 ***	0.172 ***	0.119 ***
	(11.82)	(5.49)	(7.87)	(3.12)	(10.43)	(4.19)	(2.60)
Agricultural Mechanisation	0.061 ***	-0.067 *	0.132 ***	0.014	0.071 ***	0.107 ***	0.049
	(2.99)	(-1.66)	(5.60)	(0.30)	(3.00)	(2.59)	(1.04)
Fertilizer Use	-0.002	0.039	0.045	0.037	-0.024	-0.009	0.193 ***
Household Characteristics	(-0.09)	(0.90)	(1.61)	(0.86)	(-0.90)	(-0.16)	(4.03)
Dependency Ratio	-1.430 ***	-1.238 ***	-1.551 ***	-1.198 ***	-1.448 ***	-1.363 ***	-1.368 ***
	(-25.37)	(-9.35)	(-23.79)	(-14.37)	(-18.98)	(-13.37)	(-11.83)
Adults	-0.554 ***	-0.569 ***	-0.620 ***	-0.460 ***	-0.556 ***	-0.547 ***	-0.600 ***
	(-21.57)	(-10.13)	(-19.75)	(-12.52)	(-14.98)	(-13.73)	(-12.78)
Male Head of Household	0.090 ***	0.094 *	0.142 ***	0.058	0.110 ***	0.007	0.047
Environmental Factors	(2.72)	(1.94)	(2.46)	(1.35)	(2.90)	(0.11)	(0.60)
Access to Dry Season Road	0.031	-0.406 ***	0.085	-0.124 **	0.078	-0.031	0.104
	(0.63)	(-10.32)	(1.26)	(-2.31)	(1.05)	(-0.45)	(0.92)
Access to All Season Road	0.048	0.268 ***	-0.038	0.107 *	-0.008	0.134 **	0.045
	(1.10)	(5.52)	(-0.78)	(1.68)	(-0.13)	(2.00)	(0.58)
Electricity Access	0.127 ***	0.204 ***	0.046	0.080	0.187 ***	0.061	0.027
	(4.68)	(2.95)	(1.29)	(1.37)	(5.22)	(1.01)	(0.50)
Healthservice Access	0.050	0.143 ***	-0.007	0.065	0.009	0.096 **	0.089
	(1.49)	(2.40)	(-0.16)	(1.34)	(0.17)	(2.06)	(1.07)
Observations	8048	6474	4211	2263	4122	2489	1437
R^2	0.395	0.248	0.335	0.260	0.394	0.360	0.367
F-ratio	65.10 ***	-	45.16 ***	17.99 ***	42.77 ***	26.50 ***	22.28 ***
Degrees of Freedom	[20, 467]	[19, 80]	[20, 245]	[20, 116]	[20, 414]	[20, 359]	[20, 400]

T-values in parentheses

Estimated Coefficient statistically significant at a (***) 99%, (**) 95%, and (*) 90% confidence levels.

Source: Authors' calculations based on LECS3.

Production Factors

Looking at the estimated coefficients group-wise, starting with production factors, it can first be noted that most variables exhibit the expected positive effects. This indicates that the production factors included in the model do indeed contribute to household consumption.

The four land variables show a positive contribution to consumption capacity, with a notable exception: irrigated land has a negative albeit statistically insignificant coefficient. It should be noted that the result is dependent on the household altitude. Lowland households experience a positive effect of irrigated land. This is an indication that the contribution to household welfare of access to irrigated land is dependent on other circumstances. This result is noteworthy since irrigated land could be expected to be most productive and thus give the highest contribution to consumption. Possible explanations are that irrigation is provided to otherwise unproductive land or that deficiencies in water management lower the productivity of irrigation systems. Only a further analysis could show the exact cause for these results.

The contribution from ownership of farm animals to household consumption is in general consistent with expectations. Cattle ownership consistently contributes positively to consumption across all household categories. This is also true for buffaloes, albeit with negative and insignificant variables for lowland and urban households.

The variables related to agricultural technology – mechanisation and chemical fertilizers – appear to have different effects on consumption capacity. Mechanisation tends to have a consistently positive impact, but the result for fertilizer use is more indeterminate. This could be due to the fact that fertilizers mostly are used to enhance the yield of land with low quality soil.

The biggest individual impact on consumption capacity, however, does not seem to be directly related to agriculture, but rather to a move away from agriculture, since the variables for families with a household business records a large and significant positive coefficient across the subpopulations. Households with a business have a consumption capacity that is higher than that of similar households that do not operate any household business. It appears clear that this result provides support for policies focusing on diversification of rural activities.

All variables for education and human capital are strongly significant, and it appears that literacy has a particularly positive impact for women. The coefficient for female literacy is consistently higher than that for male literacy: male literacy does not have any significant impact in many of the subpopulations. This is an interesting observation with potentially important policy implications. If investments in female literacy actually give better results than investments in male literacy, there are clear reasons for focusing such investments on women. However, the reason for the weaker results for males may be due to less variation in male literacy. As shown in Table 6, there is a literate adult man in more than 80 percent of the households, compared to 64 percent of households having a literate female member. Therefore the variable for male literacy might not capture differences between households' human capital endowments to the same extent.

Besides literacy, more advanced education has a value as shown by the variable max education. Raising the educational level of the most advanced household member by one unit, e.g. from lower secondary to upper secondary training raises the family's average per capita consumption level significantly. This result matches the findings from studies of other developing countries (Jolliffe 2002).

Household Characteristics

Turning to household characteristics it is clear that both dependency ratio and the number of adults are strongly negatively associated with per capita consumption. These results imply that larger families typically have lower per capita consumption, and that the consumption level is reduced further if the family has many members that can be categorized as dependents. This is consistent with cross country studies indicating that higher fertility increases poverty (Eastwood & Lipton, 1999).

The positive impact of labour that could be expected from theory is not obvious in the model, but this depends partly on the distribution of observations and partly on the diminishing marginal productivity of labour at the household level (keeping other inputs constant). There are no households without working members, and few households with only one working adult. The standard case is a household with three working adults: the positive contribution of this standard labour input is not

captured by the regression model. Moreover, households with more than three working adults tend to earn less per capita, because the best income earning opportunities are exploited by the first working adults in the household. Additional working family members are left with less productive tasks, and their lower marginal income will therefore reduce average income. Table 18 in the Appendix presents the results of an alternative regression with total household consumption as the dependent variable. This allows us to identify the marginal effect of labour input, but does not give any measure of per capita consumption. The results suggest that each additional adult raises total household consumption by approximately 40 percent. Assuming that the average household has limited savings capacity, this is also a rough estimate of their production contribution. The dependency ratio records a significant positive coefficient, which indicates that minors and elders also participate in production, raising the household's total consumption capacity.

The variable for male head of households exhibits a positive and statistically significantly value. This indicates that there could be a gender bias against the less than 5% of households that is headed by a female. An implication for this finding is that additional attention should be paid to promoting equal opportunities for women. It should be noted that very small share of households that are headed by females could deviate from the majority in other respects not captured by this model and a further in-depth analysis is needed to establish causal relationships.

Environmental Characteristics

Most of the environmental characteristics related to access to infrastructure and public services record significant coefficients of expected signs. Households in villages with access to electricity and health services have higher average consumption levels. Part of the result could be due to these variables acting as instrumental variables indicting whether the household is living in more prosperous areas. Still, it is reasonable to conclude that access to electricity and health services contribute positively to productivity. Electricity enables the household to enhance productivity by using electric equipment and lights. Access to health services lessens the risk of productivity loss due to sickness.

