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Interregional Trade of High-value Fruits and Vegetables: Issues on Transport and Shipping

Gilberto M. Llanto, Mercedita A. Sombilla, and Francis Mark A. Quimba

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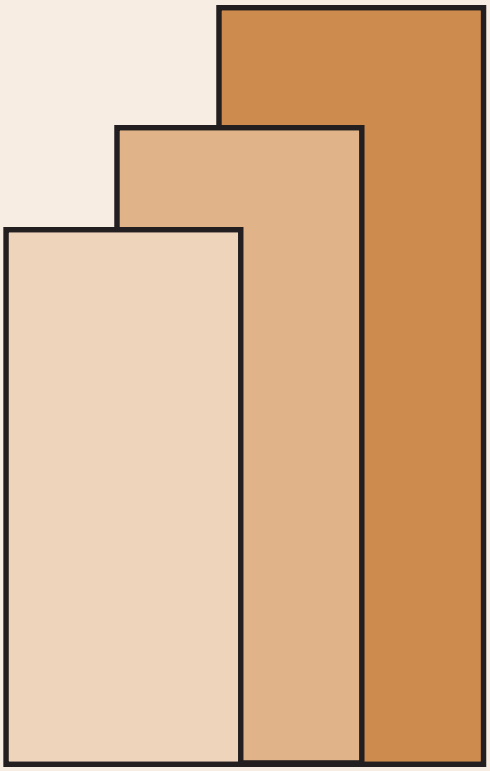

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Summary

The study focuses on the transport of vegetable and fruit produce from Mindanao, a major food producing area, to particular regions in Luzon and Visayas to meet increasing market demands. The estimated gravity model showed the key determinants of inter-regional trade. Economic growth in both sending and recipient regions is necessary for inter-regional trade to flourish. Economic growth and inter-regional trade are anchored on access to markets by various economic agents, which is facilitated by the presence of hard and soft infrastructure that make inter-regional exchange possible.

Because distance drives up transport and marketing costs, the necessity of a good network of roads and ports that links production areas to consumer markets cannot be underestimated. The lack of an efficient transport and distribution system increases the cost of transporting agricultural produce, reduces the quality and quantity of those goods, and diminishes the profitability of actors involved in the supply chain. Inadequacy of infrastructure has been a major reason for the country's lack of competitiveness and attraction as a viable and profitable business destination.

There is a scope for government intervention at two levels. At the macro level, government has a critical role to play in increasing investments in roads and ports, portside facilities, and related investments; in improving monitoring and coordination of markets; and in ensuring effective regulation at the national and local level.

Key words: inter-regional trade, gravity model, transport, logistics, supply chain, shipping

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Inter-Regional Trade of High Value Fruits and Vegetables: Issues on Transport and Shipping

Gilberto M. Llanto[1], Mercedita A. Sombilla[2], and Francis Mark Quimba[1]

I. INTRODUCTION

Mindanao is considered the food basket of the country owing to its bountiful production of food staples consisting of a variety of fruits, vegetables and grains, which are transported to major urban centers for consumption by a growing population. A favourable climate and availability of fertile land underpin the bountiful harvests. It is a major source of livestock and poultry for consumers in Luzon and the Visayas. However, farmers, traders and transporters (truckers and shippers) in Mindanao, have complained about the high cost of transporting agricultural products from the region to demand centers in Metro Manila (in Luzon) and the Visayas. They argue that inefficiency in the road and port network constrains the movement of produce from key production areas to intermediate and terminal markets with adverse consequences on both prices and profits. It seems that farmers especially face problems with transporting produce from the farms to major Mindanao markets due to a number of reasons, e.g. possible shortage of motor vehicles, delays caused by inefficient logistics. Shipping farm produce to Metro Manila and Visayan markets could be problematic because priority is given to the transport of tuna and other high-value fish products especially during peak production season.

Much of the postharvest losses are encountered during the storage and transportation stages of the production to market continuum (Rapusas 2006; Serrano 2006). This limits the potential gains that farmers may realize from their produce given the size of the markets of the region's agricultural products. When an avoidable supply glut happens from failure to move the commodities out of the region, prices become greatly depressed to the disadvantage of the small

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producers. The erosion of economic incentives hinders farmers from further increasing production and improving the quality of farm produce. As a consequence, vegetables and fruits production has failed to keep pace with the food requirements of a fast growing population. Imports of some of these commodities have, thus, been substantially increasing over the years to fill the supply-demand gap that occurs in key market areas.

The movement of vegetable and fruit produce to particular regions in Luzon and Visayas from Mindanao, a major food producing area to meet the increasing market demands will be the focus of this study. While several studies have recognized the huge impact of logistics on the cost structure of agriculture products being sold in the market, there has been limited research in the Philippines on improving the efficiency in logistics services and transport infrastructures to lower marketing costs and increase financial returns to supply chain players while lowering the cost to consumers through competitive prices.

Previous studies on Philippine vegetable and fruit supply chain focused on prices and the net margins realized at different nodes in the chain. Transport and logistics costs, specifically fuel costs, have been identified as a major component of the cost structure of wholesalers in past studies. However, the role of other factors such as government policies and regulations especially those related to infrastructure development in cutting down transport and logistics costs, which could lead to financial benefits to participants in the supply chain, has not been analyzed so far. Likewise, most past studies have looked at aggregative infrastructure investments in the agricultural and rural sector as a whole to stimulate agricultural economic activity. The present study looked specifically at the impact of road and port network on supply chain players with a view to determine possible policy interventions to make those networks more efficient.

a. Objectives of the study

The objectives of the study are as follows:

1. Analyze inter-regional trade of selected major fruits and vegetables in the period 1990-2008[1].
2. Quantify the effects of inter-island transport and infrastructure on inter-regional trade[2] of agricultural products through econometric analysis.
3. Analyze the factors that contribute to high transportation costs and other problems in relation to the flow of goods, focusing on the possible influence of government regulations and investment program; and
4. Recommend policy directions and development approaches to meet the demand for transportation infrastructure in relation to need, attainment of growth potentials, and competitiveness of the Mindanao region.

b. Methodology and data

The study has two parts. The first part provides a macro-perspective of the relationship of transport and logistics and inter-regional trade of agricultural products in the country. In a descriptive analysis, we used data from the commodity flow survey conducted annually by the National Statistics Office. A set of regional tables similar to that of **Table 1** was constructed for each product group each year in the period 1990-2008. Using this set of tables we traced the flow of agricultural commodities from one region to the next, observed the flow pattern and marked any significant shifts in flow through the years. The changes in the flow of commodities provided important information to analyze the possible effects of changes in policy, industry organization and other factors or special circumstances that could have influenced the flow of commodities. The next step was to estimate a gravity model, traditionally used for analysis of international trade, for inter-regional trade in the Philippines. We divided the country into distinct regions and indicated the flow of commodities from a reporting region (RR) to a partner region (PR) (**Table 3**).

The second part of the study used both secondary and primary data, the latter taken from field surveys done in Mindanao in 2011. The study team conducted a survey and focus group

[1] Data availability constrains the analysis to this time period.
[2] From Cagayan de Oro, Bukidnon and South Cotabato in Mindanao to Metro Manila and the cities of Bacolod and Cebu in the Visayas,

discussions involving the growers/producers, the consolidators/agents, the truckers/shippers, the forwarders, the wholesalers and the retailers depending on who are involved in the supply chain process of the commodities selected. The end buyers were excluded from the surveys and focused group discussions because the main concern of this study is the analysis of transport costs and logistics issues, which constrain the efficient movement of farm produce to the major consumer markets. To make the study tractable considering time and budget constraints, the surveys and focused group discussions centered on three major commodities that are produced in the region namely tomato, lettuce, and papaya (See **Appendix 1** for details on the selection of the commodities).

The empirical results of the estimation of a gravity model of intra-regional agriculture trade and an analysis of micro data on three commodities, namely, tomato, lettuce and papaya, in will contribute to a greater understanding of how improvements of transport and logistics can improve the efficiency of inter-regional trade of these important high value crops so as to provide greater benefits to small famer-producers.

The study is organized as follows. After an Introduction, which provides an overview of the problem, study objectives, data, and methodology, Section II gives a brief review of literature and explains the research gap that is addressed by this study. Part of the review is a discussion of a few vegetable supply chain studies done by local researchers, which give important insights in the analysis of the specific farm produce covered by the study. Section III examines the transport and logistics factors affecting inter-regional trade of high value fruits and vegetables with the help of a gravity model. Section IV gives a descriptive analysis of the factors that affect the movement of high value fruits and vegetable in the supply chain from producing areas to demand centers. Section V uses the results of the gravity model and the findings from the field survey to draw up some policy implications. The final section enumerates a few policy recommendations.

II. BRIEF REVIEW OF LITERATURE

The vegetable industry in the country contributes about 30 percent to agriculture gross value added (UNDP, 2005). Resources have also been continuously invested in the sector as the areas harvested of vegetables have steadily increased by about 1.3 percent annually from 1980 to 2005. This has resulted to an average of 2.0 percent growth annually in production volume (Johnson et al. 2008). In 2005, exports of more than 34 million tons of both fresh and processed vegetables earned US$20 million for the vegetable industry players. It is no surprise, therefore, that the Philippine government has identified vegetable cropping as a priority activity for enhancing food security and farm incomes under Republic Act 7900 or the High-Value Crops Development Act of 1995. A snapshot of the inter-regional trade of agricultural products is presented in **Table 1** to give an idea of the magnitude of commodity flow patterns.

Table 1. Food and live animals inter-island commodity flow pattern (2009)
(million metric tons)

Origin	Destination (million tons)			
	Luzon	**Visayas**	**Mindanao**	**Total**
Luzon	7,104	5,198	2,217	14,519
Visayas	835	4,741	699	6,275
Mindanao	7,493	6,806	1,069	15,367
TOTAL	15,431	16,745	3,985	36,161

Source: National Statistics Office

Reading **Table 1** by row shows that for 2009[5], 14.5 million metric tons of agriculture produce and live-animals were produced in Luzon and about half of these were retained in Luzon for consumption or processing, while about 36 percent went to the Visayas and the rest were shipped to Mindanao. For the Visayas, about 80 percent of agriculture and livestock production remained in the Visayas while about 13 percent went to Luzon. Mindanao received only about 11 percent of the total production of food and live animals of the Visayas. Mindanao is the largest producer of food and live animals but it only retained about 7 percent of its produce for local

[5] Latest data produced by the National Statistics Office.

consumption. The 90 percent went to Luzon and Visayas where the major urban markets are located.

Figure 1 shows the trend in the value of agriculture commodities traded in the country by source area. The interesting fact in **Figure 1** is that the value of agricultural trade in real terms has been declining. After reaching a peak in 1998, the value of the traded agriculture commodities continued to decline and in 2009 it amounted to only about a little more than 8 billion pesos (1985 prices).

Figure 1. Value of agriculture commodities traded by reporting (source) area in 1985 Prices

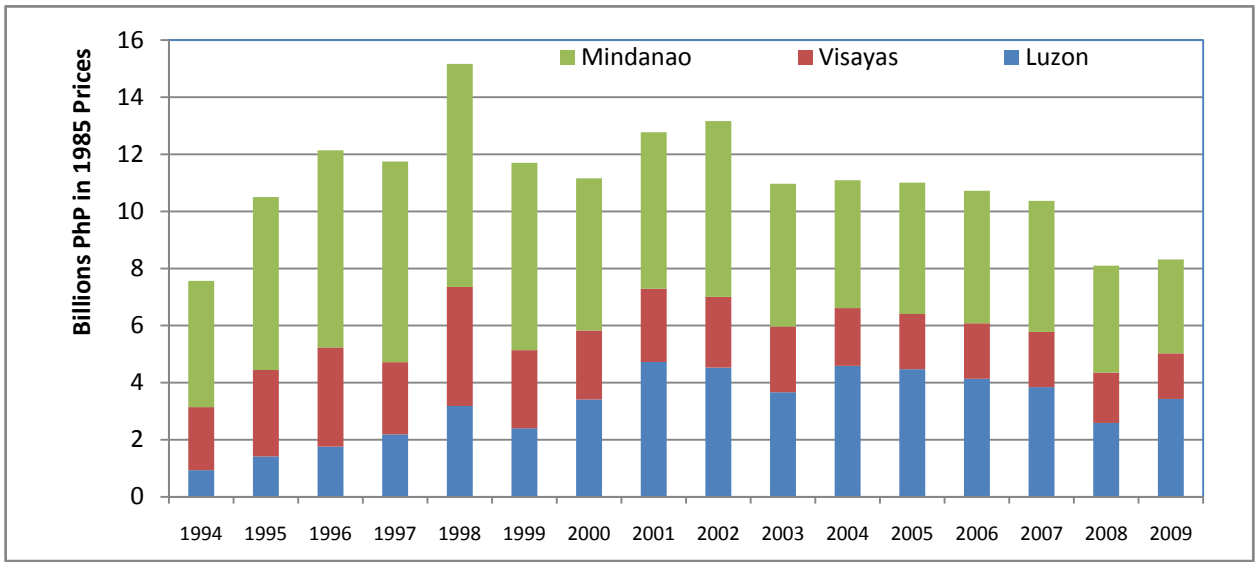
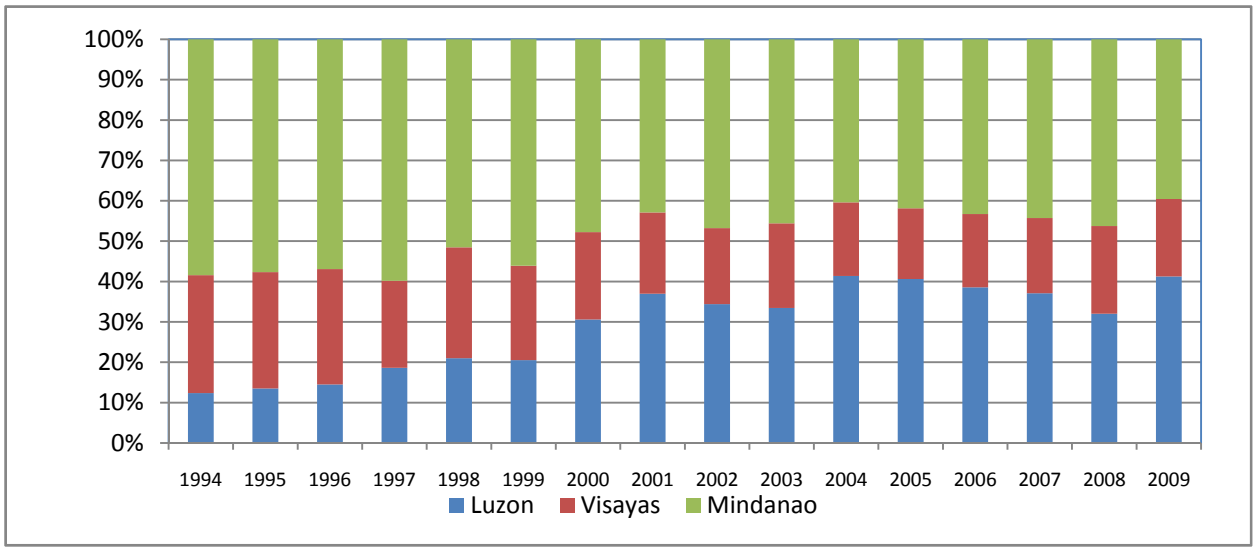


Figure 1 shows the trend in the value of agriculture commodities traded in the country by source area. The interesting fact in Figure 1 is that the value of agricultural trade in real terms has been declining. After reaching a peak in 1998, the value of the traded agriculture commodities continued to decline and in 2009 it amounted to only about a little more than 8 billion pesos (1985 prices).

