6. Domestic Market Integration in Lao PDR

6.1 Introduction

The traditional theoretical view suggests that an improvement in the transport infrastructure that reduces transport costs stimulates greater demand, providing enhanced economies of scale and initiating a process of cost reductions and sales growth as the market area expands. In addition, lower transport costs (through shorter transport times and lower vehicle operating costs) enable firms to sell their products at lower price. The reduction in transactions costs lowers barriers to entry in sales and distribution, which tends to raise the number of market actors, raising competition and lowering mark-ups, with further reductions in consumer prices as a result. This implicitly assumes rational economic agents in a economic system where market supply and demand determine prices and a transport service sector providing efficient, effective and predictable services. The focus in this discussion has often been on the increased efficiency in a market system that follows from lowering transport costs, together with a higher degree of connectivity between geographically scattered local and provincial markets.

There are four key elements affecting market integration in Lao PDR:

- landlockedness creating a dependency on transit routes through neighboring countries;
- a geographically scattered population;
- high dependence on subsistence agriculture;
- an insufficient transport infrastructure impeding integration of scattered local and provincial markets.

To alleviate the negative impact of these characteristics on economic development, large investments in transport infrastructure have been carried out as presented in Chapter 5.

Transferring retail products through a complex market system does not only require a transport network but also individual traders who are willing to accept the risks associated with trading on distant located markets. A complex network of retail markets is emerging in Lao PDR, despite high transport costs and substantial uncertainty due to the low quality of existing transport infrastructure and the shortage of transport services. These emerging retail markets supply a wide variety of products to rural areas (Andersson *et al* 2005; LECS 3 2003). The relationship between markets can be studied through the mapping of spatial price patterns. If the market system is integrated and works well, prices on individual markets should tend to converge, and differ mainly because of transport costs (including other costs of trading). In weakly integrated market, the dispersion of prices can be expected to be larger because of differences in local market characteristics, for example the nature of competition at the local level, population size, and income levels of the households in the area covered by the market (Christaller 1933; Badiane & Shively 1998). If markets are well integrated, these differences will tend to disappear as a result of arbitrage.

A better understanding of the nature of spatial statistical models has three potential advantages. First, it will highlight the relationships between known processes in geography, socio-economic analysis and market research and any other field that may face large sets of problems with spatially dependent data. Therefore, it will assist decisions in applications of location, and order of neighborhood structures. Secondly, it will force the researcher to pay more attention to the careful selection of appropriate models which incorporate a spatial dimension. Presently, many researchers are tempted to use simple measures and simple models to make data processing more tractable. A frequent consequence of this is that crucial expert knowledge about the spatial pattern-process relationships are ignored or neglected as in the neoclassical view on economic integration and/or transport services as discussed in Chapter 2. Therefore, thirdly, more challenging and more focused questions would be posed when developing statistical models.

An application of existing models using statistical data conducted by Minten & Kyle (1999) demonstrate the effect of distance and road quality on food collection and marketing margin with data from Zaire. The study show that transportation costs have a major impact on regional differences on food prices and that quality of roads is an important factor in the transportation costs. Moreover, considerable attention has been focused on the relative isolation of rural markets and the implication of this isolation for agricultural producers and consumers (e.g. de Janvry *et al.* 1991; Fafchamps 1992). However few attempts have formally linked the spatial price patterns of homogenous retail product with village characteristics such as location, size, expenditure, transport costs and competition on local markets in a context of a developing country. Examples can be found from Sweden where Asplund & Friberg (2002) examine retail grocery price levels across a large panel of stores in Sweden. Their results indicate that variation in prices can be attributed to store-specific factors such as size and affiliation to a chain of supermarkets. Several studies have examined the impact of market structure on retail pricing using U.S. data; Cotterill (1993) provides a survey. The studies make use of variation in prices across geographical markets. In almost every case, the number of observations is quite limited, price indexes for areas rather that store-level prices are used, and markets definitions are broad. Some examples can be illustrative of the problems and results when conducting these types of studies. An often-cited study by Cotterill (1986) uses a cross section of prices of a product basket from 35 supermarkets in rural Vermont. The findings suggest that prices are high where supermarket concentration is high. Newmark (1990) questions the validity of the literature with the reason that it had not controlled for regional difference in income and that the studies used small non-random samples. Controlling for income, and with data on the price of a basket of goods in 14 cities across the U.S. and the 13 cities in Florida, he are not able to find any correlation between chain concentration and price levels. Claycombe & Mahan (1993) regress a price index of beef to market structure and also find little in terms on correlation. Marion (1998) relates the rate of change in a price index from 15 U.S. metropolitan to the presence of warehouses, and finds lower price increases where their

market shares are increasing. In the literature on demand analysis in developed countries, almost all of the identifying price variation has come from price changes over time, with little attention paid to variation in prices over space. The reason for this can be explained by the fact that most developed countries where transport and distribution systems are highly developed, and where transport costs are relatively low, there is little price variation between localities at any given time. However, in developing countries, transport is often more difficult, markets are not always well integrated (Deaton, 1997).

To study the process of integration of the domestic market in Lao PDR, the spatial variation in beer prices and its relationship with travel times as a proxy for freight rates for domestic freight transport is examined. More specifically, local prices per 640 ml bottle of Beer Lao is examined, which, at the time of data collection, was a homogenous retail product manufactured only in one location in Lao PDR[9]. The rationale behind using a manufactured retail product as the study object is that the production of the good is not dependent on the local context where is it consumed. The pricing of locally produced agricultural goods sold in local markets is dependent on various local factors such as fertility of land, climate, access to irrigation, usage of pesticides and fertilizers, and the quality of products (Deaton 1988). Focusing on a homogenous manufactured retail product manufactured in one location only allows us to abstract from many of these local determinants and concentrate on the impact of transactions costs and market conditions.