The relationship between road access and household welfare seems more complex. The standard assumption is that households with limited road access lack market access and have weaker income earning capacity. A lack of market access will limit the possibilities for non-agricultural employment and increase costs of inputs and lower the price of sold goods. Rice, the staple good for most Lao households, is of central importance: aside from own consumption, rice sales provide the income needed to purchase other goods. The transaction costs for selling rice are higher for households located in villages without road access and the sales prices net of transportation and other costs are lower.[4]

For the sample as a whole there seems to be some support for this interpretation; households in villages with access to roads record higher, albeit not statistically significant, consumption levels. There is a large difference regarding the effect of road access between households in different types of environments. The results for urban areas are highly significant: 99% of households have all season road access and the

[4] The determinants of farm gate prices for rice are explored in a related paper, see Andersson et al. (2005).

remaining single percent with only dry season road access has much lower consumption levels. For the rest of the categories, results are more mixed and it is difficult so detect any strong impact of road access in the data.

Robustness of Results

As discussed at length above, the formulation of the regression model require many supporting assumptions. To test the robustness of our results to alternative specifications, alternative regression models are presented together with the base-case results in Table 18 in the Appendix: Tables and Charts.

The first alternative model is a probit regression where the dependent variable is equal to one if the household is below the poverty line and zero if the household is non-poor. The results are roughly in accordance with those discussed above. In particular, the probit estimation underlines the importance of demographic factors: the likelihood that a household is classified as poor increases very strongly with the dependency ratio.

The second alternative regression use total household consumption as dependent variable. The results are consistent with those for per-capita consumption. The main difference in that the coefficients for the demographic variables change sign. The addition of more family members that weigh down the results in the per capita consumption model does not have the same effect when total household consumption is studied. These alternative regression specifications seem to confirm the view that the results are robust.

Geographic Characteristics

The effect of geographic location has been analysed in two steps. First of all Table 17 in the Appendix adds province dummy variables to the basic regression to control for unobserved environmental factors. The result is an improvement in the fit of the model, with most of the variables recording increased significance. Most of the province variables display significant coefficients. With Vientiane Municipality as the standard, the influence of household location in other provinces tends be negative, other things being equal. Table 17 indicates that geographic factors have a significant impact on household welfare. As a second step, Table 8 presents separate regressions for the three main geographic regions of Lao PDR and Vientiane Municipality.

It is noteworthy that Vientiane exhibits a pattern of determinants that is very different from other regions. The production factors related to agriculture do not have any significant impact on household consumption, but the impact of the proxies for education and human capital seems stronger than in other regions. The lack of significance for the male literacy variable is mainly related to the smaller variation for this measure in Vientiane: there are very few households in Vientiane without any literate male members. The weak result for the health service variable has a similar explanation. It is also interesting to note that the household business dummy records a lower coefficient in Vientiane than in the other regions. A likely reason is that household businesses are more common in Vientiane than elsewhere in the country, at the same time as there are better opportunities for wage employment and other alternatives to low-productive agriculture.

There are less striking differences between the three main regions, but a number of distinguishing characteristics can still be noted. There are differences in the impact of land access and agricultural mechanization and fertilizer use. These are probably related to difference in land quality, both regarding fertility and slopes. For instance, irrigated land has a positive sign for the central region only. Both the South and the Central show significant and positive coefficients for grazing land, whereas un-irrigated land seems to be more important for households in the North. These results can be an effect of large geographical variations in land quality. Prime agricultural land is unevenly distributed with most of it confined to the floodplains of the Mekong River and its tributaries in the central parts of the country; here agricultural mechanization gives a positive contribution to household consumption as high-yield soils can

be more intensively used with machinery. Conditions for agriculture in other parts of the country are weaker because of the mountainous landscape: over two-thirds of the land area has slopes exceeding 20 percent and one-third of the country has slopes exceeding 30 percent. Soils on these sloping land slots are thin and prone to erosion and agricultural mechanization does not contribute to household welfare. An additional constraint on the agriculture in the Eastern and South-eastern parts of the country is the presence of unexploded ordnance left from the war.

Male literacy has a significant impact only in the Central region. One possible reason is that the possibilities to find off-farm employment are better in parts of this region than in the more remote Northern and Southern provinces. Owning a household business seems to contribute most to household consumption in the South. A higher reliance on cash crops as well as better access to the Thai market may improve opportunities for various kinds of business operations.

Table 8: Regression Results. By Region and Border Effect.

	Vientiane	Northern Region	Central Region	Southern Region	Lao PDR Border Effect
Dependent Variable	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita
Constant	12.704 ***	12.600 ***	12.384 ***	12.543 ***	12.484 ***
Factors of Production	(62.53)	(111.79)	(101.12)	(104.74)	(186.64)
Irrigated Land Area	0.180 **	-0.061	0.034	-0.073	-0.005
	(2.23)	(-1.41)	(0.47)	(-1.13)	(-0.14)
Unirrigated Land Area	-0.014	0.041 *	0.024	0.088 **	0.028 **
	(-0.30)	(1.75)	(1.29)	(2.26)	(1.99)
Grazing Land Area	0.099	0.015	0.213 ***	0.093 ***	0.085 ***
	(0.80)	(0.24)	(4.58)	(3.25)	(2.57)
Forest Land Area	0.548 ***	-0.029	0.097	0.110 ***	0.008
	(9.57)	(-1.14)	(0.87)	(3.47)	(0.24)
Number of Cattle	0.017	0.091 ***	0.025	0.085	0.051 ***
	(0.24)	(3.69)	(1.34)	(1.51)	(2.95)
Number of Buffalo	-0.038	0.064 ***	0.015	-0.006	0.016
	(-0.49)	(2.58)	(0.68)	(-0.15)	(1.07)
Number of Pigs	0.006	0.012	0.006	-0.019	0.017
	(0.04)	(0.45)	(0.16)	(-0.44)	(0.88)
Literate Female	0.190 ***	0.070 ***	0.111 ***	0.097 ***	0.100 ***
	(2.59)	(2.34)	(3.64)	(2.93)	(5.53)
Literate Male	0.000	0.017	0.085 ***	0.038	0.041 **
	(0.00)	(0.52)	(2.61)	(1.13)	(2.17)
Household Business	0.185 ***	0.295 ***	0.248 ***	0.413 ***	0.287 ***
	(3.34)	(5.39)	(7.72)	(9.04)	(11.81)
Max Education Index	0.264 ***	0.168 ***	0.201 ***	0.190 ***	0.217 ***
	(4.45)	(4.42)	(6.17)	(5.88)	(11.84)
Agricultural Mechanisation	-0.070	0.032	0.103 ***	0.100 ***	0.052 ***
	(-1.14)	(0.90)	(3.19)	(2.34)	(2.58)
Fertilizer Use	0.042	0.097 *	-0.028	0.047	-0.014
Household Characteristics	(0.65)	(1.91)	(-0.83)	(1.10)	(-0.63)
Dependency Ratio	-1.221 ***	-1.383 ***	-1.394 ***	-1.536 ***	-1.394 ***
	(-6.25)	(-14.95)	(-14.69)	(-15.35)	(-24.69)
Adults	-0.542 ***	-0.522 ***	-0.581 ***	-0.626 ***	-0.548 ***
	(-6.44)	(-13.05)	(-12.20)	(-13.93)	(-21.57)
Male Head of Household	0.114	-0.097	0.124 ***	0.119 **	0.093 ***
Environmental Factors	(1.45)	(-1.34)	(2.50)	(2.31)	(2.80)
Access to Dry Season Road	dropped	0.068	0.095	0.019	0.019
		(1.16)	(0.92)	(0.18)	(0.41)
Access to All Season Road	dropped	0.035	0.053	0.007	0.038
		(0.62)	(0.81)	(0.07)	(0.86)
Electricity Access	dropped	0.062	0.113 ***	0.191 ***	0.119 ***
		(1.24)	(2.92)	(3.49)	(4.39)
Healthservice Access	-0.030	0.117 ***	0.012	-0.002	0.046
Border Variables	(-0.64)	(2.56)	(0.19)	(-0.04)	(1.39)
Thai Border (Mekong)	-	-	-	-	0.018
					(0.57)
Thai Border (Land)	-	-	-	-	0.020
					(0.57)
China Border	-	-	-	-	0.092
					(1.57)
Vietnam Border	-	-	-	-	-0.143 ***
					(-3.61)
Cambodia Border	-	-	-	-	-0.158 ***
					(-2.75)
Myanmar Border	-	-	-	-	0.155 *
					(1.71)
Observations	720	3042	2670	1616	8048
R^2	0.177	0.3928	0.3481	0.4533	0.4043
F-ratio	-	30.95 ***	24.98 ***	25.16 ***	51.5 ***
Degrees of Freedom	[14, 33]	[20, 163]	[20, 143]	[20, 77]	[26, 461]