Figure 2 shows the distribution of the value of agriculture commodities by source area. The lengths of the bars representing each area show that the major source of agriculture produce in the country has been Mindanao. During the time period 1994-2009, an average of 48 percent of the agriculture commodities being traded in the country came from Mindanao while only 29

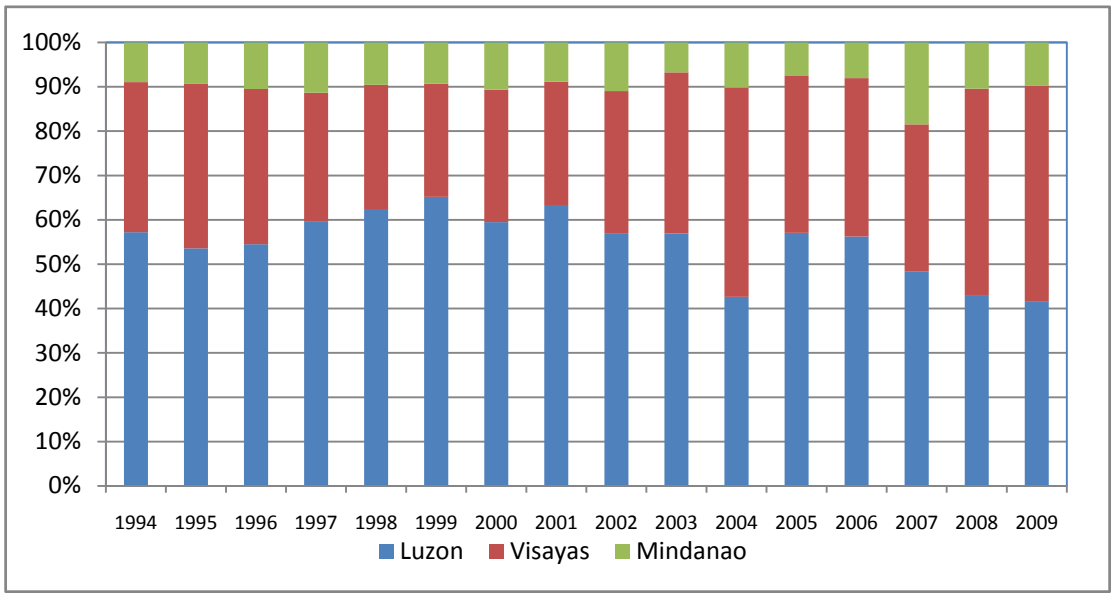
percent came from Luzon and an average of about 22 percent came from the Visayas. In 2009, however, it can be observed that there was a sharp increase in the share of the value of traded agriculture commodities coming from Luzon, from 32 percent in 2008 to 41 percent in 2009. This sharp increase has resulted to Luzon over-taking Mindanao, which only had a share of 39.6 percent in 2009, as the region with the largest share in the value of traded agriculture commodities.

Figure 2. Distribution of agriculture commodities traded by reporting (source) area



While Mindanao has been the main source of agriculture produce and livestock being traded, its share (as a destination) of the value of agriculture commodities being traded has consistently been the smallest. **Figure 3** shows the shares of the different island groups to the total value of the agriculture commodities being traded as recipients of these commodities.

Figure 3. Distribution of agriculture commodities traded by partner (destination) area



It is clear in **Figure 3** that Mindanao has always had the lowest share of commodities being traded with the largest share reaching only about 20 percent in 2007, which returned to its normal level of about 10 percent in 2007. What is surprising in **Figure 3** is the fact that Luzon's share has been declining since 1999 while Visayas' share has been increasing. In fact, in recent years (2008 and 2009), the share of Visayas (averaging about 48 percent) has been greater than Luzon's share of only about 43 percent on the average during the same period.

Another source of insight about the trade of agriculture commodities within the country would be the extent of intra-island group trade. **Table 2** shows that almost 60 percent of agriculture commodities are at the same time produced and traded in Luzon, while 65 percent of agriculture commodities produced in the Visayas are at the same time traded within this island group. On the other hand, 91 percent of agriculture commodities produced in Mindanao are sent to the island groups of Luzon and the Visayas, leaving only 9 percent for the consumption of Mindanao consumers. This clearly shows that the high demand for agriculture commodities is with the highly developed markets and large concentration of people and businesses in Luzon and the Visayas. It also then implies the need for an efficient inter-island transportation system, that will facilitate the flow of agricultural products across the island groups to help ensure all participants of the supply chain from the farmer-producers to the retailers to maximize their

gains and at the same time enable the end beneficiaries, the consumers, to be able to access competitively priced food commodities.

Table 2. Trends in the share of commodities produced and traded within the same island group, 1994-2009

	Luzon	Visayas	Mindanao
1994-1998	54.75	49.41	10.03
1999-2003	71.96	47.21	11.04
2004-2009	59.82	64.62	9.23

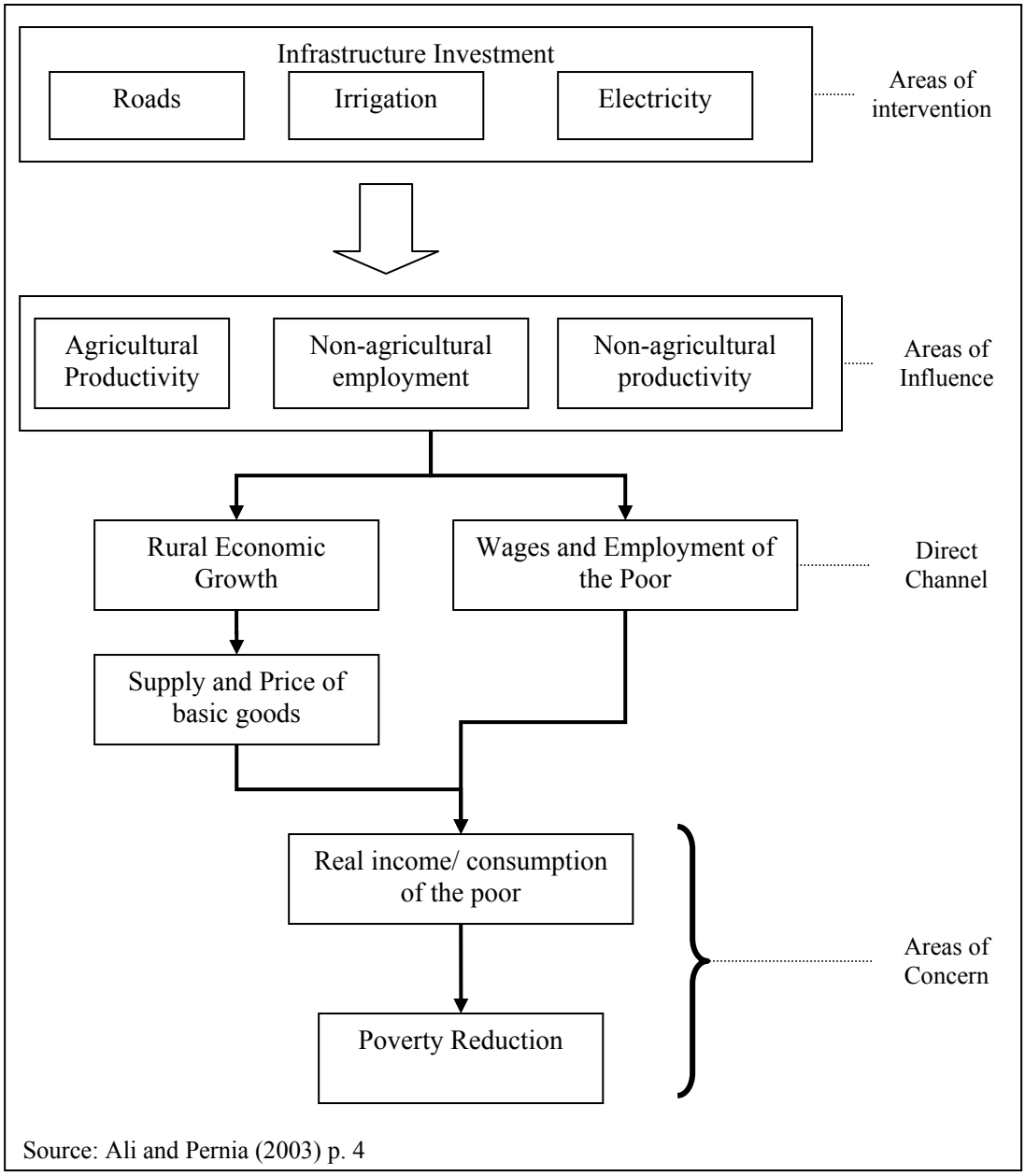
Aside from illustrating the flow of agriculture goods from one island group to another, **Table 2** also implicitly identifies the major role of agricultural trade in meeting the demand for food in different parts of the country. Related to agricultural trade would be the support services and the physical environment that would be supporting and facilitating the efficient flow of agricultural products from Mindanao to major areas like Luzon and the Visayas. Being an archipelago, the country needs an efficient sea transport system supported by air and land transport to link the islands. Unfortunately, the country's current transport and distribution system has become more of a barrier to domestic trade by increasing the cost of transporting goods and reducing the quality and quantity of the products that have to be transported (UNDP 2005; Aldaba et al. 2010; Llanto et al. 2005).

A number of studies have looked into the relationship of infrastructure development and agriculture development as a means of reducing poverty. Ali and Pernia (2003) formulated an analytical framework that could be used in relating infrastructure development and poverty reduction. **Figure 4** shows that the government can invest in different types of physical infrastructure (areas of intervention) and these physical infrastructures can influence the determinants of rural poverty including agricultural productivity. Ali and Pernia identified rural roads, rural electrification and irrigation as the three most important areas of intervention where the government can channel investments.

Empirical studies in different countries tried to quantify the effects of improved investment in infrastructure on agricultural production. Findings by Fan, Zhang and Rao (2004 p. 47) for Uganda show that government spending on rural infrastructure, specifically on the low-grade feeder roads, has a large impact on reducing rural poverty through two channels: first, by

increasing agriculture productivity as prospects for market expansion are enhanced and secondly, by providing better access to non-farm employment opportunities.

Figure 4. Nexus of infrastructure investment and poverty reduction



Source: Ali and Pernia (2003) p. 4

For the case of China, Fan, Zhang and Zhang (2000 p. 37) found that government investment in roads and rural electrification had a significant effect on agricultural production. The study indicated that for each additional Yuan invested in roads and rural electrification, the value of agricultural production was estimated to increase by about 4.91 Yuan and 3.90 Yuan,

respectively. The results obtained in Thailand are a bit different from that of China. Using a slightly modified version of the China model for the study of Thailand, Fan, Jitsuchon and Methakunnavut (2004) showed that rural electrification was found to be the most significant determinant of agricultural productivity. Rural roads did not come out as a significant factor for raising agricultural productivity in that country.

Fan, Huong and Long (2004) demonstrated that in rural Vietnam their estimated agricultural production function suggested the importance of conventional inputs such as land, labor and fertilizer. Coming out to be a significant contributor to agricultural production growth were the public input variables, in particular, the education variable. Other public input variables such as irrigation, roads, access to telephone and electricity and agricultural research were also indicated to have contributed to the growth of Vietnamese agriculture. However, the electricity and telephone variables were not statistically significant although they were positively correlated with Vietnam's agriculture production performance.

A recent study by Manalili and Gonzales (2009) evaluated the impact of roads and irrigation on farm productivity, rural income, technology adoption and transaction costs in rice farming in the Philippines. The study estimated the level of profitability and global competitiveness of rice farmers who have access to good infrastructure and compared them with those who do not have access of the same facilities. They established that good road and irrigation facilities indeed improve farm profitability and productivity.

In identifying the channels through which the road structure affects agriculture productivity, Manalili and Gonzales showed that the price of urea nitrogen fertilizer is more expensive in areas with poor roads owing to higher transportation costs incurred in the purchase of this input. In areas with better road structures, farmers tend to apply more nitrogen fertilizer because of its lower price brought about by lower transportation costs.

Similarly, Llanto (2009) estimated the effect of rural electrification, irrigation and local road density on agriculture productivity. The study found that rural roads, electricity and water (represented by irrigation infrastructure and rainfall) are significant determinants of agricultural productivity. Rural roads open opportunities for sourcing relatively cheaper inputs, and marketing and trading rural produce. They also account for the increase in labor mobility that

enables rural households to earn higher incomes from greater opportunities for non-farm and off-farm employment.