The following paragrahps present the data and descriptive statistics used in the analysis.

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[9] At the time, only one type of bottled Beer Lao was marketed in Lao PDR. More recently, Beer Lao has focused on diversification: in addition to the lager beer referred to in our analysis, the company now markets a dark beer as well as light (low alcohol) beer.

6.2 Data and Descriptive Statistics

The empirical parts of the study are based on a micro-level dataset on Lao households, the Lao Expenditure and Consumption Survey from 2002/2003. This survey provides detailed data on the expenditure, consumption patterns of households and price information on a large number of commodities. It covers all provinces, with each provincial sample stratified into urban areas, rural villages with road access, and rural villages without wet season road access. The sample consists of 8100 households selected through a two-stage sample design. A random sample of villages was selected in the first stage. The villages were stratified on eighteen provinces and within provinces on urban/rural sector. The rural villages were further stratified on villages with "access to road" and "no access to road". The total first-stage sample consists of 540 villages. 15 households were selected with systematic sampling in each village, giving a sample of 8100 households.

The number of villages (Primary Sampling Units) in the sample is 540 with 397 villages reporting prices of a bottle of Beer Lao[10]. The analysis of prices distinguishes between several geographical areas. Three spatial levels are used; the four geographical regions – South, Central, North, and Vientiane Municipality, the interaction between the captial Vientiance and all provincial centers and lastly the interaction between the provincial centers and villages located in the province. In addition, the author separate between urban and rural prices, and take into account village characteristics such as road access, quality of road access, markets, and transport services as possible determinants of price differences.

Economic reforms in Lao PDR seem to contribute to favorable outcomes in terms of lower poverty rates and high levels of expenditure by permitting greater participation

[10] A sample of 397 villages is used for the descriptive analysis. For the regression analysis the sample cover 378 as several villages lacked information of more than 2 independent variables.

in both local markets and markets in neighboring countries as discussed in Chapter 4. The majority of the poor in Lao PDR lives in rural areas and depends on subsistence level agriculture. Limited availability of resources, agricultural land, physical productive assets, livestock, number of dependents in households and lack of access to physical and social infrastructure (Andersson *et al* 2005; Richter *et al* 2005).

However, Warr (2005) illustrates in his analysis of LECS2 and LECS3 the importance of road development with the purpose to provide all year around access to markets and connectivity between provinces. His results indicate that there are limited opportunities to participate on the free market without physical access to roads and markets. This seems to be of special importance during the wet season when many roads are impassable due to flooding. Geographical factors such as location, distance to markets, and road accessibility naturally have a significant impact on the costs of intermediate and final goods. The following section will provide descriptive statistics using beer retail prices in relation to a selction of market variables.

6.2.1 Market Access and Road Access Price Levels

Mapping the variation of prices between village markets based on survey data can provide an overview of the integration/fragmentation of the domestic market. The interaction between markets and the distribution of goods for sale in local markets are dependent on both physical transportation networks and transport service providers. Table 6.1 presents descriptive data on village access to markets and characteristics of road access at the national and regional level.

Table 6.1 Market Access Characteristics

Region	**Village Markets, Share of Villages**	
	Daily	Daily or occasional
Vientiane	27.2	29.2
Central	7.3	9.6
North	8.4	12.8
South	7.4	10.2
Lao PDR	**9.5**	**12.7**

Source: Author's calculations based on LECS-data.

Market access is one of the factors influencing price levels. Only 9.5 percent of the villages at the national level in the sample from LECS 3 report having a regular daily market in the village. The market access rises to 12.7 percent if occasional markets are included. Villages located in Vientiane Municipality are well covered by markets, which can be explained by the area's urban structure. The other regions report significantly lower coverage of daily markets. When expanding the definition of market access to also account for occasional markets, there is a slightly higher coverage across the board. Occasional markets seem to have a larger importance in the North than in other parts of the country.

The variability in the quality of the road infrastructure, over time and space, is an important determinant of spatial price differences as these factors influence transport costs. Poor quality and seasonal differences in road access have direct effects on transport costs and time required to reach the villages, and will therefore raise prices of retail products. The road conditions in Lao PDR differ according to seasonal changes in weather, as seen in Table 6.2. Road access during the dry season is considerably higher in all regions. At the national level, 61 percent of the villages in the studied sample have all season access to a road. Another 14 percent of villages have dry season access only. Unsurprisingly, road access is best in Vientiane Municipality and the Central region, and weakest in the North.

Table 6.2 Road Access Characteristics

Region	**Road Access, Share of Villages**	
	Dry season	All Seasons
Vientiane	100	100
Central	88.2	70.2
North	54.7	43.8
South	77.8	61.1
Lao PDR	**74.5**	**61.1**

Source: Author's calculations based on LECS-data.

The regional differences between villages regarding access to roads are significantly higher than the regional differences between villages regarding access to markets. Access to markets can still be considered a rare facility in large parts of Lao PDR. Yet, it is important to note that the absence of a market does not mean a fully self-sufficient livelihood, as very basic retail products are marketed by small individual village shops. The market can be seen as an agglomeration of suppliers that provides a larger variety of marketed products. The larger number of suppliers is also likely to provide competition and lower prices, since it tends to reduce the market power (and profit margins) of the individual suppliers or traders.