T-values in parentheses

Estimated Coefficient statistically significant at a (***) 99%, (**) 95%, and (*) 90% confidence levels.

Source: Authors' calculations based on LECS3.

The variables for border effects present an interesting pattern. A first point to note is that a location along the border to Thailand does not seem to have any significant impact on average consumption. One likely reason is that infrastructure facilitates a spread of the benefits of trade with Thailand to interior parts of the country. Many road investments have been made with an objective of linking inland areas to the Mekong Valley. As a result border location doesn't give any unique effect as markets in Thailand are accessible for more distant districts as well. Pakse in Champasack province is one example of this. Thanks to excellent infrastructure, Pakse has evolved into one of the most important locations for trade with Thailand despite being a non-border district. Looking at the more remote areas bordering China, Myanmar, Vietnam, and Cambodia, it is easier to identify a direct effect of border location. There seems to be a clear distinction between the pairs China/Myanmar and Vietnam/Cambodia. Households in the provinces adjacent to China and Myanmar record significantly higher consumption than those in provinces on the borders to Vietnam and Cambodia. The reasons for the positive effects in the former case are undoubtedly related to the increasing border trade, which has been stimulated by improvements in transport infrastructure. The results for the districts with border to Myanmar should be interpreted with some caution. There are only two districts along this stretch of border and the Mekong River gives these districts access to markets in Myanmar, Northern Thailand and the Yunnan Province of China. While there is some border trade with Vietnam and Cambodia, it seems clear that any positive effects are overshadowed by other locational disadvantages. One important factor is likely to be the presence of unexploded ordnance in these areas as noted above. These regression results are in line with the findings presented in Table 2 above, where it was shown that the developments between 1997/98 and 2002/03 were more favourable in the Northern provinces bordering China and Myanmar.

Ethnic Minorities and Sources of Inequality

It is commonly suggested that an analysis along ethnic dimensions is important for understanding economic and social developments in Lao PDR (see Evans, 2003), as well as neighbouring countries in Southeast Asia (Plant, 2002). Data presented in Table 4 above confirm findings of earlier studies indicating that poverty is concentrated and more severe among ethnic minorities and qualitative inquiries that have investigated the causal relationships between ethnicity and poverty (ADB, 2001 and UNDP, 2001).

However, the effects of ethnic origin are not captured in the basic regression models discussed above. In order to explore the direct and indirect effects of ethnicity further, we therefore undertake three additional steps. First we analyse the differences between ethnic groups by including ethnic variables in an extended regression. This reveals whether households belonging to some ethnic family are more likely to suffer from poverty, controlling for other determinants of poverty. Secondly, we perform separate regressions for the five ethnic families to examine whether the marginal effects of the various poverty determinants are different across the ethnic families. These different effects are then further analysed through a decomposition.

Table 9: Regression Results. Fixed Effects of Ethnicity.

	Ethnic Effect	Ethnic Effect Rural HH	Ethnic and Province
Dependent Variable	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita
Constant	12.493 ***	12.517 ***	12.577 ***
Factors of Production	(179.79)	(166.57)	(157.39)
Irrigated Land Area	-0.004	-0.026	-0.008
	(-0.12)	(-0.75)	(-0.24)
Unirrigated Land Area	0.035 ***	0.061 ***	0.035 ***
	(2.46)	(3.79)	(2.64)
Grazing Land Area	0.082 ***	0.107 ***	0.064 **
	(2.35)	(4.72)	(2.19)
Forest Land Area	0.019	0.003	0.017
	(0.66)	(0.08)	(0.63)
Number of Cattle	0.039 **	0.038 **	0.047 ***
	(2.24)	(2.01)	(2.88)
Number of Buffalo	0.012	0.037 **	0.029 **
	(0.79)	(2.30)	(1.99)
Number of Pigs	0.011	0.012	0.026
	(0.54)	(0.59)	(1.38)
Literate Female	0.094 ***	0.080 ***	0.086 ***
	(5.32)	(4.72)	(4.94)
Literate Male	0.053 ***	0.068 ***	0.046 ***
	(2.83)	(3.59)	(2.54)
Household Business	0.288 ***	0.259 ***	0.271 ***
	(11.70)	(10.65)	(11.88)
Max Education Index	0.202 ***	0.151 ***	0.173 ***
	(10.93)	(7.60)	(8.80)
Agricultural Mechanisation	0.060 ***	0.118 ***	0.050 ***
	(3.02)	(5.33)	(2.55)
Fertilizer Use	-0.016	0.026	0.007
Household Characteristics	(-0.72)	(1.05)	(0.28)
Dependency Ratio	-1.426 ***	-1.475 ***	-1.367 ***
	(-25.29)	(-26.57)	(-25.81)
Adults	-0.552 ***	-0.583 ***	-0.543 ***
	(-20.83)	(-21.83)	(-22.26)
Male Head of Household	0.084 ***	0.112 ***	0.081 ***
Environmental Factors	(2.60)	(2.58)	(2.57)
Access to Dry Season Road	0.047	0.059	0.078
	(0.96)	(1.25)	(1.57)
Access to All Season Road	0.054	0.020	0.053
	(1.27)	(0.48)	(1.31)
Electricity Access	0.115 ***	0.052 *	0.098 ***
	(4.28)	(1.72)	(3.68)
Healthservice Access	0.048	0.021	0.048
Ethnic Characteristics	(1.42)	(0.60)	(1.44)
Mon-Khmer	-0.096 ***	-0.073 **	-0.178 ***
	(-2.85)	(-2.02)	(-2.33)
Tibeto-Burman	0.145 ***	0.172 ***	0.034
	(2.43)	(2.50)	(0.49)
Hmong-Mien	0.032	0.077	-0.060
	(0.71)	(1.56)	(-0.88)
Other Ethnic	-0.215 ***	-0.226 ***	-0.050
Province Variables	(-2.58)	(-2.57)	(-0.74)
Phongsaly	-	-	-0.099
			(-1.35)
Luangnamtha	-	-	-0.145 *
			(-1.66)
Oudomxay	-	-	-0.144 ***
			(-2.37)
Bokeo	-	-	-0.153 *
			(-1.73)
Luangprabang	-	-	-0.081
			(-1.42)
Huaphanh	-	-	-0.115 *
			(-1.65)
Xayabury	-	-	-0.132 **
			(-2.14)
Xiengkhuang	-	-	-0.206 ***
			(-3.87)
Vientiane Province	-	-	-0.316 ***
			(-5.39)
Borikhamxay	-	-	-0.153 **
			(-2.22)
Khammuane	-	-	-0.037
			(-0.65)
Savannakhet	-	-	-0.326 ***
			(-4.89)
Saravane	-	-	-0.103
			(-1.44)
Sekong	-	-	-0.094 ***
			(-2.77)
Champasack	-	-	0.115 *
			(1.75)
Attapeu	-	-	0.000
			(0.01)
Xaysomboun SR	-	-	-0.198 ***
			(-2.91)
Observations	8048	6474	8048
R^2	0.4024	0.3546	0.4217
F-ratio	57.14 ***	51.51 ***	39.98 ***
Degrees of Freedom	[24, 463]	[24, 376]	[41, 446]

T-values in parentheses

Estimated Coefficient statistically significant at a (***) 99%, (**) 95%, and (*) 90% confidence levels.