In the same study Llanto (2009) included a review of the available studies that analyzed the relationship between agriculture, on the one hand, and transport and logistics and other infrastructure facilities, on the other. It was pointed out in his review that this area of study is still largely an unexplored topic. Most of the past studies undertaken in the past focused more on the macro aspect of the relationship, e.g. agriculture taken as the whole sector. Although these studies have significantly contributed to the literature of assessing the impact of infrastructure and transport logistics investments on agriculture development, commodity level relational studies are needed in the light of the differential transport and marketing requirements to facilitate more efficient commodity flow and expansion of markets for the benefit the growers and other participants in the supply chain.

Our review of the literature seems to indicate that there is a dearth of studies on the effect of transport and logistics on agricultural trade within the country. The importance of transport infrastructure in terms of their effects in facilitating the trade of agriculture commodities has not been quantified. Section 3 of the study used a gravity model to analyze the determinants of inter-regional trade of high value agriculture products, specially focusing on transport and ports infrastructure. It provides information on the possible types of infrastructure that are more important for agriculture trade within the country.

The following section in this review looks at commodity specific studies that would supplement the micro-analysis of this study.

The various commodity working papers submitted for the ACIAR funded Southern Philippines Horticulture Program (ACIAR Program HORT/2007/067) made use of the price spread, price transmission and net margin analysis to determine the price structure and of crops from Mindanao. Tomato, papaya and lettuce are among the crops that were studied. The succeeding paragraphs provide summaries of the studies relevant for this study.

The supply chain for tomato produced in Kapatagan is presented in **Figure 5**. The major actors or participants identified by the study are the farmers, wholesalers and retailers. Transport of tomato from the farmers to the Bankerohan Public Market in Davao rests on the wholesalers. According to the study, wholesalers of tomatoes from Kapatagan transport the tomatoes in

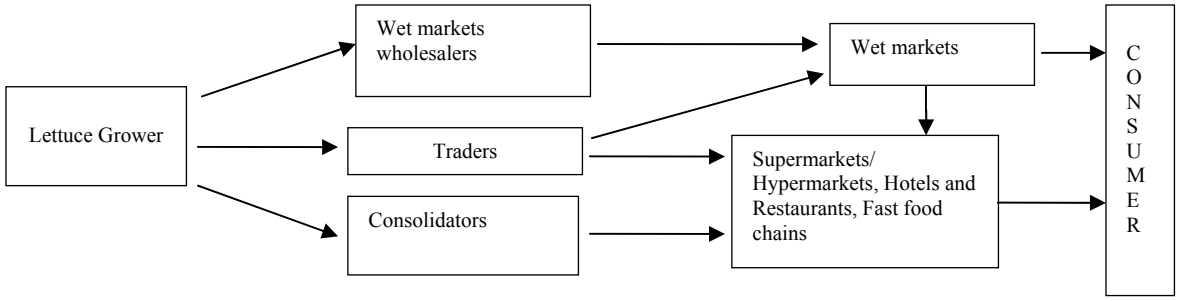
wooden crates, which they load on ten-wheeler forward trucks. For farmers who live in far-flung farms, the burden of transporting the tomatoes rests on the farmers themselves who rely on hired laborers to bring the goods to the nearest road where the trucks of the wholesalers are parked. Aside from wholesalers who transport the goods from farms to the Bankerohan Public Market, wholesaler-retailers who transport the goods to Manila were also interviewed by the study. The retailers who were respondents of the survey are stall owners in the Bankerohan Public Market (Vicencio 2010).

In the case of tomato, data show that the farmers' share of the returns to this produce at the national level has generally benefited producers in contrast to the declining share of wholesalers and retailers. This trend holds true with the Bukidnon (farm gate)-Region X (wholesale)-Manila (retail) chain, but not with the Davao del Sur (farm gate)-Region XI (wholesale)-Davao City (retail) chain. It appears that high transportation and labor costs have reduced the share of wholesalers and retailers. For the wholesaler-retailers who are in Metro Manila, the study found that aside from the understandably higher transportation cost, wastage costs are also higher for these actors relative to their counterparts in Davao.

Figure 5. Supply chain of tomato from Barangay Kapatagan to Bankerohan public market

The study on lettuce has identified three major supply chains. The conventional supply chain of lettuce is presented in **Figure 6**. Farmers pack the lettuce in cartons and then deliver

Figure 6. Conventional lettuce supply chain in Bukidnon

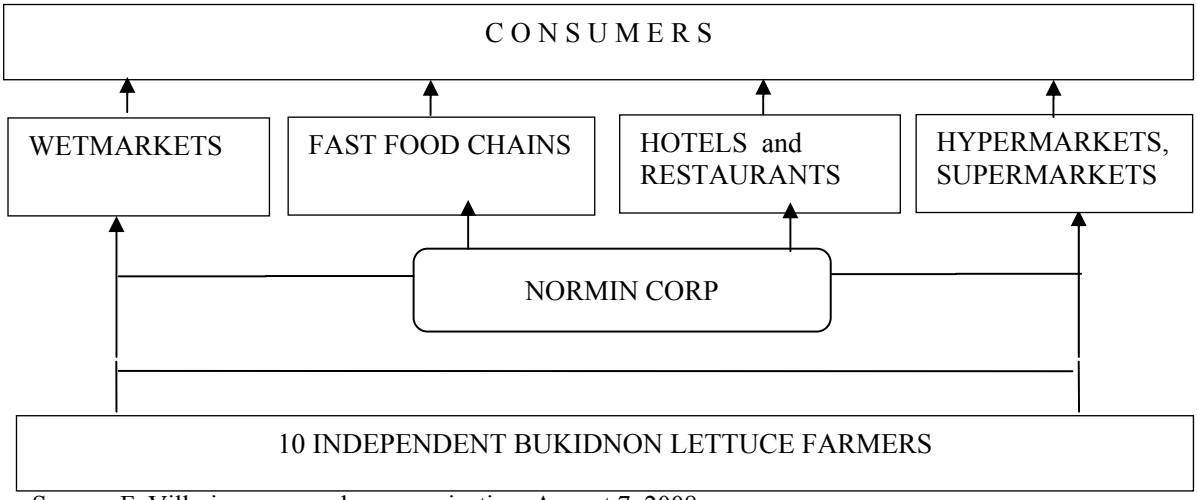


Source: F. Villarino, personal communication, August 7, 2008

them to traders, wholesalers and consolidators where the lettuce are repacked and branded making it ready for a bigger market. The chain continues to the supermarkets, hypermarkets, hotels and restaurants and wet markets until it reaches the end consumer.

Another supply chain (**Figure 7**) that was identified by a study looks at the case of the Northern Mindanao (Normin) Corporation. The Normin Corporation acts as a market facilitator that provides marketing services to growers. The supply chain in the area where Normin Corporation operates is shorter because of the elimination of traders and other middlemen. The Normin Corporation contributes to the improvement of the quality of the produce being transported because it helps the farmers to meet the requirements of the market for quality produce. For instance, to meet the volume requirements of the market, the yield of the growers need to increase. This was supported by the supply chain through the promotion of better production practices and introduction of technology, e.g. cool chain to maintain the freshness of the produce. Farmers share their modern practices and technology in their respective clusters.

Figure 7. NORMIN Corporation lettuce supply chain in Bukidnon

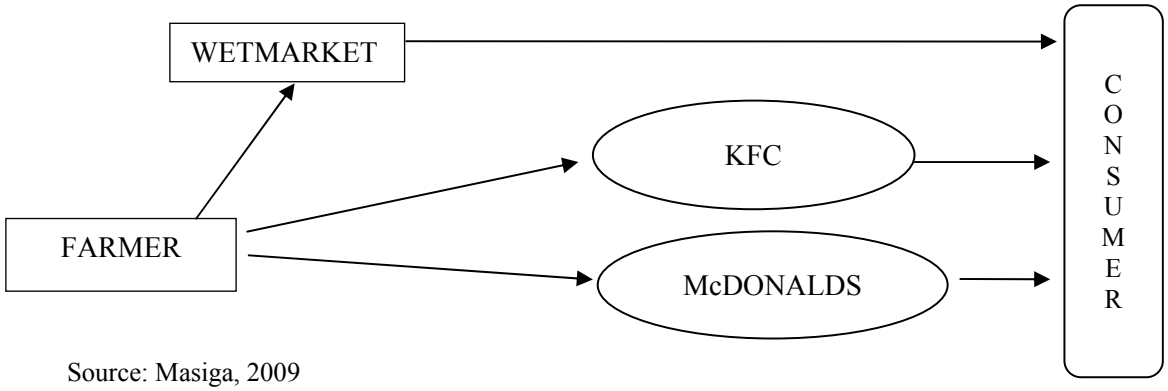


Source: F. Villarino, personal communication, August 7, 2008

Another lettuce supply chain involves the growers linking directly to institutional buyers making the chain much shorter (**Figure 8**). The actors involved in this kind of supply chain are usually large lettuce growers and fast food chains or other restaurants engaged in special contractual agreements. However, only a few farmers are engaged in lettuce growing. Many of

them have left the industry because of low production, inefficient marketing strategy and poor product quality. During the wet season, some farmers grow lettuce in plots under their elevated houses especially in the month of May. During dry season a relatively high supply of lettuce drives prices down, which makes it hard for farmers to have better prices in the market.

Figure 8: Supply chain of lettuce in Bukidnon involving fast food chains and restaurants



Source: Masiga, 2009

The study identified the varieties of lettuce grown as iceberg, romaine, anvida, and fancy lettuce. Despite the higher potential profitability of romaine, only the iceberg variety is sold in wet markets because the romaine variety has yet to be established and be accepted in the market. The calculation of net margins has underscored the importance of transportation costs and allowance for losses, which were found to be the major cost items for agents/traders viajeros and retailers.

The study of papaya by Abenoja (2010) identified 4 cases of supply chains. The first case involves a farmer selling his produce to a wholesaler-retailer based in Bankerohan Public Market in Davao City. These two actors have been engaged in a trading relationship for five years without need for a written contract. The second case is that of a farmer with a one-hectare Solo papaya farm (located in Tupi, South Cotabato) who sells his produce to a viajero who in turn ships the fruits to Manila via the General Santos City port. The wholesaler-retailers in Manila interviewed represent the receiver of the product from General Santos City. Another case is that of a farmer engaged in a contract-growing arrangement with Dole Tropifresh, a subsidiary of Dole Philippines. The fourth case is that of another farmer with a one-hectare Solo papaya farm

in Tupi, South Cotabato who sells papayas found unfit ("rejected") for the export market to a wholesaler-retailer stationed in Tupi, South Cotabato. The papayas in turn are sold to a wholesaler-retailer in Good Harvest Market in Cubao, Quezon City only during peak demand season.

A general finding of the study is that aside from high logistic costs, increasing marketing costs in all nodes of the supply chain are also due to wastage and rapid quality deterioration of papaya, which lead to the estimated significant loss figures. Wastage and rapid quality deterioration, on the other hand, are due to poor farm management practices that affect the quality of products, more frequent occurrence of severe weather condition that affect yield, lack of good transport facilities that prevent access to markets, competition among traders that contribute to frequent fluctuation of prices and lack of financial capital that leads to borrowing and bad debts arising from loan defaults. Among the recommendations of this study are the following: proper application of fertilizer, pesticides, and other farm chemicals during cultivation of the crop to produce good quality papaya, implementation of better postharvest handling practices, and expanding the market of papaya to include appropriate international destinations. Any intervention that will result to lower farm input expense and an improvement in farm efficiency will benefit the whole supply chain. Income can also be increased through higher volume transaction, investment in hard assets such as transportation vehicles, and better linkage with suppliers.

Apart from the above mentioned commodity studies there are other studies that have information on the importance of transport and logistics on the trade of fruits and vegetables from Mindanao. A study by the UNDP, for instance, shows that transport and logistics have a huge impact on the cost structure of farmers in Cagayan de Oro who sell their goods directly to the final market in Manila via shipping. Competition in shipping transport may translate to a 5% savings in transport-logistic cost. The net margins analysis shows that transportation cost, fertilizer, wooden crate, and wastage costs are among the cost components with the largest share in the total cost at farm, wholesale and retail levels. Most of the players generate positive net margins, the farmer having the highest net margin and the wholesaler with the lowest net margin. An important element in acquiring higher net margins is an increase in volume of produce and transactions at all levels, which will bring down cost.

The Seed-to-Shelf study by the NEDA identified several major challenges and opportunities in the supply chain of the vegetable industry. The chain consists of different institutions or persons (local traders, large wholesalers and retailers in the urban markets, vendors, restaurants hotels and other institutions) that are inter-related and interdependent with each other (e.g. farmers are dependent on wholesalers for production inputs; wholesalers are dependent on farmers for the supply of the produce; retailers are dependent on wholesalers as sources of the produce for sale and in some cases for marketing loans; etc). There may be efficiencies to be exploited or inefficiencies to be avoided or minimized within the chain. Inefficiencies result to high marketing cost, high profit margins to cover high risks and exercise of market power, which ultimately lead to high consumer prices. Major determinants of these inefficiencies at the production side start with the high cost of inputs such as seeds, fertilizers and pesticides, which are applied in large quantities. Fertilizer prices are expensive due to high transport cost; they appear to be more expensive when supplied on credit by the traders. The seasonal gluts, which affect producer incentives and supply, were not only attributed to agro-ecological and climatic conditions but also mainly to the lack of planning of production in relation to market demand.

III. INTER-REGIONAL TRADE THROUGH THE LENS OF A GRAVITY MODEL

The gravity model is commonly used in trade and migration studies. Its formulation is based on the laws of Newtonian Physics, which says that the attractive force or gravitation exerted on an individual/good is a direct ratio of the mass of a given space and inversely related to distance. Mathematically, the relationship is expressed as:

$$M_{ij} \propto \frac{P_i P_j}{D_{ij}^2} \qquad \text{Equation (1)}$$

where M_{ij} is the migration/trade from region i to region j

P_i, $P_j$is the population/economic mass in region i and region j, respectively

$D_{ij}$is the distance between region i and region j.