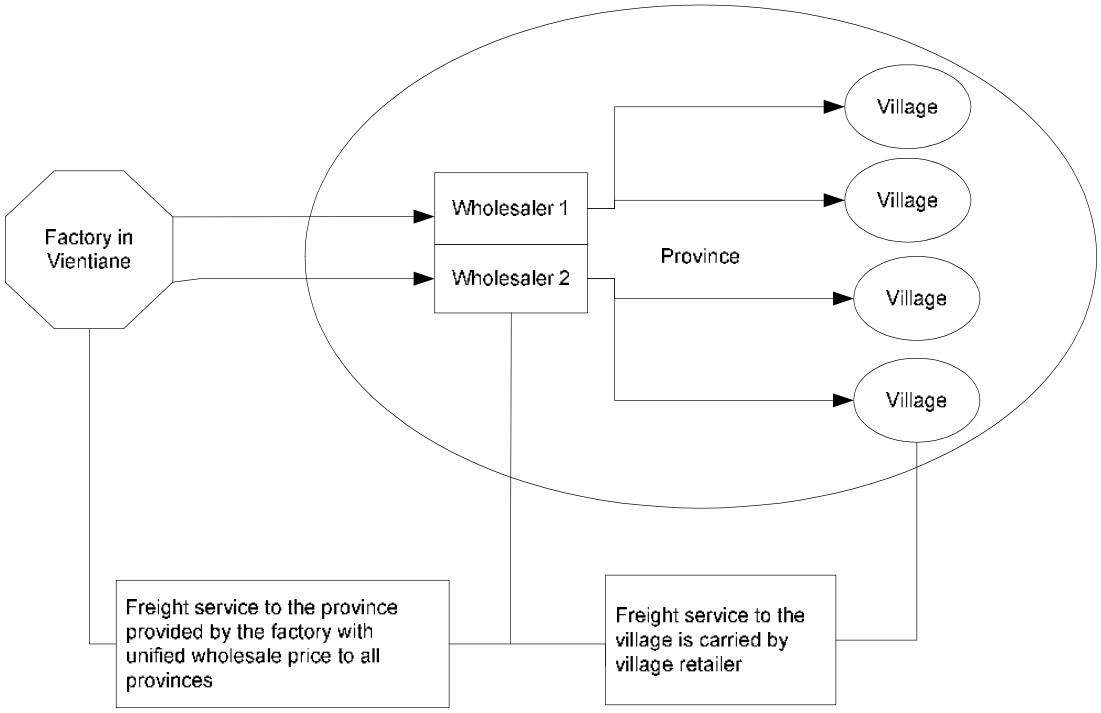
6.2.2 Spatial Price Variation

To examine spatial price variations, the price of a domestically manufactured retail product, namely a 640 ml glass bottle of Beer Lao is studied. This product is only produced at one location in Vientiane Municipality and transported and sold to all parts of Lao PDR. The market for beer in Lao PDR at the time of the LECS surveys could be characterized as a monopoly market with only one marketed beer brand. The company had specially assigned dealers in the provinces that provided distribution to within their respectively province.

The framework of analysis are developed using Beer Lao distribution system in order to reflect the actual domestic value chain of the product. It is important to understand the basic characteristics of the distribution system. The distribution of Beer

Lao occurs through an extensive distribution network as shown in Figure 6.1. The beer is produced in Vientiane. In Vientiane Municipality Lao Brewery delivers directly to retail outlets through trucks owned by the company. In the provinces Lao Brewery contracts 3 trucking companies. The distribution is divided into three regions; Northern, Central and Southern. The trucking delivers to the provincial agencies who in turn distribute to the retail outlets. The company covers the transport costs of deliver the beer to the provincial wholesalers. There are always at least two provincial agencies in each province in order to avoid a monopoly market situation. The distribution of beer is approximately 50/50 between Vientiane and the provinces. The distribution network is represented below.