Source: Authors' calculations based on LECS3.

A first point to note is that the results in Table 9 cast some doubt on the established views regarding the significance of ethnicity. While some ethnic variables are significant both when including the whole population and when the sample is limited to rural households, there is no clear pattern in comparison with the default case, the Tai-Kadai majority population. The dummies for the categories Mon-Khmer and Other record negative coefficients, but the variables for Tibeto-Burman and Hmong-Mien categories are positive. Thus, even though the average income and consumption levels of minorities are lower than those of the Tai-Kadai, it seems that this is not the outcome of a direct effect depending only on ethnic origin.

Recalling the discussion in connection with Figure 1 above, it was argued that consumption differences between different subgroups in a population can be caused by three different effects. These are:

a) A direct effect from ethnicity to consumption.
b) An indirect effect where ethnicity determines the access to consumption enabling factors (consumption opportunities).
c) An indirect effect where ethnicity affects the returns that are realized from the consumption enabling factors (realized consumption opportunities).

These were illustrated as lines a), b), and c) in Figure 1. The results in Table 9 have established that the lower average consumption levels of minority groups cannot be explained by the first of these arguments., Instead, it is reasonable to examine how the minority groups differ from the majority population regarding access to various production factors (b), and to ask if there are differences in the production processes that translate inputs into income and consumption capacity (c). As a basis for the discussion about ethnicity and poverty, Table 10, provide statistics for household characteristics across the main ethnic families.

Table 10: Summary Statistics Explanatory Variables. By Ethnic Family.

	All Ethnic Groups		Tai-Kadai		Mon-Khmer		Tibeto-Burman		Hmong-Mien		Other	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Observations	8048		4833		2020		410		704		81	
Factors of Production												
Irrigated Land Area	0.05	0.01	0.07	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00
Unirrigated Land Area	1.48	0.04	1.44	0.05	1.56	0.07	1.55	0.12	1.54	0.10	1.60	0.35
Grazing Land Area	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forest Land Area	0.03	0.01	0.02	0.01	0.04	0.01	0.03	0.02	0.05	0.03	0.03	0.02
Number of Cattle	1.10	0.07	1.07	0.08	0.61	0.06	0.82	0.15	2.74	0.43	0.60	0.39
Number of Buffalo	1.02	0.04	0.98	0.04	1.07	0.08	1.05	0.13	1.25	0.24	0.76	0.20
Number of Pigs	0.85	0.03	0.61	0.03	1.14	0.07	1.52	0.19	1.99	0.19	0.39	0.10
Literate Female	0.64	0.01	0.80	0.01	0.39	0.02	0.19	0.04	0.21	0.03	0.38	0.09
Literate Male	0.83	0.01	0.89	0.01	0.74	0.02	0.33	0.06	0.69	0.04	0.70	0.12
Household Business	0.24	0.01	0.31	0.01	0.08	0.01	0.04	0.01	0.13	0.04	0.11	0.06
Max Education Index	2.01	0.03	2.35	0.04	1.31	0.03	0.88	0.09	1.56	0.07	1.23	0.21
Agricultural Mechanisation	0.18	0.01	0.23	0.01	0.10	0.01	0.02	0.01	0.11	0.03	0.19	0.07
Fertilizer Use	0.28	0.01	0.38	0.02	0.06	0.01	0.08	0.04	0.05	0.02	0.07	0.03
Household Characteristics												
Dependency Ratio	0.54	0.00	0.52	0.00	0.57	0.00	0.55	0.01	0.63	0.01	0.55	0.03
Adults	3.05	0.03	3.07	0.03	2.98	0.05	3.12	0.11	3.07	0.12	2.85	0.22
Male Head of Household	0.96	0.00	0.94	0.00	0.97	0.01	0.99	0.00	0.98	0.01	0.93	0.03
Environmental Factors												
Access to Dry Season Road	0.81	0.01	0.87	0.02	0.72	0.03	0.36	0.07	0.64	0.06	0.93	0.07
Access to All Season Road	0.68	0.02	0.77	0.02	0.55	0.04	0.22	0.07	0.47	0.07	0.77	0.15
Electricity Access	0.49	0.02	0.62	0.02	0.20	0.03	0.18	0.05	0.28	0.07	0.45	0.18
Healthservice Access	0.79	0.02	0.86	0.02	0.68	0.04	0.47	0.10	0.69	0.06	0.74	0.16

Source: Authors' calculations based on LECS3.

Besides large differences in realized consumption, the table gives a picture of unequal access to production factors, as well as substantial differences in household characteristics and environmental factors. Land, a crucial factor of production in a largely agricultural society such as Lao PDR, seems to be rather evenly distributed across the ethnic families. The majority Tai-Kadai is in fact the ethnic family with the smallest average landholdings, but this land is in much higher extent irrigated. Yet, other factors influencing agricultural productivity are less evenly distributed. Fertilizer use ranges from 38% of households among Tai-Kadai to 5% among Hmong-Mien; cattle ownership averages 3 animals per household among the Hmong-Mien, but less than 1 among Mon-Khmer and Tibeto-Burmans; almost one in four Tai-Kadai households but only one in fifty Tibeto-Burman households have access to a tractor, and so forth. The overall picture is one of great variation in the endowments of factors of production. The picture is similar regarding household characteristics. Minority households are burdened by more dependents and the households tend to have more adult family members. The largest differences can probably be found in the environmental factors. Almost 80% of Tai-Kadai lives in villages with all-season road access and more than 60% have electricity. The corresponding figures for Tibeto-Burman households are 22% for road access and less than 20% have access to electricity. These descriptive statistics indicate that uneven access to important consumption opportunities – alternative (b) above – could be a crucial part of the explanation for differences in poverty among ethnic groups.

Still, it is commonly noted that livelihoods, agricultural practices and work habits differ between ethnic groups. It is reasonable to assume that these differences are reflected in significantly different consumption generating processes. It is possible that households with different ethnic origin make different use of their resources and thus compensate (or aggravate) the differences in access to consumption generating factors. Through separate regressions for the different ethnic subpopulations (Table 11) it is possible to provide some insights as to how ethnic groups utilize available endowments.

Some highly interesting patterns emerge from the separate regression models for the five ethnic groups presented in Table 11. Firstly, looking at the explanatory power of the five models, all are lower than those for the aggregate household sample. This suggests that some of the variation in consumption is related to ethnic origin and perhaps geographic location (which is omitted from these models because most ethnic groups are concentrated to distinct regions in Lao PDR): when these characteristics are filtered out, it becomes more difficult to explain the variation in each specific sub-sample. The exception is the residual Other group, which records substantially higher explanatory power even though the number of observations is much lower than for the main ethnic groups. The most likely explanation for this is that geography matter more for the differences within this group than in the other cases. The variable that explains most of the consumption difference is electricity which could identify households in or near urban centres.