Despite criticisms that the model has weak foundations in economic theory especially in trade or migration analysis, e.g., the gravity model lacks the ability to describe the decision to migrate (Gallup 1997), there have been a number of studies that have used gravity modeling for trade or migration analysis because of the relative simplicity of the concept, which yields interesting insights and implications.

Carrere (2006) began with the theoretical gravity model by Baier and Bergstrand (2002) in order to derive an estimable gravity model equation. Their econometric model is adopted for this study and is presented as Equation 2 below:

$$\ln M_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln N_j + \beta_4 \ln D_{ij} + \beta_5 \ln L_{ij} + \beta_6 \ln IN_i + \beta_7 \ln IN_j \quad \text{Equation (2)}$$

where M_{ij} is the trade flow from region i to region j

Y_i and Y_j is the GDP of regions i and j, respectively

N_j is the population of the destination region

IN_i, IN_j is the level of infrastructure in region i and region j, respectively.

D_{ij} is the distance between region i and j.

L_j is the presence of supermarkets and markets in j.

Equation 2 can be used as a starting point for the analysis on inter-regional trade as it is able to provide expected signs for each of the $\beta_{k,(k=1 \text{ to } 7)}$: β_1, β_2, β_5, β_6, $\beta_7 > 0$, β_3, $\beta_4 < 0$. Note that the explanatory variables are not limited to the ones used by Carrere as other more significant variables for the Philippines may be found depending on availability of data.

The data used in the estimation of the gravity model indicated in Equation (2) were collected from a number of sources like the National Statistics Office (NSO), National Statistical Coordination Board (NSCB), other government agencies and other websites.

It should be noted that the data for the Philippine regions are not comparable across time. This is because the regions of the Philippines have been redefined across time, increasing in number from the original 13 to the present 17 regions. We, thus, limited the dataset used for the

estimation of the gravity model to the most recent disaggregation of the Philippine regions. Thus, the time frame for the dataset was from 2002-2009 allowing analysis for an 8-year time series.

There are 17 regions that were considered in the analysis. **Table 3** presents a summary of the regions in the country and some indicators. What is notable in **Table 3** is the fact that while the National Capital Region (NCR) is a region belonging to Luzon, it does not yield agricultural output and only relies on the surrounding regions in Luzon and on Mindanao for meeting its demand of agricultural commodities. The NCR is comprised of the major cities of the country making it a vast urban market with an estimated population of around 11 million.

Table 3. Sample statistics by region, average 2002-2009

Region	Capital City	Average Gross Regional Domestic Product (1985=100 million pesos	Average Gross Value added in Agriculture (1985=100 million pesos	Total No. of Municipalities
NCR	Manila	375.9941	0.001153	1,694
CAR	Baguio City	27.51847	3.643095	1,172
I - Ilocos Region	San Fernando, La Union	35.37563	15.0506	3,265
II - Cagayan Valley	Tuguegarao City	24.22354	12.27851	2,311
III - Central Luzon	San Fernando, Pampanga	102.2352	24.76195	3,100
IVa - CALABARZON	Calamba, Laguna	149.2293	28.71425	4,008
IVb - MIMAROPA	Calapan, Mindoro Oriental	32.78115	13.34515	1,455
V - Bicol Region	Legaspi	33.51309	11.07845	3,471
VI - Western Visayas	Iloilo	85.77494	23.51497	4,048
VII - Central Visayas	Cebu City	83.90461	9.625022	3,003
VIII - Eastern Visayas	Tacloban	26.20327	8.688336	4,391
IX - Zamboanga Peninsula	Pagadian, Zamboanga del Sur	30.95313	15.5666	1,825
X - Northern Mindanao	Cagayan de Oro	56.87683	16.43369	2,020
XI - Davao Region	Davao	54.05395	14.65598	1,158
XII - SOCCSKSARGEN	Koronadal	41.72543	17.67705	1,289
XIII –Caraga	Butuan City	15.31333	5.574353	1,307
ARMM	Cotabato City	10.61102	6.078395	2,394

Head (2000) defined the dependent variable as the flow from origin *i* to destination *j*. The data for this variable were collected from the National Statistics Office's Quarterly Survey on

Domestic Trade Statistics. The data obtained were coastwise trade data which contain a compilation of data on all agricultural commodities carried through the water transport system. The information is gathered using the Outward Coasting Manifests, which is a document that the Philippine Ports Authority (PPA) collects from sea vessels before they depart from the port. These documents contain information on the port of origin, port of destination, description of commodity, quantity and value (NSO website). Because the data of the NSO on Domestic Trade have been aggregated at the three-digit Philippine Standard Commodity Classification (PSCC) commodity group code, the estimation utilized for its dependent variable the total agricultural trade and the aggregate for the fruits and vegetables (PSSC group code 054, 056 and 057). Other commodity groups (001 Live Animals, 034 Fish, 042 Rice etc…) were disregarded for the fruits and vegetables estimation but included in the total agricultural trade estimation.

The independent variables for the gravity model include the standard economic mass and distance variables. Head (2000) describes economic mass as the economic size of the source and destination areas which is appropriately and usually measured by the Gross Domestic Product. In the case of the gravity model used in this study, economic mass was measured using Gross Domestic Regional Product (GRDP) which is the total Gross Value Added (GVA) of all producer units in the region (National Statistical Coordination Board website). The data were expressed in 1985 prices.

Distance between the two regions was estimated using the Globe distance calculator for the Philippines (http://distancecalculator.globefeed.com/Philippines_Distance_Calculator.asp). The website provides the distance between two areas calculated as the straight line or flying distance based on the latitudes and longitudes. Naturally, this distance would differ from the actual travel distance given that the roads would not always connect two areas in a straight line. The software also calculates an estimated distance using the mileage calculator which may provide a closer estimate of the distance between two areas assuming roads are used. For the purpose of this study and due to the lack of other sources for distance, this estimated distance was used to calculate the distance between the capital cities of the regions.

Apart from these control variables, the more important indicators that were incorporated in the model were infrastructure variables. Indicators such as road density in the region, which were adjusted for the quality of roads, were incorporated as an indicator of number of inter-

connectedness of the region. Another indicator was the number of vessels calling in the ports located at the region as an indicator of the efficiency of the ports. Finally, a weighted average of the number of areas (provinces, municipalities, districts) in the region that has a public market and the number of supermarkets within the region was incorporated as an indicator for markets. The data for the markets was taken from Form 5 of the Philippine Census of Population, which is administered by the NSO. Data on roads were obtained from the Department of Public Works and Highways and the NSCB publication Countryside in Figures (CIF). It is emphasized that we had to look for the nearest proxy indicators in the absence of good data on a given variable, e.g., distance between two regions, number of vessels calling on a certain port as an indicator of port efficiency. The lack of relevant or good data is acknowledged to be a limitation of the study.

The data have to be organized in such a way that the origin and destination regions will be identifiable. **Table 4** illustrates the format of the data. The format of the database allows for a cross-sectional OLS estimation and a panel regression estimation. The results with the accompanying explanations are presented below. .

Table Error! No text of specified style in document.**4. Data structure of gravity model**

Year	Reporting Region (RR)	Partner Region (PR)	Import of Vegetables (of RR from PR)	Export of Vegetables (from RR to PR)	GRDP-RR	GRDP-PR	Distance (RR to PR)	No. of Sea vessel Trips (RR to PR)
1990	NCR	NCR						
1990	NCR	CAR						
1990	NCR	Reg 1						
1990	NCR	Reg 2						
1990	NCR	.						
1990	NCR	.						
1990	NCR	.						
1990	NCR	CARAGA						
1990	NCR	ARMM						
1991	CAR	NCR						
1991	CAR	CAR						
1991	CAR	Reg 1						
1991	CAR	Reg 2						
1991	CAR	.						
1991	CAR	.						
1991	CAR	.						
1991	CAR	CARAGA						
1991	CAR	ARMM						
1992	Region 1	Reg 1						
.	Region 1	Reg 2						
.	Region 1	.						

Notes: Where ellipsis indicates remaining regions or years; RR is the reporting region; PR is the partner region.

The results of the regression analysis using standard OLS and panel regression assuming random effects are presented in **Table 5**. Among the transport infrastructure indicators that have been included in the model, only the markets and ports were found to be significant in both models. The other infrastructure variables (roads of the destination and origin) were both found to be not significant but the signs agree with a priori assumptions. Distance between regions is also a significant explanatory variable.

Table 5. Estimation results for total agriculture trade

Dependent Variable: Total Agriculture Trade				
	Ordinary Least Squares		**Panel Regression with Random Effects**	
Explanatory Variables	**Coefficient**	**Significance**	**Coefficient**	**Significance**
GDP-reporting region	2.82	***	1.09	
GDP-destination region	1.91	***	1.96	***
Distance	-0.48	***	-0.48	***
Paved road of reporting region	0.32		0.46	
Paved road of destination region	0.61		0.59	
Markets-destination	8.08	***	8.03	***
No. of vessels in port of origin	0.39	***	0.44	***
Constant	-116.21	***	-86.93	**

Table 5 shows that a positive economic activity in the reporting region or in the partner (destination) region would translate into an increase in total agriculture trade between the regions. The estimated effect of a 1 percent increase in the number of markets in the destination region would result to an increase of 8 percent in total agriculture trade to that region. Finally, an increase of about 0.4 percent in agriculture trade is associated with a 1 percent increase in the number of vessels in port of origin.

Distance can be seen as a consistent determinant of trade of vegetables. Even in the panel regression, which corrects time variant omitted variables, the coefficient of distance is consistent at -0.48. This indicates that the estimated coefficient is robust. Head (2000) explains that the distance variable captures transport costs, which were not captured in the explanatory variables that were included in the estimation. Furthermore Head states that "distance indicates the time elapsed during shipment. For perishable goods the probability of surviving intact is a decreasing

function of time in transit. Perishability may be interpreted quite broadly to include the following risks:

(a) Damage or loss of the good due to weather or mishandling (e.g. ship sinks in a storm).
(b) Decomposition and spoiling of organic materials (e.g. maggot infestation).
(c) Loss of the market (the intended purchaser becomes unwilling or unable to make payment)." (Head 2000: p.7)

The results for total agriculture trade are consistent with the results for the trade of vegetables (fresh and dried). The trade of vegetables is associated highly with level of economic activity (economic mass) of both the origin and the destination regions as well as with the infrastructure and transport variables like markets and number of vessels in the ports. **Table 6** shows the results for the trade of vegetables. While the indicators for economic mass may not be significant, the estimated coefficients are still positive indicating a positive relationship between the trade of vegetables and economic mass or gross regional domestic product. It can also be clearly seen in both estimations that with 1 percent more markets, an associated increase of about 5 percent in trade of vegetables could be obtained (ceteris paribus) while a 1 percent increase in the number of vessels in the ports is associated with about 0.2 to 0.3 percent increase in the total trade of vegetables (ceteris paribus).

Table 6. Estimation results for trade of vegetables

Dependent Variable: Total Vegetables (Fresh and Dried)				
	Ordinary Least Squares		**Panel Regression with Random Effects**	
Explanatory Variables	**Coefficient**	**Significance**	**Coefficient**	**Significance**
GDP-reporting region	0.77		0.41	
GDP-partner region	0.08		0.13	
Distance	-0.32	***	-0.32	***
Paved road-reporting region	2.49	***	0.50	
Paved road-destination region	0.69		0.68	
Markets-destination	5.18	***	5.14	***
No. of vessels in port-reporting	0.21	***	0.26	***
Constant	-49.23	***	-39.99	

Finally, what is also interesting to note in the results presented in **Table 6** is that paved roads in the region of origin of vegetables is positive and significant in the OLS estimation. This may point to the importance of roads in the producing region especially in areas where the goods have to be transported from farms located far away from the major roads. While this result may not be robust from a regression analysis viewpoint, the survey data used in our micro analysis confirms the importance of good, all-weather roads in the farming areas.

While the results of the total agriculture trade and trade of fresh and dried vegetables may be encouraging, the same cannot be said about the fruits (including nuts). A number of problems in the results arise when the estimation is limited to fruits. We guess that this may be due to the inter-relationship of paved roads and GRDP.

It can be seen in **Table 7** that there is a high correlation between the percentage of paved roads and the level of economic mass in a region. Such a high correlation results to a multicollinearity problem.

Table 7. Correlation of explanatory variables

	GDP-reporting region	**GDP-partner region**	**Distance**	**Paved road of reporting region**	**Paved road of destination region**	**Markets of destination**	**No. of vessels in port of origin**
GDP-reporting region	1.00						
GDP-partner region	0.02	1.00					
Distance	-0.01	-0.01	1.00				
Paved road of reporting region	0.84	0.01	-0.01	1.00			
Paved road of destination region	0.01	0.84	-0.01	0.00	1.00		
Markets-destination	0.00	0.58	-0.01	0.00	0.59	1.00	
No. of vessels in port of origin	0.48	0.00	-0.01	0.29	0.00	0.00	1.00

One remedy that is often used to correct for multicollinearity is to drop the variables which are highly correlated. While we may do this to the paved roads variables, it is not advisable to drop the GDP variables as this may result to a model specification error. **Table 8** presents the results of the estimation once the road indicators were dropped. It can be clearly seen that there has been quite an improvement in the results. **Table 8** actually shows that the variables that were identified to be important in the trade of agriculture in general and vegetables in particular are also significant for fruits.

Table 8. Estimation Results for Total fruits

Dependent Variable: Total Fruits				
	Ordinary Least Squares		**Panel Regression with Random Effects**	
Explanatory Variables	**Coefficient**	**Significance**	**Coefficient**	**Significance**
GDP-reporting region	2.44	***	-0.26	
GDP-partner region	1.71	***	1.77	***
Distance	-0.40	***	-0.40	***
Markets-destination	5.50	***	5.42	***
No. of vessels in port-reporting	0.29	***	0.38	***
Constant	-102.22	***	-55.61	**

There may be problems with the estimation results for fruits because the estimated coefficient for economic mass of the reporting region is negative but fortunately, not statistically significant. However, there are insights that can be drawn from the OLS estimates. All the coefficients under the least square estimates are significant and follow expected signs.