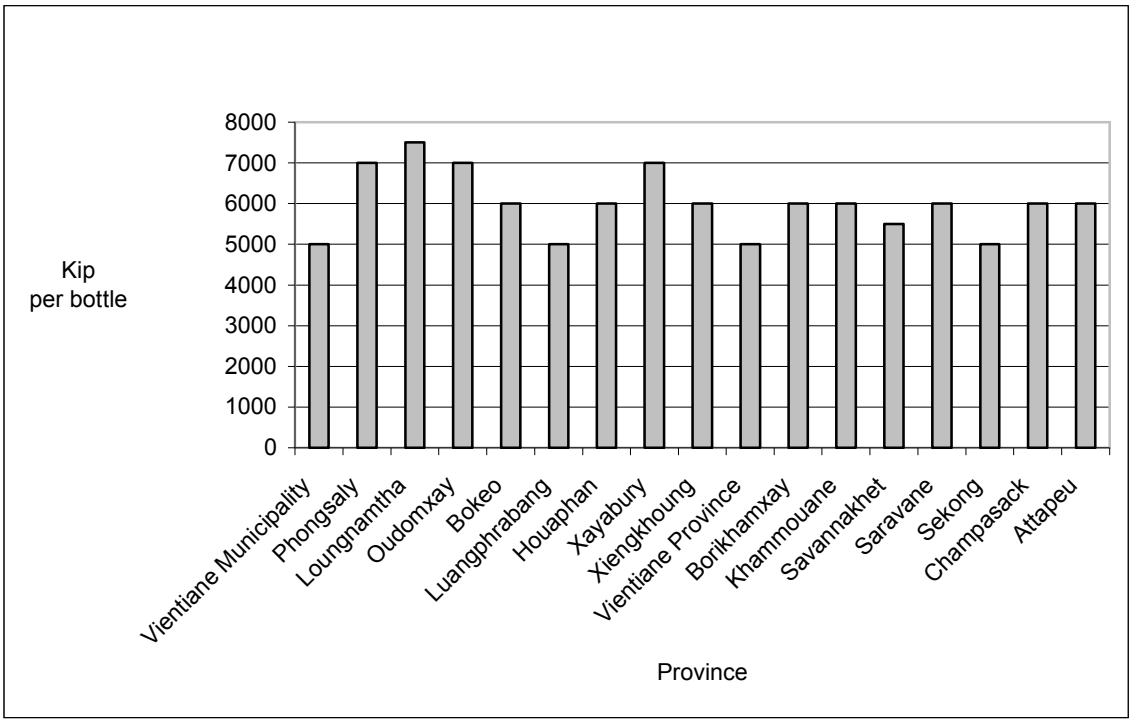
Figure 6.1 Beer Lao Distribution System



Source: Author's figure based in interviews with marketing department at Beer Lao.

The provincial agencies are private companies who are contracted to Lao Brewery to sell to the retail outlets. The wholesale price of beer is controlled by the company and the agencies cannot increase their prices greater than 15 percent of what they buy from Lao Brewery. However, retailers in villages are allowed to set their prices depending on supply and demand. Thus provides a rather uniformed price band on the provincial wholesale market.

Figure 6.2 Average Retail Price of Beer in Provincial Centers, Kip per Bottle



Source: Author's calculations based on LECS-data.

The first step in the analysis is to compare the retail price per bottle of Beer Lao in the provincial centers, as presented in Figure 6.2. The lowest prices are found in Vientiane Municipality, Luangphrabang, Phongphong (which is the provincial center of

Vientiane Province) and Sekong in the South, which all exhibit a price per bottle of approximately 5000 Kip.

This finding gives as indication of other factors apartment for the transport costs. Luangphrabang is located 397 km from Vientiane Municipality (see Table 6.3), but the price is the same as the retail price in the two closest located markets, Vientiane Municipality and Phongphong in Vientiane Province. Despite the distance, Luangphrapang dealers are able to serve their markets with the same price as the dealers located next to the production site in Vientiane, presumably because of the heavy competition in that location. This suggests that physical transportation costs make up a relatively small share of the beer price in Luangphrabang and Sekong. Loung Namtha's provincial center Namtha exhibits the highest price per bottle at Kip 7500 with Oudomxay, Xayabury, and Phongsaly, all located in the North, recording about Kip 7000 per bottle.

Table 6.3 Distance from Vientiane to Provincial Centers

Provincial center	Province	Distance from Vientiane Municipality in km	Price of one bottle Beer Lao in Kip
Sisattanak	Vientiane Municipality	0	5000
Phongsaly	Phongsaly	747	7000
Namtha	Loungnamtha	644	7500
Xay	Oudomxay	605	7000
Houayxay	Bokeo	811	6000
Luangphrabang	Luangphrabang	397	5000
Xamneua	Houaphan	629	6000
Xayabury	Xayabury	508	7000
Pek	Xiengkhoung	435	6000
Phongphong	Vientiane Province	153	5000
Pakxanh	Borikhamxay	154	6000
Thakhek	Khammouane	354	6000
Khantabouly	Savannakhet	487	5500
Saravane	Saravane	649	6000
Lamarm	Sekong	812	5000
Pakse	Champasack	685	6000
Xaysetha	Attapeu	847	6000

Source: National Geographic Department 2005, LECS 3 and MPWT.

Countries like Lao PDR with large differences in quality of road infrastructure and markets access does not only exhibit a large variation in transport costs but also in retail prices. As shown in Figure 6.1, there is a 50 percent difference in the average retail price per bottle between the provincial center of Xayabury and Luangaphrabang, which are located only 111 km apart: this large price gap probably reflects high transactions costs due to difficult transport conditions.

One interesting conclusion from the retail price comparison between provincial centers is that the distance between producer and consumer is not a good predictor of the price of consumer goods. In addition, already this very rough price comparison suggests that it is necessary to account for differences in transport costs emanating from uneven road quality, as well as differences related to the degree of competition (or the number of traders) in each location.

The next step is a regional descriptive analysis using means and standard errors of the price data based on differences in village characteristics: the analysis distinguish between urban villages, rural villages with access to roads, and rural village without access to roads. Looking first at the pattern at the national level, the results are as expected (see Table 6.4), with the lowest prices in urban villages and the highest prices in rural villages without road access.

Table 6.4. Price and Standard Error of one 640 ml bottle Beer Lao.

Vientiane				
Urban village	Mean (in Kip)	5348	Max. (in Kip)	6500
	Std. Error	79.9	Min. (in Kip)	5000
Rural village with access to road	Mean	5654	Max.	7000
	Std. Error	173.48	Min.	5000
				n= 46 villages
Central				
Urban village	Mean	6138	Max.	8000
	Std. Error	140.1	Min.	5000
Rural village with access to road	Mean	6905	Max.	10000
	Std. Error	117.6	Min.	5000
Rural village without access to road	Mean	8103	Max.	12000
	Std. Error	286.6	Min.	6000
				n= 159 villages
North				
Urban village	Mean	6696	Max.	8000
	Std. Error	177.1	Min.	5000
Rural village with access to road	Mean	7714	Max.	12500
	Std. Error	166.0	Min.	5000
Rural village without access to road	Mean	7810	Max.	10000
	Std. Error	254.1	Min.	6000
				n= 111 villages
South				
Urban village	Mean	6233	Max.	8000
	Std. Error	200.4	Min.	5000
Rural village with access to road	Mean	7309	Max.	13000
	Std. Error	169.7	Min.	5000
Rural village without access to road	Mean	8000	Max.	12000
	Std. Error	315.3	Min.	6000
				n= 81 villages
Lao PDR				
Urban village	Mean	6020	Max.	8000
	Std. Error	86.14	Min.	5000
Rural village with access to road	Mean	7155	Max.	13000
	Std. Error	86.49	Min.	5000
Rural village without access to road	Mean	7986	Max.	12000
	Std. Error	164.51	Min.	6000
				n= 397 villages

Source: Author's calculations based on LECS-data.