Table 11: Regression Results. By Ethnic Family.

	Tai-Kadai	Mon-Khmer	Tibeto-Burman	Hmong-Mien	Other Ethnic
Dependent Variable	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita	Cons. Per Capita
Constant	12.558 ***	12.161 ***	12.501 ***	12.520 ***	12.740 ***
Factors of Production	(141.09)	(84.42)	(94.30)	(66.78)	(31.75)
Irrigated Land Area	0.004	-0.072	0.140	0.181 **	dropped
	(0.11)	(-1.40)	(1.45)	(2.15)	
Unirrigated Land Area	0.006	0.107 ***	0.040	0.125 ***	-0.145 ***
	(0.40)	(2.85)	(1.56)	(3.53)	(-2.58)
Grazing Land Area	0.093 ***	0.070	dropped	dropped	dropped
	(2.47)	(0.94)			
Forest Land Area	0.025	0.018	0.013	0.195 **	0.131 ***
	(0.46)	(0.32)	(0.46)	(2.20)	(3.62)
Number of Cattle	0.034	0.006	0.138 **	0.083 ***	0.124 ***
	(1.49)	(0.18)	(2.30)	(3.19)	(2.44)
Number of Buffalo	0.005	0.015	0.030	0.086 **	-0.017
	(0.28)	(0.46)	(0.55)	(2.04)	(-0.14)
Number of Pigs	-0.029	0.034	0.022	-0.007	0.062
	(-1.10)	(0.95)	(0.46)	(-0.16)	(0.46)
Literate Female	0.111 ***	0.061 ***	-0.013	0.138 **	-0.012
	(4.79)	(2.39)	(-0.18)	(2.16)	(-0.22)
Literate Male	0.022	0.110 ***	-0.136 ***	0.175 ***	0.101
	(0.82)	(3.73)	(-2.41)	(3.61)	(0.80)
Household Business	0.305 ***	0.224 ***	0.245 *	0.091	0.033
	(11.56)	(4.66)	(1.80)	(1.32)	(0.27)
Max Education Index	0.216 ***	0.166 ***	0.204 **	0.070	0.083 ***
	(10.50)	(3.84)	(1.86)	(1.14)	(2.35)
Agricultural Mechanisation	0.069 ***	0.133 ***	0.131	-0.015	0.041
	(2.94)	(3.08)	(0.60)	(-0.26)	(0.46)
Fertilizer Use	-0.016	0.147 **	0.092	0.089	-0.233 *
Household Characteristics	(-0.67)	(2.05)	(1.03)	(0.82)	(-1.72)
Dependency Ratio	-1.487 ***	-1.347 ***	-1.150 ***	-1.305 ***	-1.318 ***
	(-21.22)	(-14.05)	(-10.91)	(-9.19)	(-5.13)
Adults	-0.585 ***	-0.548 ***	-0.373 ***	-0.526 ***	-0.229 *
	(-16.86)	(-11.96)	(-7.42)	(-8.69)	(-1.86)
Male Head of Household	0.087 ***	0.204 **	-0.098	-0.066	-0.245
Environmental Factors	(2.66)	(2.09)	(-0.90)	(-0.49)	(-0.62)
Access to Dry Season Road	0.069	0.112	-0.050	-0.112	-0.559 ***
	(1.01)	(1.33)	(-0.28)	(-1.09)	(-12.62)
Access to All Season Road	0.058	0.002	0.216	0.129	0.149 ***
	(1.18)	(0.02)	(1.62)	(1.39)	(2.66)
Electricity Access	0.101 ***	0.090	0.035	0.192 ***	0.634 ***
	(3.29)	(1.52)	(0.18)	(2.54)	(5.29)
Healthservice Access	0.044	0.047	0.115	0.059	-0.152 *
	(0.86)	(1.09)	(1.26)	(0.69)	(-1.74)
Observations	4833	2020	410	704	81
R^2	0.359	0.309	0.330	0.288	0.626
F-ratio	43.1 ***	21.71 ***	22.01 ***	13.4 ***	-
Degrees of Freedom	[20, 457]	[20, 449]	[19, 76]	[19, 266]	[11, 85]

T-values in parentheses

Estimated Coefficient statistically significant at a (***) 99%, (**) 95%, and (*) 90% confidence levels.

Source: Authors' calculations based on LECS3.

A second observation is that there are substantial differences between the five estimations. In particular, it seems that the *Lao Soung* Tibeto-Burman and Hmong-Mien, ethnic families are different from the others. Several coefficient estimates differ significantly from those with other ethnic origin. For instance, in the case of Tibeto-Burman, land records a non-significant coefficient and both male and female literacy have negative coefficients. In all other groups, the effect of literacy is the opposite, raising the household's consumption capability. The Mon-Khmer, on the other hand, seems to be most similar to the majority population. This is

consistent with the classification as of this group as *Lao Theung*, inhabiting the slopes between the *Lao Loum* valley population and the *Lao Soung* mountainous population.

The results presented in Table 10 and Table 11 suggests that the differences in consumption and poverty levels are generated both by unequal access to consumption generating factors as well as by differences related to how these factors are used in the production process. It is therefore relevant to explore what is the relative role of each of these two explanations.

Consumption Gap Decomposition

To analyze the shares of the consumption gap between ethnic minorities and the Tai-Kadai majority that are due to access to production factors (b) and how these factors are used (c), we have carried out a further decomposition. This technique, commonly used in studying labour market discrimination, is known as a Blinder-Oaxaca decomposition (Blinder, 1973 and Oaxaca, 1973). Following Psacharopoulos and Patrinos (1994), we apply this decomposition to analyze differences in consumption between ethnic groups.

In principle, the decomposition uses the data presented in Table 10 and Table 11 above, and traces the shares of the consumption gap that are due to factors of production or endowments (c) and to how these are used or returns (b). (The decomposition technique is presented in detail in Appendix Table 19.) Building on the earlier framework of analysis, the results presented in Table 12 further divides the consumption generating factors into factors of production, household characteristics and environmental factors.

Table 12: Consumption Gap Decomposition. Ethnic Minorities.

Consumptiongap Analysis	All Minorities	Mon-Khmer	Tibeto-Burman	Hmong-Mien	Other Ethnic
Share Due To:					
Factors of Production Endowment	57%	53%	97%	57%	48%
Household Characteristics Endowment	19%	14%	18%	43%	2%
Environmental Factors Endowment	19%	14%	30%	17%	5%
Total Difference in Endowments	**95%**	**83%**	**154%**	**120%**	**54%**
Total Difference in Returns	**5%**	**17%**	**-54%**	**-20%**	**46%**

Source: Authors' calculations based on LECS3.

The decomposition strengthens the argument that unequal access to consumption generating factors is highly important for explaining the consumption gap. Looking jointly at all minorities, 95 percent of the consumption gap can be explained by different endowments of production factors, household characteristics, and environmental factors than for the majority population. The most important of these is the category production factors, which accounts for 57 percent of the gap. In brief, minorities have lower levels of education, less capital, and weaker technology than the Tai-Kadai. The Tibeto-Burman sub-group differs from this general result with unfavourable environmental factors accounting for a much larger share of the consumption gap. Overall, only 5 percent of the differences are due to different marginal effects. This indicates that the main channel for differences in poverty incidence between ethnic groups can be illustrated with the dotted line b) in Figure 1: unequal access to production factors. Regarding the efficiency of resource use, it is notable that the Tibeto-Burman and Hmong-Mien subgroups actually use their scarce resources more efficiently than the majority population, thus to some extent compensating for their weaker

endowments. This is an indication that these Lao Soung groups have adapted their livelihoods to the conditions in the upland areas, making efficient use of available resources. Similar decomposition exercises analyzing ethnic differences in Vietnam also showed a compensating behaviour among minorities (van de Walle & Gunewardena, 2001).