The results show that, taking all other variables as constant, a 1 percent increase in markets would be associated with around 5 percent increase in total trade of fruits while a 1 percent increase in vessels in the port would be associated with around 0.3 to 0.4 percent increase in total trade of fruits.

To summarize, the results of the gravity model emphasize the importance of markets, ports, and roads in the facilitation of trade of agriculture products. Distance between regions is a major deterrent to the growth of inter-regional trade. Economic growth in both sending and destination regions is an all important determinant of inter-regional trade of high value

agricultural products. The following section expounds on these findings by looking at the cases of papaya, tomato and lettuce as the commodities being traded from Mindanao to other areas of the country. In section V we tie the results of the gravity model with the findings from the survey to draw policy implications.

IV. RESULTS OF THE FIELD SURVEY

a. Background

In this section we focus on the analysis of the supply chain of selected fruit (papaya) and vegetables (tomato and lettuce) in the Mindanao region. We used a survey questionnaire to identify the determinants of the performance of the supply chain and focused group discussions with port operators and shipping lines. The survey questionnaire is presented in Appendix 2[6]. The different sections of the questionnaire are as follows:

1. Part I are specific only for the producers.
2. Part II is to be answered only by traders/viajeros/agents. The questions are focused on the trader's access to the market, his/her profit margin, market activity and credit.
3. Part III is to be answered only by wholesalers/retailers. The questions in this part focus on the end buyer's access to the market, market participation and his/her access to information.

The survey was conducted in major markets in Mindanao, principally General Santos City (the port of origin of papaya produced in Tupi, South Cotabato going to Manila), Cagayan de Oro City (the port of origin of papaya from Tupi South Cotabato, tomato and lettuce from Bukidnon going to the Visayas and other parts of Mindanao like Davao City) and other major urban centers where fruits and vegetables are actively traded.

b. Results

i. Growers

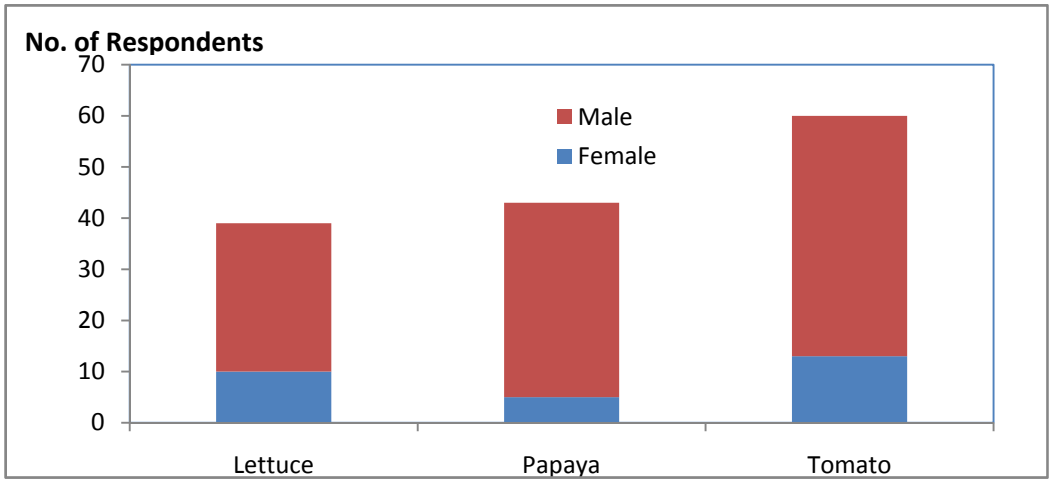
A total of 142 growers were interviewed across all three commodities. The growers were identified using a list obtained from the municipal agriculturist of the local government who

[6] In constructing this questionnaire, we drew in part from the questionnaire used for a case study in Tanzania by Eskola (2005).

monitors or has information on the crops produced by the growers in the area. From that list, the growers to be interviewed were selected randomly.

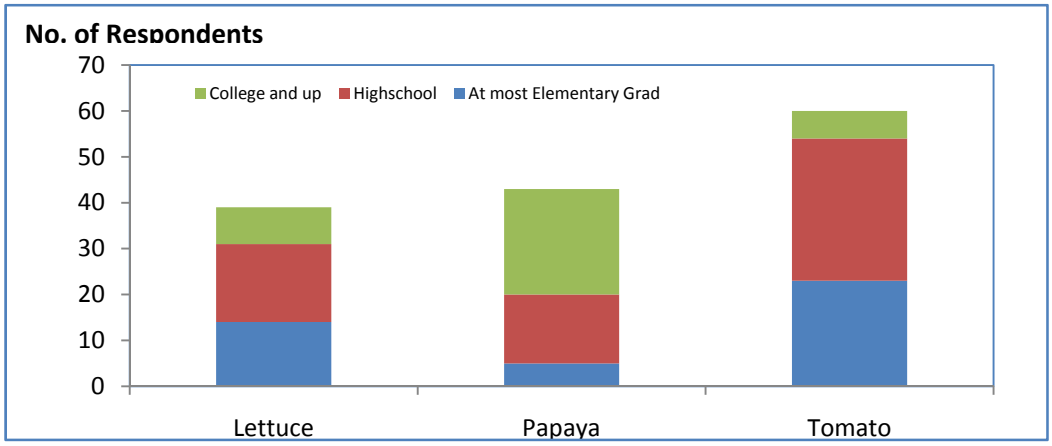
The distribution of the growers interviewed across all three commodities by sex is presented in **Figure 9**.

Figure 9. Distribution of growers by commodity, by sex



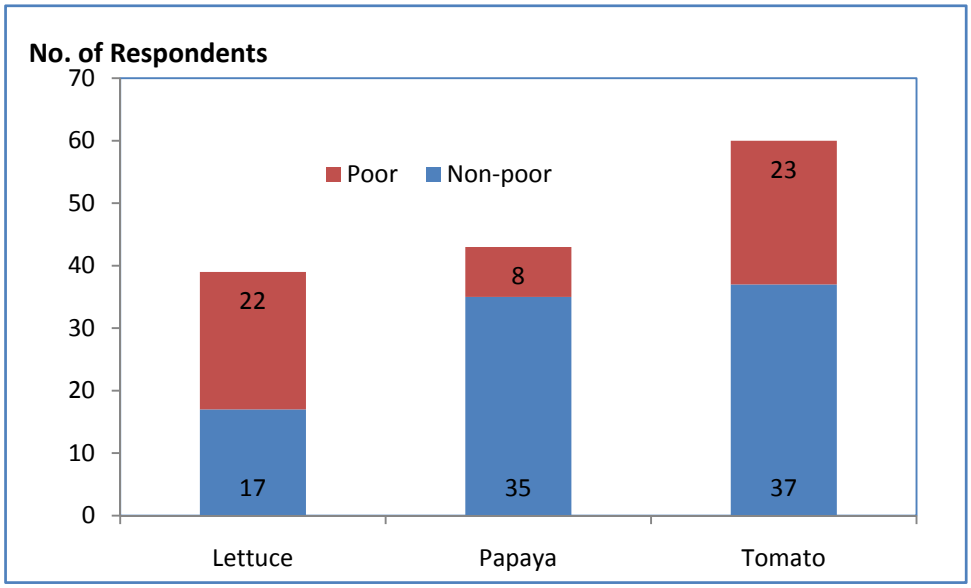
Most of the respondents who were interviewed were male and most have limited education. For lettuce and tomato, most of the growers have at most a high school education with very few having college or vocational education (only about 20 percent for lettuce and 10 percent for Tomato). For Papaya, close to 53 percent have at most college education (**Figure 10)**.

Figure 10. Distribution of growers by commodity, by educational attainment



Because the questionnaire for growers asked questions on assets, a wealth index can be calculated following the procedure discussed by Vyas and Kumaranayake (2006). Their procedure applied principal components analysis on a group of selected assets to identify which of the households are poor. Of the 142 growers who were surveyed, around 40 percent may be considered poor. The distribution of the growers by commodity planted by poor or non-poor is presented in **Figure 11**.

Figure 11. Distribution of Growers by Commodity, by Poor/Non-Poor



It is evident that among the three crops, the growers of papaya are more educated and thus, have a tendency to be non-poor relative to the other crop growers. Lettuce growers on the other hand seem to have the highest tendency to be poor with about 22 out of 39 being considered poor and about 36 percent have at most only elementary education.

The questionnaire for growers asks them about their marketing activities. **Figure 12** presents the number of growers who go to the market to sell their goods while **Table 9** presents some of the market-related characteristics of these growers. Papaya growers, on the average, have the shortest distance to travel to get to the market, about 7 kilometers away while the distance that lettuce and tomato growers have to travel to get to the market is on the average,

almost the same at about 15 kilometers. Because of the longer distance, it takes about 10 minutes longer for the Lettuce and Tomato growers to get to the market relative to the Papaya growers.

Table 9. Characteristics of growers who go to the market

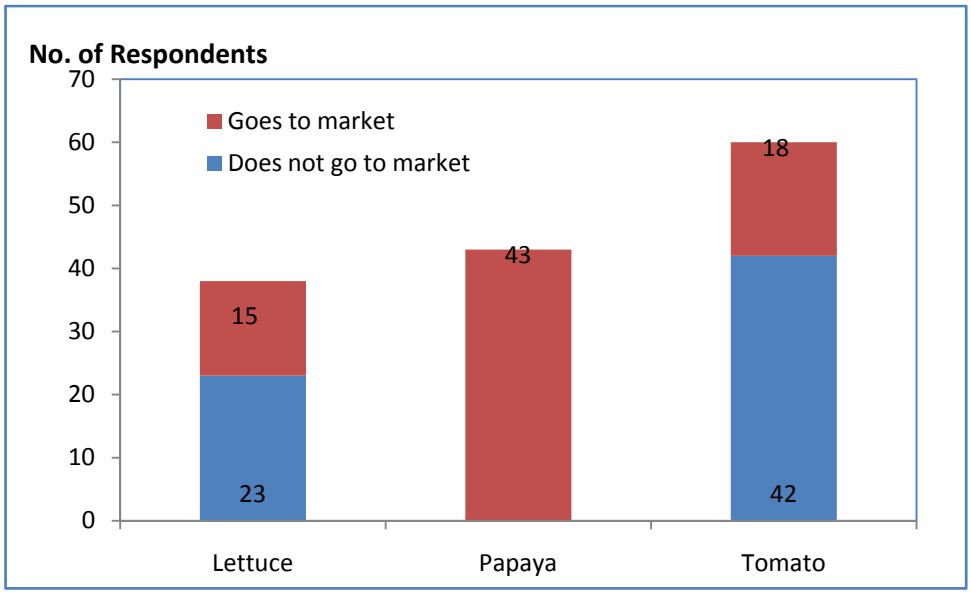
Row Labels	Total Number of growers	No. of growers go to the market	Average Distance to Market (kms)	Average time to Market (Minutes)	Average cost to go to the market round trip (Pesos)	Average frequency going to the market (days in a week)	Growers who said that the road to the market is passable (%)
Lettuce	38	15	12.20	35.00	53.33	2.33	100
Papaya	43	43	7.29	24.01	66.86	1.72	97
Tomato	60	18	14.78	34.94	148.89	1.25	77

It can be observed from **Table 9/Figure 12** that all of the papaya growers have access to the market. All 43 growers (regardless of being poor or non-poor) have access to the market while only about 37 percent of lettuce growers and 30 percent of tomato growers go to the market. Despite having, on average, the shortest distance to the market, papaya growers' cost to go to the market is slightly higher than that of the Lettuce growers even if the distance to the market is double that of the Papaya growers. One possible explanation for this would be the quality of roads. To the respondents, if the road is always passable, then it would imply an easier time to go to the market and this affects their estimate of the distance. If the road is not always passable the year round, then growers face constraints in accessing markets for their produce.

Table 9 also shows a negative relationship between perceived road quality and cost. For the case of lettuce, all the respondents mentioned that the road to the market is always passable and thus their average estimated cost of bringing the goods to the market is the lowest (about 53 PhP). The cost is slightly higher for papaya growers as there is a slightly lower than 100 percent of growers who said that the roads to the markets is always passable. Finally, when about a

quarter (23 percent) of the growers mentioned perceived that the road to the market is not always passable the cost is significantly higher, as can be seen in the case of Tomato.

Figure 12. Distribution of growers who go to the market



One might attempt to explain the non-poor Papaya growers' access to markets by their ownership of vehicles and other assets. However, the decision to go to the market is not solely based on having vehicles. Even non-poor households (lettuce and tomato growers) would choose not to go to the market even if they have the means to do so because of poor road quality.