Turning to the regional level, the lowest average prices (Kip 5348 per bottle) and the lowest standard error are found in urban villages in Vientiane. Urban villages in the

North record higher prices than urban villages in the South, which presumably reflects differences in transportation distance from Vientiane. Road access also has a strong impact on both the mean and the standard deviation of prices. Rural villages with access to roads (in particular, those with wet season road access) have lower average prices than rural villages without road access. The standard deviation of prices is also lower, suggesting that there are relatively few villages where traders are able to use their market power to raise prices: the access to road transportation means that the market is contestable, i.e. that a competitor may enter if the profit margin begins to grow. In rural villages without road access, the entry barriers are higher, which presumably gives more market power to traders and contributes to wider dispersion in prices, depending on demand and other market conditions. Comparing rural villages without road access, it can be seen that the highest average prices as well as the highest standard deviations are recorded in the Central and Southern parts of the country. This indicates either that the transportation costs to these villages are higher and vary more than in the North, or that competition is lower than in the North, or a combination of the two.

Table 6.5 illustrates the importance of competition by comparing prices in villages with and without markets. The presence of a market, where several sellers are likely to compete for customers, clearly reduces both the average price and the standard deviation of prices. It was already noted that weaker competition could account for the higher prices in rural villages without road access. This is confirmed in Table 6.5, which shows that none of the sampe villages without road access has a market.

Table 6.5. Price and Standard Error of one 640 ml bottle Beer Lao and Access to Markets

Lao PDR				
Urban village	With market or occasional	Mean (in Kip)	5990	
		Std. Error	86.7	n=96
	Without market or occasional	Mean	6750	
		Std. Error	478.7	n=4
Rural village with access to road	With market or occasional	Mean	7143	
		Std. Error	87.2	n=212
	Without market or occasional	Mean	7313	
		Std. Error	442.2	n=16
Rural village without access to road	With market or occasional	Mean		
		Std. Error		
	Without market or occasional	Mean	7985	
		Std. Error	164	n=69
Total number of villages are 397				

Source: Author's calculations based on LECS-data.

Market size can also be assumed to influence the price pattern. Large villages should exhibit lower prices, since they should attract a larger number of sellers. Table 6.6 shows the national price variation depending on the type and size of the village. Villages are divided into; large villages, with more than 50 households; and small villages, with fewer than 50 housholds. The expected pattern, with a lower price in large villages, holds for urban and rural villages with road access, but not for rural villages without road access. This is very interesting, and suggests that the entry barriers for traders acting in villages without road access are quite high. The fact that larger villages without road access record higher prices indicates that they do not attract more sellers: instead, it is likely that the incumbent seller just meets more demand which allows him or her to raise prices. In these cases, improved road access would not only result in lower prices because of the reduction in transport costs, but also because of the reduction in entry barriers and the marker power of traders.

Table 6.6 Price and Standard Error of one 640 ml bottle Beer Lao in Small and Large Villages

Lao PDR				
Urban village	Large village	Mean (in Kip)	5979	
		Std. Error	86.00	n=96
	Small village	Mean	7000	
		Std. Error	408.25	n=4
Rural village with access to road	Large village	Mean	7069	
		Std. Error	92.42	n=190
	Small village	Mean	7584	
		Std. Error	226.25	n=38
Rural village without access to road	Large village	Mean	8083	
		Std. Error	208	n=48
	Small village	Mean	7762	
		Std. Error	257	n=21
Total number of villages are 397				

Source: Author's calculations based on LECS-data.

Note: Definition of a Small village is a village with less than 50 households and Large village more than 50 households.

The free flow of products between markets is of great importance for the functioning of any economy. An integration of markets, supported by improvements in market infrastructure and transportation systems, can reduce transaction costs and allow trade between locations, with gains from comparative advantages and specialization. The descriptive analysis of beer prices indicates that transport costs in Lao PDR are not only determined by distance. Road access and the presence of markets are important determinants of prices at the village level.

The high average prices and large price variations between villages without access to a road are likely to reflect a high variation in transportation costs and competition. The prices are high not only because it is expensive to transport Beer Lao to villages lacking road access, but also because there is not likely to be much competition between traders. Given the high entry barriers (in terms of transport costs) the markets are too small to support several traders, and the incumbents can therefore charge high

profit margins. This suggests that the benefits of improvements in transport infrastructre can be very substantial, extending far beyond the cost savings related to transport costs. By making the local markets constestable, transport investments can contribute to a reduction in the cost of imported products. However transport infrastructure alone can not bring down the observed fragmentation of prices. Minten (1999) results from Madagascar that soft infrastructure and competition also have an influence on prices.