However, some restraint is in place when interpreting these results. There is a risk that the comparison is one of "Apples and Oranges", i.e., that the comparison is done between households that not only differ in ethnicity but also in many other respects. To check the robustness of the results, we have therefore carried out similar decompositions for matched samples of households from the majority Tai-Kadai and minority samples. Demographic variables (number of income generating adults and the dependency ratio) and variables for location (urban/rural with or with out road and province) were used in the matching process. This is expected to eliminate some of the differences between households, leaving less of a gap to be explained by ethnicity. The results from the decompositions based on matched samples are presented in Table 13. (See Appendix Table 20 for a detailed presentation of the decomposition).

Table 13: Consumption Gap Decomposition. Matched Samples.

Consumptiongap Analysis, Matched Samples	All Minorities	Mon-Khmer	Tibeto-Burman	Hmong-Mien	Other Ethnic
Share Due To					
Factors of Production Endowment	60%	43%	60%	163%	22%
Household Characteristics	0%	-1%	-1%	-3%	1%
Environmental Factors Endowment	23%	15%	54%	46%	-49%
Total Difference in Endowments	**83%**	**57%**	**113%**	**207%**	**-26%**
Total Difference in Returns	**17%**	**43%**	**-13%**	**-107%**	**126%**

Source: Authors' calculations based on LECS3.

Overall, the share of the consumption gap that is explained by differences in endowments falls and the share accounted for by differences in returns increases. However, it is still clear that the main explanation for consumption gaps is still unequal access to factors of production. The only exception is the small Other group, which appears to combine small ethnic groups in remote rural locations and Chinese and Vietnamese minorities in urban areas.

Summarizing these results, it seems clear that the analysis has uncovered some new facts on the sources of ethnic differences. The analysis has shown that the large differences in consumption and poverty among different ethnic families have economic explanations. The access to economically significant consumption enabling factors – in particular factors of production – differs significantly across ethnic families, explaining the major part of the consumption gap. Households from different ethnic groups also use factors of production in different ways, as shown by the widely different results in the regression analysis in Table 11. However, it is mainly the weaker access to education, capital, agricultural inputs, and the limited incidence of household business that explains the lower consumption levels among the minorities in Lao PDR. Improvements in these areas are obviously crucial for poverty alleviation.

Conclusions

This report has sought to improve our understanding of the determinants of poverty in Lao PDR by creating an analytical model for household welfare and by using available quantitative information in a multiple regression framework. This concluding section summarizes the results, key implications, and limitations of the analysis.

The results of the determinants of poverty in Lao PDR indicate that poor households are characterized by large household size, large dependency ration, low levels of human capital, simple technology, limited access to agricultural inputs, and unfavourable locational characteristics: less access to essential infrastructure, and limited access to health services. In many instances, poor households belong to ethnic minority groups. These results provide policy makers with reasonably objective measures of the potential poverty reduction impacts that may be realized from well designed poverty alleviation programs. Drawing upon the analysis presented here, it is possible to identify five principal elements or objectives of a poverty reduction strategy for Lao PDR. These include (1) reduced numbers of dependents in households, (2) investments in (female) education, (3) efforts to stimulate entrepreneurship and diversification of economic activity from agriculture to other sectors, (4) adoption of measures to raise agricultural productivity, and (5) improved infrastructure and health care.

The in-depth analysis of ethnic dimension of poverty in Lao PDR also provides some indications for policy, as well as highlighting the need for further research. It is clear that poverty is concentrated to some ethnic sub-groups. However, our study indicates that poverty is mainly due to a lack of access to certain type of factors of production and surrounding environmental factors, notably agricultural technology and infrastructure. Once ethnic minority households have access to these resources, they are capable of using them for productive activities at least as well as the majority population. Since active government and donor policies can be used to stimulate access to resources, alleviation of minority poverty is within the scope of active policies.

The LECS3 provides a wealth of information on household living conditions, economic activities and surrounding environment and institutions, and offers unique opportunities to explore the causes for poverty. However, the available data also have some limitations. A first caveat is that any estimation results should be interpreted with some caution, and seen as indicators of broad patterns and trends, rather than

exact measures of specific relationships between variables. A second concern is related to the continuous changes in the economic environment at all levels, local as well as regional and international. Such environmental changes may lead to rapid fluctuations in economic conditions and changes in behaviour. Regular collection and analysis of primary data is therefore crucial to understand the underlying processes of change and development: in the case of Lao PDR, a particular problem in this area is the lack of timely and reliable regional and provincial data.

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Appendix: Tables and Charts

Table 14: Ethnolinguistic Families.

	Ethnic Group	Ethnolinguistic Family	Lao PDR Ethnic Classification
1	Lao	Tai-Kadai	Lao Loum
2	Phoutai	Tai-Kadai	Lao Loum
3	Tai	Tai-Kadai	Lao Loum
4	Leu	Tai-Kadai	Lao Loum
5	Nhuane	Tai-Kadai	Lao Loum
6	Yang	Tai-Kadai	Lao Loum
7	Xaek	Tai-Kadai	Lao Loum
8	Thaineua	Tai-Kadai	Lao Loum
9	Keumu	Mon-Khmer	Lao Theung
10	Prai	Mon-Khmer	Lao Theung
11	Cingmoon	Mon-Khmer	Lao Theung
12	Phong	Mon-Khmer	Lao Theung
13	Thian	Mon-Khmer	Lao Theung
14	Irdue	Mon-Khmer	Lao Theung
15	Bid	Mon-Khmer	Lao Theung
16	Lamed	Mon-Khmer	Lao Theung
17	Samtao	Mon-Khmer	Lao Theung
18	Katang	Mon-Khmer	Lao Theung
19	Makong	Mon-Khmer	Lao Theung
20	Tri	Mon-Khmer	Lao Theung
21	Yru	Mon-Khmer	Lao Theung
22	Trieng	Mon-Khmer	Lao Theung
23	Taoey	Mon-Khmer	Lao Theung
24	Yae	Mon-Khmer	Lao Theung
25	Brao	Mon-Khmer	Lao Theung
26	Katu	Mon-Khmer	Lao Theung
27	Harak	Mon-Khmer	Lao Theung
28	Ouy	Mon-Khmer	Lao Theung
29	Krieng	Mon-Khmer	Lao Theung
30	Cheng	Mon-Khmer	Lao Theung
31	Sadang	Mon-Khmer	Lao Theung
32	Xuay	Mon-Khmer	Lao Theung
33	Nhahern	Mon-Khmer	Lao Theung
34	Lavy	Mon-Khmer	Lao Theung
35	Pako	Mon-Khmer	Lao Theung
36	Kmer	Mon-Khmer	Lao Theung
37	Toum	Mon-Khmer	Lao Theung
38	Nguane	Mon-Khmer	Lao Theung
39	Meuang	Mon-Khmer	Lao Theung
40	Kri	Mon-Khmer	Lao Theung
41	Akha	Tibeto-Burman	Lao Soung
42	Singsili	Tibeto-Burman	Lao Soung
43	Lahou	Tibeto-Burman	Lao Soung
44	Sila	Tibeto-Burman	Lao Soung
45	Rangy	Tibeto-Burman	Lao Soung
46	Lolo	Tibeto-Burman	Lao Soung
47	Ho	Tibeto-Burman	Lao Soung
48	Hmong	Hmong-Mien	Lao Soung
49	Ilmain	Hmong-Mien	Lao Soung
50	Other	Other	Other

Table 15: Provinces and Regions.