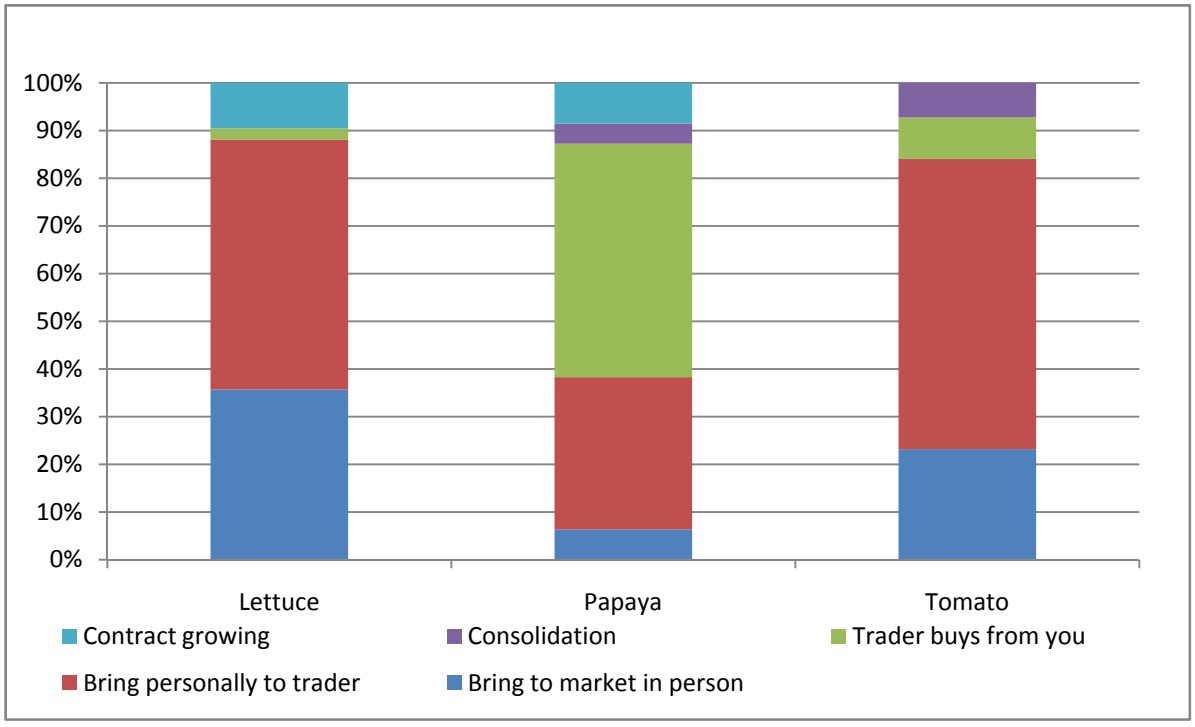
Table 10. Number of respondents by poverty status and market access

Commodity, Poverty Status	Does not go to market	Goes to market
Lettuce	**23**	**15**
Non-poor	11	6
Poor	12	9
Papaya		**43**
Non-poor		35
Poor		8
Tomato	**42**	**18**
Non-poor	25	12
Poor	17	6

Why are they not going to the market? One possible explanation has been provided in the earlier discussion. The road quality or perception of road quality affects the grower's perception of distance.

Another reason why the growers are not going to the market is presented in **Figure 13**. **Figure 13** shows the distribution of the growers according to the different means by which they sell their crops. Across all commodities, it is clear that most of them are trader-dependent: they will either personally bring the commodities to the trader or allow the trader to pick up the produce at the farm gate. Thus, the need to go to the market is lost. Even the Papaya growers who all mentioned that they have access to the market have resorted to relying on traders in order to dispose their crops. **Figure 13** also shows how small the scope of consolidation of farm produce is. Only about 3 percent of the papaya growers and 5 percent of the tomato growers mentioned that they consolidate their crops before they sell it. The growers have or maintain individual relationships with buyers or traders and do not seem to be inclined to consolidate their produce before selling.

Figure 13. Distribution of growers by method of disposing their crop



The above tables and figures for growers further support the results of the macro analysis in the previous chapter regarding the importance of markets and physical infrastructure for transport. While going to markets would provide the growers with better opportunities to earn from their produce, bad road infrastructure can discourage attempts to bring their produce to the markets by themselves. The practical alternative seems to be the convenience and the certainty of disposing their commodities through traders.

To test the importance of markets, a regression model is used. The dependent variable is the selling price of the respective crops of the growers as function of their volume of production and other dummy variables to control for the access to markets, dummy for type of crops and finally dummy for other options for selling crops.

Table 11. Results of the regression for growers to test the importance of markets

Dependent Variable: Selling price of their crops			
Explanatory Variables	**Coef.**	**Std. Err.**	**Significance**
Volume of production	0.00003	0.00002	*
Access to Market Dummy	6.1849	1.9724	***
Dummy for other options of selling crops	2.2593	1.7569	
Lettuce	1.4719	1.7077	
Papaya	-7.4567	2.0571	***
Constant	3.5216	1.2073	***
Number of obs	=	135	
F(5, 129)	=	5.62	
Prob > F	=	0.0001	

The regression results (**Table 11**) clearly show that on the average, the growers who have access to the market have a selling price that is 6 Pesos per kilogram higher. The results also show that assuming all other factors remain constant, the prices of the growers of lettuce and tomato are not statistically different from each other while the prices of papaya are 7 Pesos per kilogram lower than the tomato growers.

Trader dependency has opportunity costs that the growers may not be aware of. **Table 12** presents the characteristics of growers for each crop in terms of their production cost, average

volume and average price for each crop. In terms of actual cost, lettuce has the largest production cost. On the one hand, papaya has the largest average volume of production (48 thousand kilos) but with the lowest average price (4.03 pesos per kilo), the production translates to very low revenue for the growers (193 thousand pesos). On the other hand, lettuce has a production level that is only half of papaya but the average price at which the lettuce are sold are about 7 times that of papaya resulting into a 700 thousand peso revenue if all of the lettuce are sold.

Table 12. Production characteristics of growers

Crop	Number of Growers	QI4.2 How much is your estimated production cost? pesos per hectare	QI4.3 How much did you produce last year? (Kilos)	QI4.4 What is the average price at which you sell? (pesos/Kilo)
Lettuce	39	110,447.46	24,094.42	29.06
Papaya	43	63,019.37	48,058.34	4.03
Tomato	60	70,744.44	24,475.14	9.35

In **Table 12** the volume of production translates to higher revenue if the price is high. **Table 13** now shows that the average price of goods would vary depending on whether the growers have an alternative mode of selling their respective crops.

Table 13. Number of growers and average prices by access to alternative mode of selling crops

	Do you have other means of selling your crops?			
	No		Yes	
Row Labels	No. of growers	Average Prices	No. of growers	Average Prices
Lettuce	27	28.24	12	31.50
Papaya	25	3.46	18	4.83
Tomato	49	8.65	11	12.45

It is quite clear from the table that the 12 lettuce growers who have access to other means of disposing crops actually do have a 3.30 peso advantage over the 28.24 peso of those who do not. For Papaya, there is a 1.40 peso advantage for the 18 growers. The largest difference would

be for Tomato which has about 3.80 peso advantage. The table also shows that the access to alternative modes of disposing crop is not a common phenomenon. Only 41 of the 142 growers reported to have access to other modes of selling their crop. **Table 14** shows that the growers actually have a number of reasons why they choose a certain mode of selling their crops. The most popular reason for selling their crop is economic and convenience for lettuce and tomato growers. For Papaya growers, their method of selling their crops is mainly based on custom and economic reasons. What the table highlights is that there is a large room for improving the options for growers. Those who responded that "it has been the custom" and "no other choice" range from about 20 percent of the lettuce growers to more than 50 percent of papaya growers.

Contrary to the view that they are not aware of opportunity costs, growers may in fact be aware of the differential between trader's buying price at the farm gate and the price that their produce can command in the market outside the farm. However, they may need a quick turnaround of their investments in production and thus, settle for the lower prices offered by traders. The volume of produce may also be relatively small, which does not encourage a trip outside the farms. Clustering of farmers to consolidate individual produce into a larger volume to warrant sale outside the farms is an option but this entails strong coordination and cooperative behaviour. On the other hand, it may also be true that growers are unaware of market prices. Information problem abounds in rural areas which makes transactions inefficient.

Table 14. Percentage of growers by reason for choice of means of selling their crop

	We get to sell at the highest price	It has been the custom	Most convenient	No other choice
Lettuce	53.8	20.5	53.8	12.8
Papaya	48.8	51.2	27.9	14.0
Tomato	51.7	43.3	45.0	20.0
Grand Total	**51.4**	**39.4**	**42.3**	**16.2**

ii. Viajeros or traders

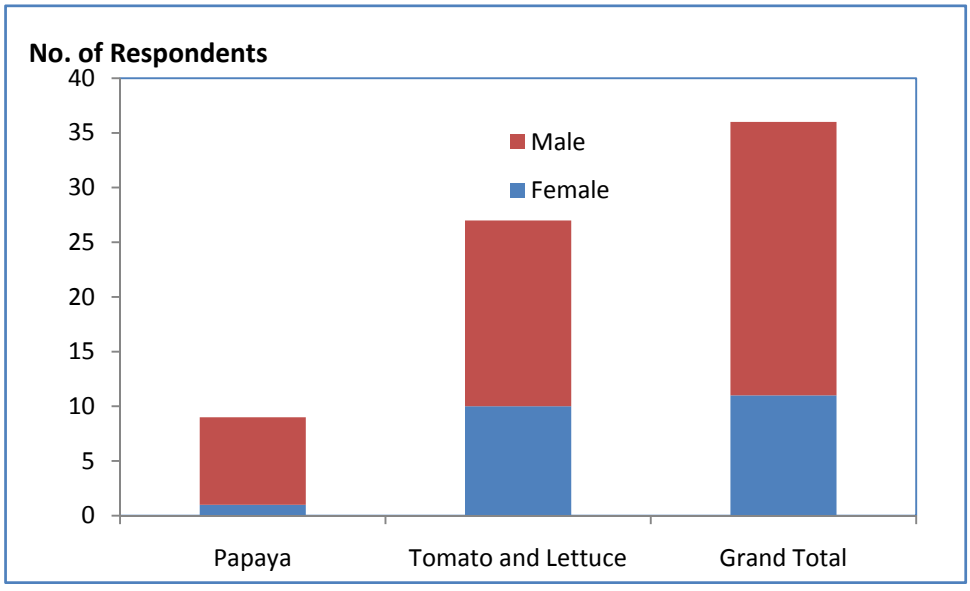
Most of the supply chains have a trader, or a viajero or middle man who links the growers to the market or to the end buyers. This sub-section analyzes the issues that affect the viajeros or traders.

Around 36 viajeros or traders in total were interviewed. **Table 15** presents the distribution of viajeros or traders by type of commodity. Because traders would behave as consolidators themselves, they do not trade a single commodity but a number of commodities. Hence, the groupings of commodity in **Figure 14** included the traders who trade Tomato and Lettuce.

Table 15. Number of traders who were interviewed

Commodity	Number of Respondents
Papaya	9
Tomato	2
Tomato and Lettuce	25
Grand Total	**36**

Figure 14. Distribution of traders by sex

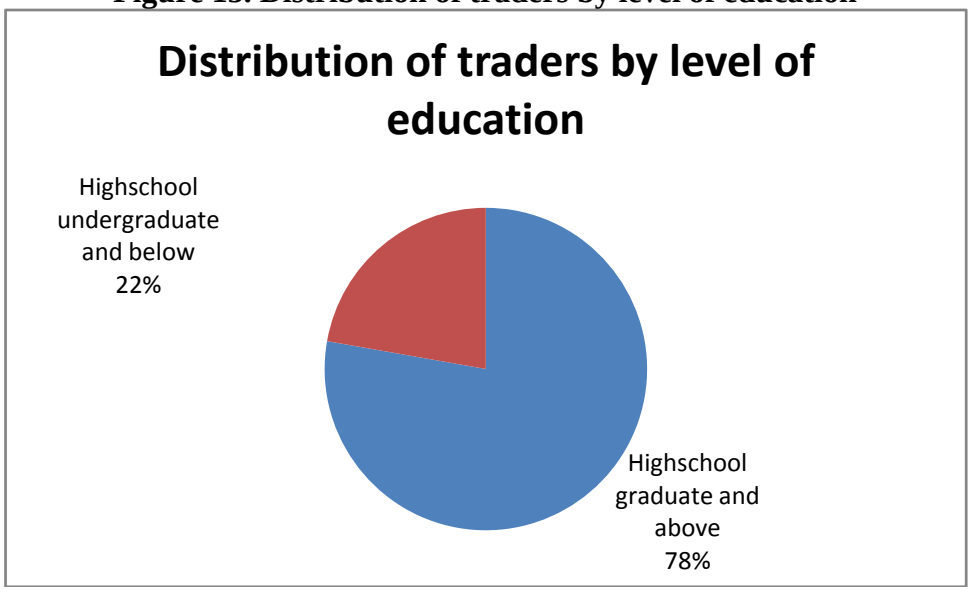


The distribution of the interviewed traders according to sex is presented in **Figure 14**. The figure showed that traders are mostly male. For papaya, it is clearly seen that most of the traders are male with only 1 of the interviewed traders being female and the rest male. For tomato and lettuce, about 37 percent of the interviewed traders or viajeros were female.

Because of the limited sample size, the cross tabulations would be limited to only two commodities: Papaya and others. Others would comprise the Tomato and Lettuce (combined) and Tomato (only) traders. This would be more meaningful and would prevent the presentation of tables where the data would mostly be zeroes because of lack of entries. In any case, despite these adjustments, the relevant issues would still be discernible from the presented tables and figures.

Majority of the traders have relatively high educational levels and this is quite understandable as usually traders are businessmen or business-minded growers who have increased the volume of their production and became traders of the commodities.. Only 22 percent of the surveyed traders did not finish high school. In fact, there were no traders who were unschooled or elementary undergraduates.

Figure 15. Distribution of traders by level of education



Other characteristics of the traders who were interviewed are presented in **Table 16**. Vegetable trading, it appears, is a business that is a family undertaking. Around 78 percent of all the traders who were respondents in the survey said that they ask for help from some of the

family members. Vegetable trading is also the major source of livelihood for most of the traders who were interviewed but there were some (about 3-4 traders) who relied on other activities apart from vegetable trading as their main activity.

Table 16. Other characteristics of traders

Commodity	Number of Respondents	Percentage of traders who said that trading is their main activity	Average no. of years in trading fruits and vegetables	Percentage of traders who ask for help from family members	No. of traders in the barangay
Papaya	9	77.78	11.67	66.67	8.67
Tomato and Lettuce	27	96.30	8.33	81.48	25.81
Grand Total	**36**	**91.67**	**9.17**	**77.78**	**21.53**

In terms of competition, the papaya traders seem to be quite few. The same can be said of the tomato and lettuce traders. In fact, the respondents in the survey almost covered the entire population of traders in the area. The local agriculture experts who were consulted regarding this survey estimated that there are 9 traders of papaya within the barangay and all 9 traders were included in the sample. Similarly, a different group of local experts were consulted in order to identify the traders of tomato and lettuce. These experts estimated that there are about 26-27 traders who did trading of tomato and/or lettuce.