At the same time, it is important to note that the increased efficiency related to the inflow of goods to villages benefitting from improved transport infrastructure reflects only part of the overall increase in welfare. Stronger links to the national (and perhaps even the international) economy will not only affect the expenditures but also the earnings of local households. It is likely that the prices of the goods produced by local households may increase, since less is lost in transport costs and profit margins charged by traders with market power. Goetz (1992) and de Janvry *et al.* (1991) argue that due to transaction costs, a specific price band exists when following a product between its purchase and selling price - the poorer the infrastructure, the greater the size of the band. The descriptive statistics above provide evidence for transport and market infrastructures influence on spatial price patterns.

The following part of the chapter will provide an in-depth analysis of the spatial price patterns using regression analysis estimated by ordinary least squares (OLS). The purpose of the section is to study the determinants of the beer retail price on a national level. The number of observation does not allow us to obtain results based on the categories i.e. urban village, rural village with access to road and rural village without access to roads, used in the descriptive statistics above.

6.3 Estimation Methods and Model Specification

The coefficient estimates that form the basis for the economic analysis of the determinants for beer retail prices in villages in Lao PDR are obtained for a series of models that incorporate increasing complexity in terms of spatial variability. This

complexity was warranted by the outcome of specification tests at each stage of the analysis. The estimations starts with a standard regression model, using beer retail price as dependent variable with a selection of variables which are supposed to influence the dependent variable, estimated by ordinary least squares (OLS). Next is the same specification (Equation (1)) but with clustered standard errors where each province is clustered individually, again estimated by OLS. Clustered standard errors incorporates groupwise heteroskedasticity (non-constant error variance) corresponding to the unique character within the individual provinces. Third is using clustered standard errors where each province is clustered individually, again estimated by OLS but with bootstrapping.

The models (1) – (3) below are based on Equation (1) illustrates the relationship between the beer retail price and the independent variables. The α is the constant, and β, γ, δ, ζ, η, θ, ι and κ are the corresponding vectors of coefficients, and ε is a normally distributed random error term.

$$\text{Beer\_retailprice} = \alpha + \beta\text{wholesaleprice\_province} + \gamma\text{distance\_provincial\_center} + \delta\text{male\_wagelevel} + \zeta\text{agriculture\_land} + \eta\text{population} + \theta\text{traveltime\_border} + \iota\text{traveltime\_province} + \kappa\text{daily\_market} + \varepsilon \quad (1)$$

Model 1: Equation 1 OLS regression

Model 2: Equation 1 OLS regression with clustered standard errors. Each province clustered individually.

Model 3: Equation 1 OLS regression with clustered standard errors. Each province clustered individually with boot strapping.

6.4 Independent Variables

The following paragraphs outline the specific independent variables of the models. 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.

The independent variables in equation (1) and their *a priori* expected signs are: wholesale price province defined as the wholesale price charged by the contracted provincial wholesaler of Beer Lao. Wholesale price is expected to hold a positive sign as a higher wholesale price is expected to provide a higher retail price in the village where the beer is sold.

Distance to provincial center is the real distance in kilometer between the provincial center and village of observation. Distance in kilometer is the standard measure used to measure accessibility. The expected sign of this variable as a determinant of the freight rate costs is positive as longer transport provide higher price.

The variable male wage is defined as the level of wage in monetary units in Kip per day a male person earns if he is hired working in the village. The variable is a proxy to capture income levels from earning wage at a local labor market within the village. The opportunity to earn wage outside the self-sufficient agriculture is supposed to have a positive impact on price thus provide higher price of beer.

The purpose of the variable agricultural land in unit hectare is a measure to capture the economic size of the local economy as most villages in Lao PDR are dependent on self-sufficient agriculture. Their income is dependent on the size and productivity of the cultivated land and is expected to hold a positive sign. Andersson *et. al* (2005) found in their study of LECS 3 that size of land is an important determinant of expenditure level where access to land is positively related with expenditure.

Population measure the market size with a negative expected sign as a large market with many customers provide higher competition thus lower retail price.

Travel time to border measure the time it takes to travel to the closest border. This variable is a proxy for the possible access to a foreign beer as a substitute to the locally produced Beer Lao. The variable are estimated from a GIS based model which calculates travel time in hours from any place to another within the country taking into account road infrastructure, road condition, slope, elevation, land cover to travel through, rivers, etc. This model[11] it is possible to calculate how much time it takes to travel from every provincial center to any place in the province and vice versa. Travel time to border is expected to hold a negative sign as competition from imported brands is expected to provide a lower price. It is important to note that during the period in the study, the import of beer was prohibited and it was prohibited to sell beer produced in other countries on local markets. This notwithstanding, beer produced in China was found on local markets located in the northern parts of the country, but business owners often took care to hide the product as sales were forbidden by authorities. The Chinese beer found on local markets was slightly cheaper than Beer Lao: however, retailers stated that Beer Lao was more popular and more frequently sold even though it was more expensive.

Travel time in hours to provincial center is a proxy to capture the quality of the road and change in elevation on the route between the observed village and the provincial center where the wholesaler is located. Routes with large share of mountainous or hilly roads consume more fuel relative to routes with lower change in elevation. The variable is also an outcome from the above described GIS-model. Chapter 5 analyzed determinants of freight rates and found strong correlation between travel time and freight

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[11] The author is grateful to Peter Messerli and Andreas Heinimann from Swiss National Centre of Competence in Research (NCCR) North – South in Berne Switzerland for sharing data from the GIS-model. The model was part of the joint project entitled Socio-Economic Atlas and Poverty Maps for the Lao PDR from where the Socio-Economic Atlas of Lao PDR (Messerli *et al.* 2008) was published.

rate. The result provides a second reason to use travel time in our present model, travel time can be used as a proxy for freight costs. The longer it takes to travel from the village to the provincial center the higher is the freight rate of transporting goods to the village from the center. An increase in travel time can be expected to raise the retail price for beer thus should give a positive sign.