	Province	Region
1	Vientiane M	Vientiane M
2	Phongsaly	North
3	Luangnamtha	North
4	Oudumxay	North
5	Bokeo	North
6	Luangprabang	North
7	Huaphanh	North
8	Xayabury	North
9	Xiengkhuang	Central
10	Vientiane	Central
11	Borikhamxay	Central
12	Khammuane	Central
13	Savannakhet	Central
14	Saravane	South
15	Sekong	South
16	Champasack	South
17	Attapeu	South
18	Xaysomboun SR	Central

Figure 2: Map of Lao PDR.

Table 16: Correlation Matrix. Base Case Regression Variables.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Irrigated Land Area (1)	1.00																				
Unirrigated Land Area (2)	-0.17	1.00																			
Grazing Land Area (3)	-0.05	0.00	1.00																		
Forest Land Area (4)	0.00	0.04	0.03	1.00																	
Number of Cattle (5)	-0.06	0.02	-0.07	0.02	1.00																
Number of Buffalo (6)	-0.08	-0.23	0.06	0.06	-0.13	1.00															
Number of Pigs (7)	0.03	0.00	0.01	-0.03	-0.17	-0.06	1.00														
Literate Female (8)	0.04	0.09	-0.02	-0.06	0.09	-0.08	0.07	1.00													
Literate Male (9)	-0.01	0.08	-0.01	0.01	0.05	0.04	0.11	-0.05	1.00												
Household Business (10)	0.00	-0.16	-0.03	0.02	0.04	0.03	-0.14	-0.05	-0.13	1.00											
Max Education Index (11)	-0.07	-0.08	0.01	0.02	0.05	-0.05	-0.04	-0.13	-0.03	-0.02	1.00										
Agricultural Mechanisation (12)	0.06	-0.08	-0.02	0.04	-0.17	-0.02	-0.06	-0.02	-0.10	-0.11	-0.09	1.00									
Fertilizer Use (13)	-0.03	-0.11	-0.02	-0.03	-0.07	-0.06	0.07	-0.01	-0.05	0.13	-0.09	-0.07	1.00								
Dependency Ratio (14)	0.00	-0.09	0.00	-0.01	0.00	-0.12	0.06	-0.02	-0.01	0.05	-0.06	-0.16	0.09	1.00							
Adults (15)	0.02	-0.18	-0.02	-0.01	-0.04	-0.13	-0.04	-0.16	-0.16	0.22	-0.12	-0.04	0.10	0.61	1.00						
Male Head of Household (16)	-0.04	-0.02	-0.02	-0.02	0.00	0.02	-0.12	-0.09	-0.15	0.12	0.04	-0.07	-0.04	-0.04	0.00	1.00					
Access to Dry Season Road	-0.01	0.11	0.04	0.02	-0.14	-0.13	-0.23	-0.14	-0.06	-0.02	-0.10	0.25	-0.12	-0.02	0.10	-0.05	1.00				
Access to All Season Road (18)	-0.05	-0.15	-0.05	-0.02	0.13	0.09	0.23	0.05	0.07	0.00	0.07	-0.20	0.14	0.08	-0.05	0.11	-0.74	1.00			
Electricity Access (19)	0.13	-0.10	0.00	0.00	-0.10	0.13	0.14	-0.08	-0.06	-0.03	-0.17	0.02	-0.08	0.05	0.02	0.03	0.00	-0.26	1.00		
Healthservice Access (20)	0.05	0.10	-0.02	-0.01	-0.09	0.00	-0.07	-0.12	-0.06	-0.11	0.03	-0.13	-0.14	0.02	-0.13	0.05	-0.11	0.05	0.00	1.00	
Constant (21)	0.04	0.07	0.03	0.02	0.03	0.07	0.01	0.08	-0.07	-0.10	-0.01	0.15	-0.05	-0.68	-0.54	-0.43	-0.15	-0.12	-0.05	-0.29	1.00

Source: Authors' calculations based on LECS3.

Table 17: Regression Results. Province Effects.

	Province Effect	
Dependent Variable	Cons. Per Capita	
Constant	12.558	***
Factors of Production	(162.93)	
Irrigated Land Area	-0.010	
	(-0.29)	
Unirrigated Land Area	0.035	***
	(2.65)	
Grazing Land Area	0.059	**
	(1.95)	
Forest Land Area	0.018	
	(0.62)	
Number of Cattle	0.054	***
	(3.24)	
Number of Buffalo	0.031	**
	(2.12)	
Number of Pigs	0.027	
	(1.40)	
Literate Female	0.093	***
	(5.11)	
Literate Male	0.037	**
	(2.01)	
Household Business	0.278	***
	(12.13)	
Max Education Index	0.185	***
	(9.34)	
Agricultural Mechanisation	0.049	***
	(2.47)	
Fertilizer Use	0.023	
Household Characteristics	(0.99)	
Dependency Ratio	-1.373	***
	(-25.94)	
Adults	-0.549	***
	(-23.26)	
Male Head of Household	0.082	***
Environmental Factors	(2.58)	
Access to Dry Season Road	0.074	
	(1.48)	
Access to All Season Road	0.046	
	(1.11)	
Electricity Access	0.111	***
	(4.12)	
Healthservice Access	0.052	
Province Variables	(1.55)	
Phongsaly	-0.102	
	(-1.38)	
Luangnamtha	0.071	
	(1.03)	
Oudomxay	-0.092	
	(-1.31)	
Bokeo	-0.061	
	(-0.93)	
Luangprabang	-0.115	
	(-1.57)	
Huaphanh	-0.145	*
	(-1.68)	
Xayabury	-0.135	
	(-2.23)	**
Xiengkhuang	-0.151	
	(-1.84)	*
Vientiane Province	-0.085	
	(-1.49)	
Borikhamxay	-0.114	
	(-1.62)	
Khammuane	-0.143	**
	(-2.31)	
Savannakhet	-0.214	***
	(-3.98)	
Saravane	-0.337	***
	(-5.81)	
Sekong	-0.216	***
	(-3.20)	
Champasack	-0.040	
	(-0.72)	
Attapeu	-0.346	***
	(-4.96)	
Xaysomboun SR	-0.109	
	(-1.42)	
Observations	8048	
R^2	0.417	
F-ratio	41.65	***
Degrees of Freedom	[37, 450]	

T-values in parentheses

Estimated Coefficient statistically significant at a (***) 99%, (**) 95%, and (*) 90% confidence levels.

Source: Authors' calculations based on LECS3.

Table 18: Regression Results. Alternative Specifications.