It is quite clear from the responses of the traders that they source the commodities they trade not from the markets but from outside-the-market sources. Of the 36 traders interviewed, only 3 source their commodities from the market (**Table 17**). They directly purchase from the growers or from some other traders or consolidators who would sell to them. Even those who mentioned that they go to the market to purchase the commodities that they trade also admitted that they purchase commodities outside of the market. Because of this limitation of the responses of the traders, it is difficult to extract information that would allow the comparison of costs between those that buy commodities in the market and those that purchase commodities outside the market, that is, at the farms or production areas.

Table 17. Source of traders' commodities

Do you go to the market to buy the commodities that you trade?	No	Yes
Papaya	9	0
Tomato and Lettuce	24	3
Grand Total	**33**	**3**

Of those traders who purchase commodities outside of the market, almost all (except for one trader of tomato and lettuce) mentioned that they purchase the commodities directly from the growers (**Table 18)**. There are costs incurred when the trader has to go to each source to buy commodities. In terms of time, Papaya growers, on the average, have to travel more than 68 minutes to bring their produce to traders. On the other hand, tomato and lettuce growers spend more time in bringing their produce, spending on the average, travel time of about 80 minutes.

Table 18. Time and cost incurred by traders in sourcing their commodities

	Average time to Source of Traded Commodities (minutes)	Average Cost (Two-way)	No. of times in a week they go to their sources	Ratio that responded the presence of road
Papaya	68.33	1,488.33	2.22	100%
Tomato and Lettuce	80.38	256.80	3.08	77%
Grand Total	**77.29**	**582.79**	**2.86**	**83%**

Apart from time costs, the Papaya traders actually have to spend on the average around 1,500 Pesos for a round-trip visit while the Tomato and Lettuce traders only spend on the average 257 Pesos per round-trip visit to the sources of their commodities. The figures for these commodities are a bit interesting since it seems counter-intuitive that the costs of traveling for the Papaya traders is greater than for the lettuce and tomato traders. The following figures below may provide some possible explanation for the high cost of transport for Papaya traders.

Figures 16 and **17** present the mode of transport used by the traders. It can be clearly seen that, the majority of papaya traders use their own vehicles (car or truck) to transport their commodities while for the Tomato and Lettuce traders, motorcycles and tricycles would be the major mode of transport followed by private car and public utility jeepneys or buses, respectively.

Figure 16. Mode of Transport used By Tomato and Lettuce Traders

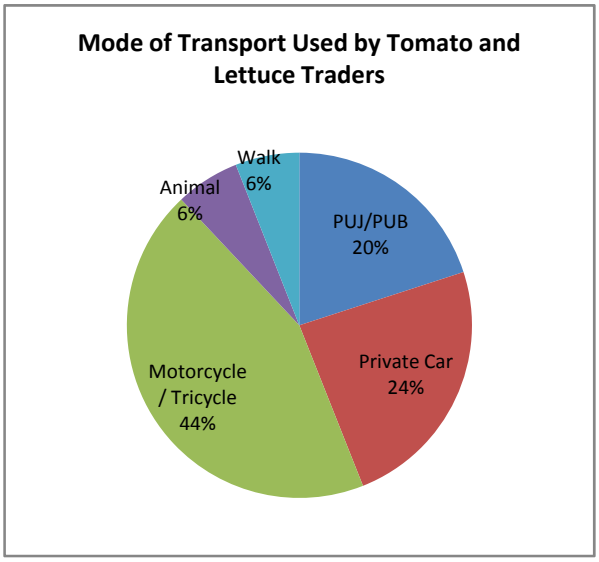
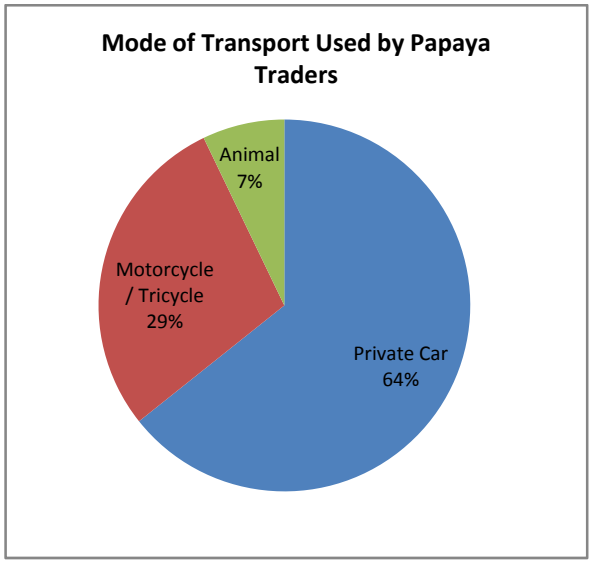


Figure 17. Mode of Transport Used by Papaya Traders



These figures indicate that the transport cost for the Papaya traders includes fuel cost. It seems that is more costly to use private transport than use public modes of transport. This is

understandable because the cost is averaged among the passengers of the public transports but for private vehicles, all costs are borne by the owner.

The formation of clusters or groups of traders who could share the cost of going to the sources of commodities is one way of reducing the cost. The reliance on public transport in going to the source of the commodities is also one way of reducing costs of transport but this will be inefficient given the need for timeliness, proper handling of goods to ensure quality, and the limited space available in public transport.

It is also very important to note that while Papaya growers say that there is a road that connects them to the source of the commodities which they trade, only 77 percent of the traders of Lettuce and Tomato say that there is a road that connects them to the source of their commodities. Probing deeper into the kind of roads that they usually traverse whenever they go to their commodity source, the papaya traders indicated that 70 percent of the road is earth road with only 20 percent of the roads being concrete. In contrast, for the tomato and lettuce traders, the majority of the road is gravel followed by earth (**Figures 18** and **19**). These figures further explain the high cost of transport that is being borne by the traders. Clearly, having to travel through earth roads twice a week (on the average) is quite costly.

Figure 18. Type of Roads connecting Papaya Traders to their commodity source

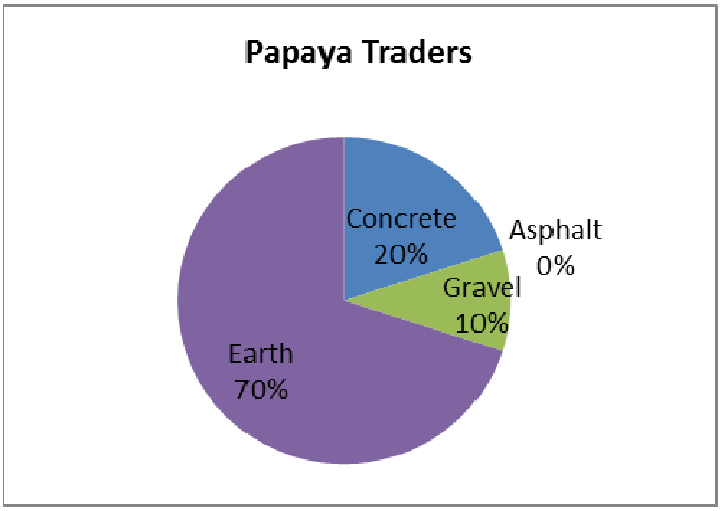
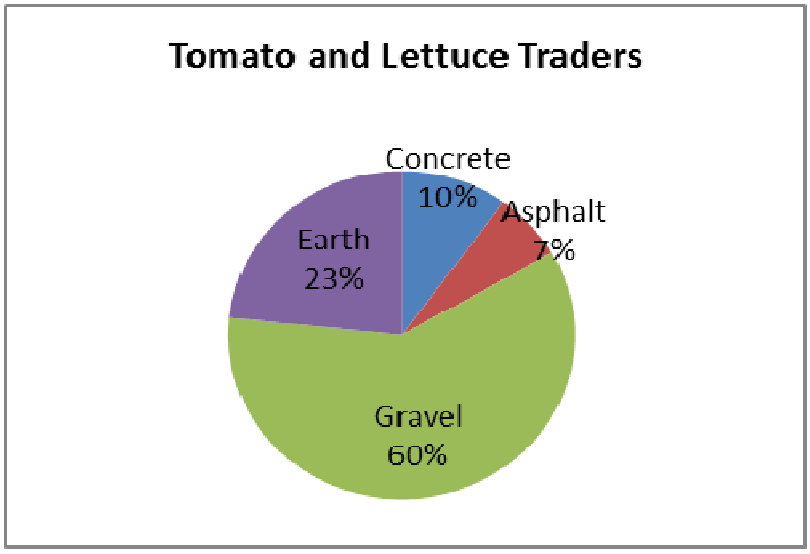
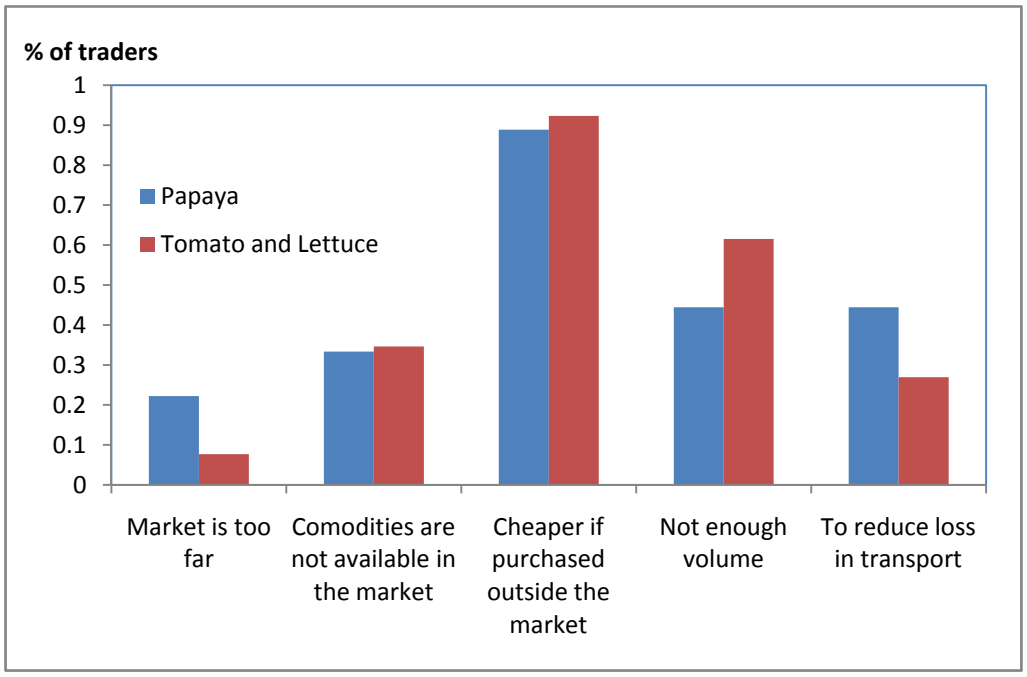


Figure 19. Type of Roads connecting Tomato and Lettuce Traders to their commodity source



Despite the costs in terms of transport and time, the major reasons for purchasing the commodities outside of the market are presented in **Figure 20**. **Figure 20** shows that the main reason for purchasing outside of the market is because the prices of the commodities are cheaper if purchased outside of the market. This is true for all traders. Almost all of the traders for both commodities mentioned this as their reason. While the two groups are the same for their top 1 reason for purchasing outside the market, the groups differ when it comes to the second and third reason for purchasing outside the market. For the papaya traders, the second and third major reason is quite close in terms of percentage. It is mainly related to the volume available in the market and in terms of reduction of losses of transport. For papaya traders, these two reasons are equally important while for lettuce and tomato traders, it is more important to consolidate enough commodities by going through different sources outside the market. For lettuce and tomato traders the unavailability of these commodities in the market is the third major reason why they do not purchase in the market. In summary, it is more advantageous for traders to make purchases at the farm gates because of (a) the volume of produce at the farms, (b) lower prices, and (c) limited availability of produce that they can buy in the markets for re-selling to wholesalers or retailers.

Figure 20. Major reasons for purchasing commodities outside market



Data from the survey show that in terms of operations, trading costs range from 8,200 pesos and 24,000 pesos respectively for Papaya and Lettuce and Tomato growers to conduct their trading operations. For the Papaya traders, the lowest cost mentioned by one of the traders is about 5,000 pesos while the maximum cost is about 12,000 pesos. The cost of Tomato and Lettuce trading is much higher with the range of cost going from about 11,400 pesos to as much as 45,000 pesos (**Table 19**).

Table 19. Estimated cost of operations for traders

Estimated cost for trading	Number of traders	Average Cost of Trading	Minimum Cost	Maximum Cost
Papaya	9	8238.33	5000	12000
Tomato and Lettuce	27	24014.81	11400	45000
Grand Total	36	20070.69	5000	45000

The figures for the total cost of operation of traders indicate that the trade of Lettuce and Tomato is more expensive than the trade of Papaya. It is also interesting to note that aside from the large difference in the cost of trading for the two groups, there is also a large discrepancy

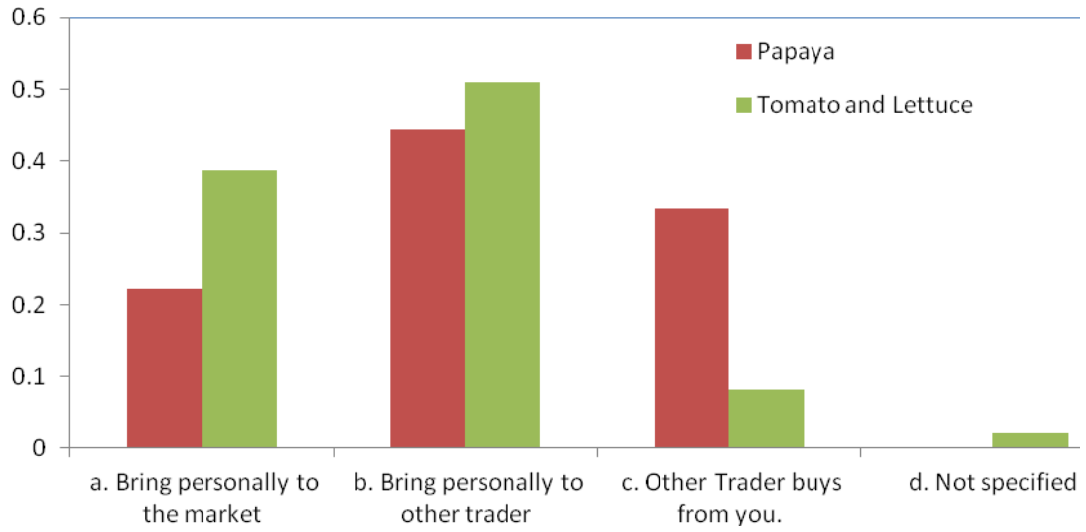
between the share of transport cost to total cost for the two groups. For the papaya growers, the average percentage of transport cost to total cost of trading is about 30 percent while for Lettuce and Tomato the average percentage of transport cost of total cost is only about 10 percent (**Table 20**). Once again these figures support the observation that was presented in the earlier tables: that the papaya traders bear the high transport cost because of the use of their private vehicles while tomato and lettuce have lower transport cost because of their reliance on the public transport. It is also noted that the roads in papaya growing areas are worse than those in tomato and lettuce growing areas, which contribute to higher transport costs in the former.