Table 6.7 Variables and Definitions

Variable	Definition and comments
Dependent Variable	
Beer Price	Retail price of one bottle Beer Lao in Kip observed in village from LECS
Independent Variables	
Wholesale price province	Wholesale price of one bottle Beer Lao in Kip in province centre
Distance to province center	Distance in km from village to province centre from GIS-model
Male wage level	Observed male wage level in village Kip per day from LECS 3
Agricultural land	Common agricultural land in village estimated in hectare from LECS 3
Population	Number of person in village from LECS3
Travel time to border	Travel time to closest border in hours from GIS-model
Travel time to province center	Travel time to province centre in hours from GIS-model
Daily market	1 if village have access to a daily market; 0 otherwise from LECS 3

The access to a daily market is a proxy for the level of development of the market economy in the village. A daily market is a hub for economic interaction often with several retailers thus giving local competition. Higher competition between retailers is

expected to have a negative impact on the price levels. This variable is expected to hold a negative sign.

The independent variables in Model (1) are similar to both Model (2) and (3). The variables are summarized and defined in Table 6.7.

6.5 Analysis

Table 6.7, presents the coefficient estimates of the three regression models based on equation (1). The method of estimation used is ordinary least squares. The results obtained from the regression models show some interesting relations between variables. A first comment concerns the fit of the model. All three models are estimated with an R^2 of about 0.42 based on a sample of 387 villages, but with different estimations of the coefficients of the various independent variables. Other studies estimating determinants to spatial price patterns in Africa show similar results. Minten & Kyle (1999) study decline in agricultural prices and the cost of transportation in former Zaire. Their study shows that transportation costs explain most of the spatial difference in price of agricultural prices. Minten (1999) estimates determinants of market access and prices using regression analysis with producer prices of rice as a dependent variable for villages in Madagascar. The study makes use of price observations from 188 villages and obtains an R^2 of 0.309, which is considerable lower than the results obtained in the present study. However, the independent variables are divided into transport costs, transactions costs and rents, with transport costs as the most important determinant of differences in producer price levels. The distance to the main paved road and the quality of the road infrastructure connecting to the main road were found to be significant determinants of producer prices for rice.

Table 6.8 Regression Results (dependent variable beer retail price in village)

Constant	3363.548	***	3363.548	***	3363.548	**
	(6.49)		(3.44)		(2.47)	
wholesale price province	0.596	***	0.596	**	0.596	***
	(7.29)		(3.82)		(2.69)	
distance to province capital	3.717	***	3.717	***	3.717	**
	(3.06)		(2.27)		(2.46)	
male wage level	-0.003		-0.003		-0.003	
	(-1.27)		(-1.65)		(-0.62)	
agriculture land	0.271	***	0.271	***	0.271	***
	(3.82)		(3.33)		(3.53)	
population	-0.465	***	-0.465	***	-0.465	***
	(-3.98)		(-4.77)		(-4.73)	
travel time to border	-2.127		-2.127		-2.127	
	(-0.05)		(-0.05)		(-0.04)	
travel time to province capital	146.810	**	146.810	*	146.810	*
	(2.08)		(1.84)		(1.72)	
daily market	-302.097		-302.097	***	-302.097	***
	(-1.64)		(-2.93)		(-2.76)	
R-squared	0.4239		0.4239		0.4239	
No. of observations	387		387		387	
F-ratio	34.77	***	49.37	***		
Degree of freedom	378		378		378	

Note: * - significant at a ten percent level; ** - significant at a five percent level; *** - significant at a one percent level. T-values in parentheses.

Model 2 shows lower standard errors, which results from the use of clustered standard errors where each province is clustered individually in order to capture variation within the province. Model 3 using bootstrapping provides similar results. Bootstrapping provides a computationally intensive but essentially mechanical way of calculating standard errors or at least for checking that the standard errors given by the ordinary least squares regression is not misleading (Deaton 1997). The discussion below will focus on Model 2 and Model 3.

Following the independent variables in Table 6.8 we find that, with the assumption of clustered standard errors, the wholesale price variable registers a positive coefficient that is significantly different from zero at a five percent level for Model 2 and

a one percent level for Model 3. This means that the prices charged by the wholesaler located in the provincial center have an influence on the retail price. Not surprisingly, high whole prices provide higher retail prices.

With regard to the distance to the provincial center, the results show that the coefficients are of the right sign and statistically significant at a one percent level for Model 2 and a five percent level for Model 3. The results confirm that increasing distance from village to provincial center is an important determinant for higher retail prices in the village.

Male wage level as a proxy for income levels and opportunity to work outside the self-sufficient agriculture do not have a significant influence on the dependent variable in our estimation.

The size of the average holding of agricultural land in hectare as a proxy for the economic development of the village and the economic size of the market holds a positive sign and is strongly significant at the one percent level for both models. Access to large amount of agricultural land can be interpreted as higher economic standard and higher purchasing power, and thus a higher retail price for beer.

The size of the village population as a measure of market size does provide a negative sign with strong significance at the one percent level. The variable influences the price negatively where a large market can be interpreted as market with higher competition thus lower price levels.

The coefficients for travel time to border as a proxy for access to other brands of beer through import provides the expected negative sign, but the estimate is not significant in any of the models. Being located closer to a border, thus having access to imported beer, does not show any impact on the retail price.

Travel time to provincial center as a proxy for freight rates holds the correct sign with a significance at the ten percent level. It is not surprising that increasing travel time

provides higher retail prices, and it is the strongest positive determinant for the dependent variable in both Model 2 and 3.