Dependent Variable	Cons. Per Capita	HH Poverty	HH Consumption
Constant	12.480 ***	-2.629 ***	12.283 ***
Factors of Production	(189.76)	(-13.95)	(212.76)
Irrigated Land Area	-0.003	0.006	-0.009
	(-0.08)	(0.07)	(-0.28)
Unirrigated Land Area	0.034 ***	-0.116 ***	0.043 ***
	(2.35)	(-3.25)	(3.27)
Grazing Land Area	0.079 **	-0.155	0.061 *
	(2.27)	(-1.17)	(1.82)
Forest Land Area	0.009	-0.073	0.026
	(0.27)	(-0.66)	(0.76)
Number of Cattle	0.048 ***	-0.134 ***	0.053 ***
	(2.76)	(-3.26)	(2.97)
Number of Buffalo	0.011	-0.077 *	0.020
	(0.74)	(-1.69)	(1.29)
Number of Pigs	0.015	-0.097 *	0.015
	(0.71)	(-1.73)	(0.77)
Literate Female	0.099 ***	-0.286 ***	0.110 ***
	(5.36)	(-5.08)	(6.32)
Literate Male	0.037 *	-0.144 ***	0.047 ***
	(1.86)	(-2.38)	(2.45)
Household Business	0.294 ***	-0.400 ***	0.291 ***
	(12.07)	(-6.07)	(12.42)
Max Education Index	0.217 ***	-0.439 ***	0.231 ***
	(11.82)	(-8.05)	(12.77)
Agricultural Mechanisation	0.061 ***	-0.192 ***	0.062 ***
	(2.99)	(-3.17)	(3.16)
Fertilizer Use	-0.002	-0.033	-0.005
Household Characteristics	(-0.09)	(-0.53)	(-0.25)
Dependency Ratio	-1.430 ***	3.517 ***	0.520 ***
	(-25.37)	(19.36)	(10.98)
Adults	-0.554 ***	1.446 ***	0.399 ***
	(-21.57)	(18.78)	(17.69)
Male Head of Household	0.090 ***	-0.266 ***	0.093 ***
Environmental Factors	(2.72)	(-2.74)	(2.84)
Access to Dry Season Road	0.031	-0.126	0.029
	(0.63)	(-0.98)	(0.59)
Access to All Season Road	0.048	-0.069	0.042
	(1.10)	(-0.57)	(0.99)
Electricity Access	0.127 ***	-0.051	0.128 ***
	(4.68)	(-0.61)	(4.76)
Healthservice Access	0.050	-0.132	0.051
	(1.49)	(-1.48)	(1.63)
Observations	8048	8048	8048
R^2	0.395	-	0.358
F-ratio	65.10 ***	36.37 ***	70.12 ***
Degrees of Freedom	[20, 467]	[20, 467]	[20, 467]

T-values in parentheses

Estimated Coefficient statistically significant at a (***) 99%, (**) 95%, and (*) 90% confidence levels.

Source: Authors' calculations based on LECS3.

Table 19: Detailed Consumption Gap Decomposition. All Ethnic Families. Total Sample.

	Consumption		Endowments				Returns			
	Majority	Minority	Maj ret	Maj end	Min end		Min end	Maj ret	Min ret	
Observations	4833	3215								
Log Consumption	11.845	11.434								
Constant			12.558	1.000	1.000	0.000	1.000	12.558	12.293	0.266
Factors of Production										
Irrigated Land Area			0.004	-0.033	-0.013	0.000	-0.013	0.004	-0.035	-0.001
Unirrigated Land Area			0.006	0.267	0.278	0.000	0.278	0.006	0.095	-0.025
Grazing Land Area			0.093	-0.005	-0.002	0.000	-0.002	0.093	0.074	0.000
Forest Land Area			0.025	-0.006	-0.017	0.000	-0.017	0.025	-0.009	-0.001
Number of Cattle			0.034	0.283	0.300	-0.001	0.300	0.034	0.075	-0.012
Number of Buffalo			0.005	0.269	0.298	0.000	0.298	0.005	0.030	-0.007
Number of Pigs			-0.029	0.148	0.365	0.006	0.365	-0.029	0.040	-0.025
Literate Female			0.111	0.801	0.327	0.053	0.327	0.111	0.054	0.019
Literate Male			0.022	0.893	0.689	0.005	0.689	0.022	0.057	-0.024
Household Business			0.305	0.311	0.087	0.068	0.087	0.305	0.184	0.011
Max Education Index			0.216	0.727	0.270	0.099	0.270	0.216	0.162	0.015
Agricultural Mechanisation			0.069	0.226	0.100	0.009	0.100	0.069	0.082	-0.001
Fertilizer Use			-0.016	0.381	0.061	-0.005	0.061	-0.016	0.106	-0.007
Household Characteristics										
Dependency Ratio			-1.487	0.523	0.585	0.092	0.585	-1.487	-1.288	-0.116
Adults			-0.585	1.030	1.015	-0.009	1.015	-0.585	-0.496	-0.090
Male Head of Household			0.087	0.945	0.976	-0.003	0.976	0.087	0.112	-0.024
Environmental Factors										
Access to Dry Season Road			0.069	0.875	0.674	0.014	0.674	0.069	0.004	0.044
Access to All Season Road			0.058	0.767	0.503	0.015	0.503	0.058	0.041	0.009
Electricity Access			0.101	0.624	0.227	0.040	0.227	0.101	0.125	-0.006
Healthservice Access			0.044	0.858	0.665	0.009	0.665	0.044	0.049	-0.003
Difference		0.411								
Sum						0.391				0.020
Total Consumptiongap			0.411							
Due to Difference in Endowments			0.391							
Due to Difference in Returns			0.020							
Share Due To										
Factors of Production			57%							
Household Characteristics			19%							
Environmental Factors			19%							
Total Difference in Endowments			**95%**							
Total Difference in Returns			**5%**							

Source: Authors' calculations based on LECS3.

Table 20: Detailed Consumption Gap Decomposition. All Ethnic Families. Matched Samples.

	Consumption		Endowments				Returns			
	Majority	Minority	Maj ret	Maj end	Min end		Min end	Maj ret	Min ret	
Observations	3215	3215								
Log Consumption	11.768	11.434								
Constant			11.281	1.000	1.000	0.000	1.000	11.281	11.205	0.076
Factors of Production										
Irrigated Land Area			-0.025	-0.038	-0.013	0.001	-0.013	-0.025	-0.052	0.000
Unirrigated Land Area			-0.027	0.272	0.278	0.000	0.278	-0.027	0.039	-0.019
Grazing Land Area			0.069	-0.007	-0.002	0.000	-0.002	0.069	0.053	0.000
Forest Land Area			-0.077	-0.007	-0.017	-0.001	-0.017	-0.077	-0.015	0.001
Number of Cattle			0.010	0.283	0.300	0.000	0.300	0.010	0.054	-0.013
Number of Buffalo			-0.042	0.297	0.298	0.000	0.298	-0.042	0.000	-0.013
Number of Pigs			-0.099	0.156	0.365	0.021	0.365	-0.099	-0.013	-0.032
Literate Female			0.094	0.783	0.327	0.043	0.327	0.094	0.050	0.014
Literate Male			-0.082	0.889	0.689	-0.016	0.689	-0.082	0.009	-0.063
Household Business			0.324	0.298	0.087	0.068	0.087	0.324	0.199	0.011
Max Education Index			0.197	0.705	0.270	0.086	0.270	0.197	0.122	0.020
Agricultural Mechanisation			0.056	0.229	0.100	0.007	0.100	0.056	0.094	-0.004
Fertilizer Use			-0.024	0.369	0.061	-0.007	0.061	-0.024	0.104	-0.008
Household Characteristics										
Male Head of Household			0.035	0.947	0.976	-0.001	0.976	0.035	0.030	0.005
Environmental Factors										
Access to Dry Season Road			0.107	0.860	0.674	0.020	0.674	0.107	0.032	0.051
Access to All Season Road			0.060	0.736	0.503	0.014	0.503	0.060	0.042	0.009
Electricity Access			0.092	0.561	0.227	0.031	0.227	0.092	0.107	-0.003
Healthservice Access			0.068	0.852	0.665	0.013	0.665	0.068	0.029	0.026
Difference		0.335								
Sum						0.277				0.058
Total Consumptiongap			0.335							
Due to Difference in Endowments			0.277							
Due to Difference in Returns			0.058							
Share Due To										
Factors of Production			60%							
Household Characteristics			0%							
Environmental Factors			23%							
Total Difference in Endowments			**83%**							
Total Difference in Returns			**17%**							

Source: Authors' calculations based on LECS3.

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