Village access to a daily market has a strong negative influence on the dependent variable and is significant at the one percent level. The fact that the village market is an important facilitating institution for economic interaction and provides higher competition between retailers, thus giving consumers access to lower prices, is strongly supported in both Model 2 and Model 3.

6.6 Assessing the Determinants of Beer Retail Prices

This chapter has sought to improve our understanding of the determinants of the spatial price pattern of beer retail prices on village levels in Lao PDR. The spatial price patterns are analyzed by creating an analytical model for the distribution of beer with a selection of variable influencing the price level are divided into two parts; firstly by using available quantitative information by analyzing the descriptive statistics, and secondly by estimating the determinants of beer retail prices using a ordinary least squares regression framework. This concluding section summarizes key implications, and limitations of the analysis.

The results from the first part indicate that type of village and road access influence the retail price where urban villages and rural villages with access to roads exhibit lowest prices.

Turning to the geographical location, lowest average prices (Kip 5348 per bottle) and the lowest standard error was not surprisingly found in urban villages in Vientiane. Urban villages in the North record higher prices than urban villages in the South, which presumably reflects differences in transportation distance from Vientiane. Road access also has a strong impact on both the mean and the standard deviation of prices. Rural villages with access to roads (in particular, those with wet season road access) have lower average prices than rural villages without road access. In rural villages without road access, the entry barriers are higher, which presumably gives more market power to

traders and contributes to larger price band, depending on demand and other market conditions. Comparing rural villages without road access, it can be seen that the highest average prices as well as the highest standard deviations are recorded in the Central and Southern parts of the country.

Further, market size have an impact on the price levels in villages. The expected pattern, with a lower price in large villages, holds for urban and rural villages with road access, but not for rural villages without road access; a very interesting finding that could be explained by entry barriers for traders acting in villages without road access are quite high. The fact that larger villages without road access record higher prices indicates that they do not attract more sellers: instead, it is likely that the incumbent seller just meets more demand which allows him or her to raise prices.

Drawing upon the descriptive analysis presented in this chapter, it is possible to identify five principal elements of the market integration based on the analysis of retail prices for beer. These include (1) type of village are an important determinants of price levels, (2) access to road, (3) size of the market, (4) and access to a daily market. The results from the regression models suggest similar results where transport has a positive impact on the retail price providing higher prices on beer while variables related to market characteristics such as market size and access to a daily market have a negative influence on the retail price. Moreover, the amount of agricultural land in the village was used as a proxy for economic size of the local economy shows a positive effect on the retail price and can be interpreted as traders in a wealthy village sets the prices to reflect what their customers are willing to pay. The result could be interpreted as customers in a wealthy village tend to be willing to pay higher prices.

The LECS 3 provides a wealth of information on village characteristics, economic activities and surrounding environment and institutions, and offers unique opportunities to explore the patterns of market integration. 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 behavior. 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.

6.7 Discussion

To start the discussion it is useful to recall the research question which was formulated in the beginning of the disseration. *What factors influence the spatial price patterns of a homogenous retail product in Lao PDR and how do these patterns influence the degree of market integration?*

The free flow of products between markets is of great importance for the functioning of any economy. An integration of markets, supported by improvements in market infrastructure and transportation systems, can reduce transaction costs and allow trade between locations, with gains from comparative advantages and specialization. The descriptive analysis of beer prices indicates that transport costs in Lao PDR are not only determined by distance. Road access and the presence of markets are important determinants of prices at the village level. The high average prices and large price variations between villages without access to a road are likely to reflect a high variation in transportation costs and competition. The prices are high not only because it is expensive to transport Beer Lao to villages lacking road access, but also because there is not likely to be much competition between retailers on village markets.

The analysis of the spatial price patterns of Beer Lao studied how transport infrastructure and the development of local market institutions affect domestic market integration, as proxied by the price of a bottle of Beer Lao. The assumption underlying the chapter is that locations with lower prices are better integrated with the domestic

market: high prices can only be upheld in locations that are isolated from the domestic market because of high transport costs or because of the presence of local monopolies.

Looking at the spatial variation of prices across the country, the results indicate that urban areas and villages with road access record the lowest prices, presumably because transport costs were relatively low. Villages with markets also have lower prices than villages without markets, because of competition between sellers and traders. Moreover, larger villages record lower prices, which is probably also a result of heavier competition among traders: large villages can support a larger number of sellers than small villages. Villages without road access generally have higher price levels, both because the direct transport costs are higher, and because traders have higher market power than in locations with road access.

Given the high entry barriers (in terms of transport costs) the markets are too small to support several traders, and the incumbents can therefore charge high profit margins. This suggests that the benefits of improvements in transport infrastructre can be very substantial, extending far beyond the cost savings related to transport costs. By making the local markets constestable, transport investments can contribute to a reduction in the cost of imported products. At the same time, it is important to note that the increased efficiency related to the inflow of goods to villages benefitting from improved transport infrastructure reflects only part of the overall increase in welfare. It is likely that the prices of the goods produced by local households may increase, since less is lost in transport costs and profit margins charged by traders with market power.

A conclusion from these findings is that improvements in transport infrastructure can be expected to yield substantial benefits, both directly, through a reduction in the cost of transportation, and indirectly, through the effects on competition: villages with road access are contestable markets, in the sense that high prices will attract new sellers that put downward pressure on prices. Both of these effects will benefit local communities. Apart from giving them access to goods at lower prices, market integration will also improve their chances of selling their own produce at more favorable prices.