Table 20. Ratio of transportation cost to total cost of operations for traders

Ratio of transportation cost to total cost	No. of Traders	Average percentage of Transport Cost to Total Cost of Trading	Minimum Percentage	Maximum Percentage
Papaya	9	29.78	5	70
Tomato and Lettuce	27	10.04	4	30
Grand Total	36	14.97	4	70

Because traders act as middlemen connecting the growers to the markets or to other traders, it is also important to look at which node of the value chain is the recipient of the goods that the respondents trade. **Figure 21** presents the method by which the traders dispose their crops which also indicates which node of the supply chain is linked with them. Looking at **Figure 21**, it is clear that most of the traders dispose their crops to other traders and they also bring their crops to the market. This is the most common method of disposal of purchased produce from farms for both the papaya traders and the lettuce and tomato traders. For papaya traders, though, the second most popular method of disposing crops would be selling to traders who would go approach the growers for their produce. In contrast, for tomato and lettuce traders, the next most-popular method of disposing crops would be bringing the goods personally to the market to sell their produce.

Figure 21. Percentage of respondents by method of disposing their crops



Further analysis of **Figure 21** was conducted by breaking it down according to crops and cross-tabulating with the information on the reason why these were the selected methods for disposing the commodities. It can be clearly seen that economic reasons, that is, selling at the highest price is the most popular motivation. The other major reasons are convenience and the custom of bringing produce to other traders (**Figure 22** and **Figure 23**).

Figure 22. Number of Papaya traders according to the method of disposing crops and the reason for choosing this method

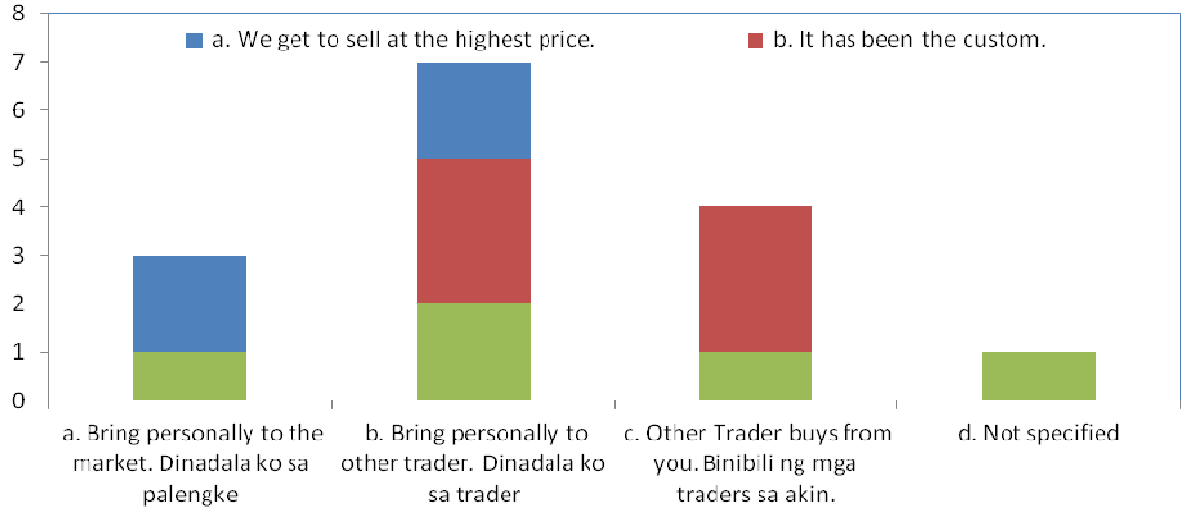


Figure 23. Number of Lettuce and Tomato Traders according to the method of disposing crops and the reason for choosing this method

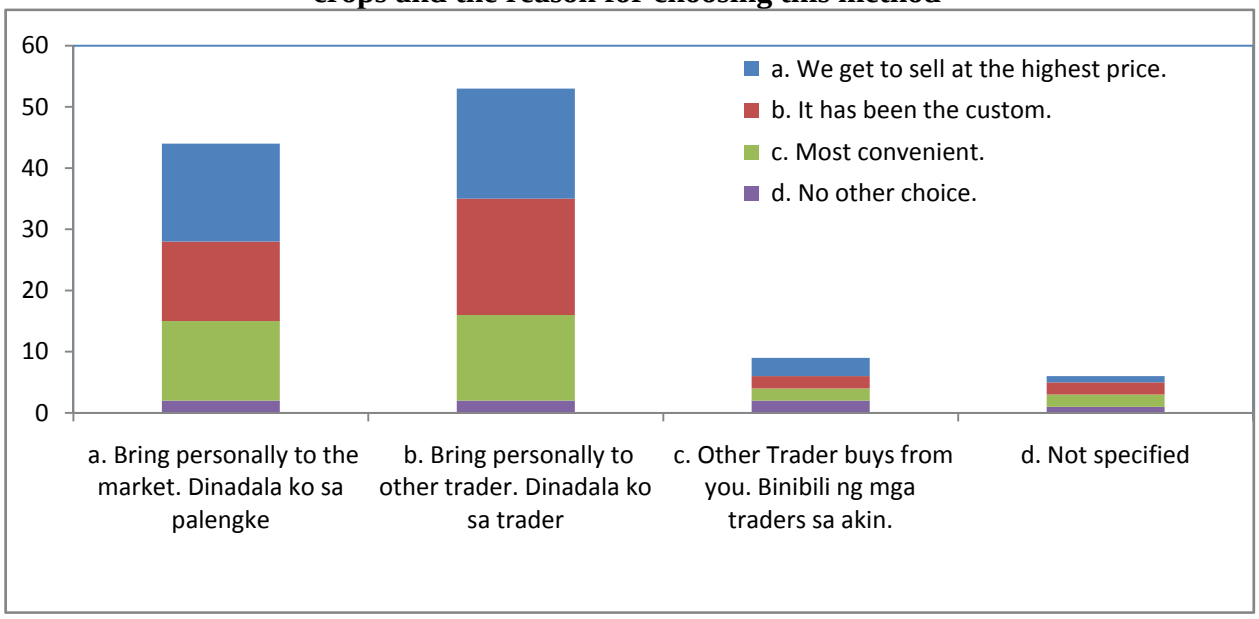
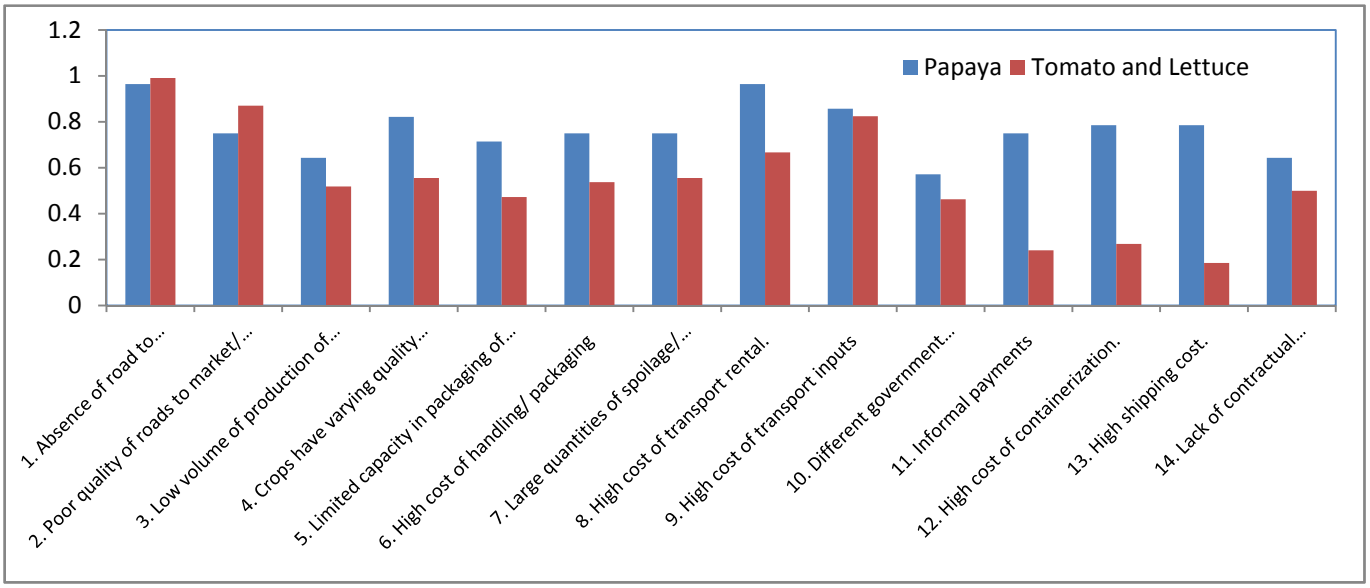


Figure 24. The factors important affecting operations of traders, by crop



Consistent with the results in **Figure 24**, is the reported average percentage of goods that is lost or damaged in transit. According to the figure, the issue of high percentage of wastage or spoilage due to transport is a more important issue for Papaya traders than for tomato and lettuce traders. This is consistent with the figures presented in **Table 21** which shows that for Papaya

traders, the average percentage of spoilage is about 16 percent while only 9 percent for Tomato and Lettuce growers.

Table 21. Losses due to spoilage/wastage in transport, by crop

Crops	No. of Traders	Average Percentage of Spoilage	Minimum	Maximum
Papaya	9	15.83	2	50
Tomato and Lettuce	27	8.54	2	15

Figure 24 also confirms the findings that have been echoed throughout this section: that for papaya traders the cost of transport is higher than for tomato and lettuce traders. It can be seen in the Figure that the cost of renting transport vehicles and equipment is actually a major issue for papaya traders but not so much for tomato and lettuce traders.

It is clear from the data that the issues for traders center on transport and the cost of transport. Policies aimed at improving the quality of transport and road infrastructure is therefore critical in reducing transport cost.

iii. Truckers

Truckers provide transport services to the growers to bring their commodities to either the market or to the trader in cases when the trader does not go to the growers in person. The truckers also act as consolidators by collecting as much produce as they can in order to maximize the space available in trucks that are used to transport farm produce. In the survey, trucker respondents are truckers for both tomato and lettuce.

About 24 truckers were interviewed for all the commodities: 11 truckers were interviewed for Papaya while 13 truckers were interviewed for tomato and lettuce (**Figure 25**). On the average, the 13 papaya truckers allocate about 80 percent of their transport volume to Papaya while tomato and lettuce allocate about 77 percent (**Table 22**).

Figure 25. Total number of truckers who were interviewed per commodity

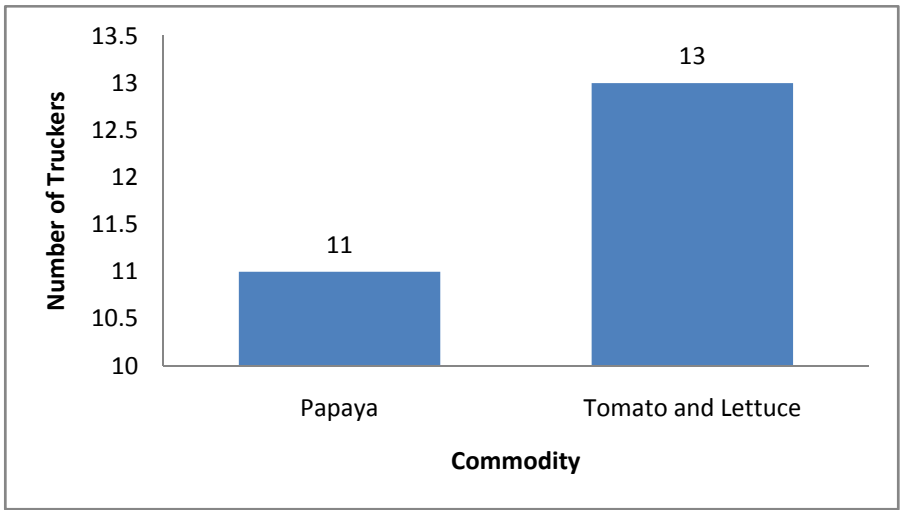


Table 22. Average percentage of transport volume allocated for fruits and vegetables, by commodity

Commodity	Transport Volume
Papaya	79.47
Tomato and Lettuce	77

On the average, the truckers transport 6 tons of the commodity (**Table 23**). Other characteristics of the truckers are presented in **Table 24**. It is clear from **Table 23** that there seems to be some shortage in the number of truckers in terms of the number of routes that these truckers traverse[7] There are some routes that are serviced by only one trucker. This implies a need for more truckers in those areas which will contribute to reducing transport costs. The interesting issue to raise is the dearth of trucking services in certain areas. This may have to do with the relatively small volume of farm produce for transporting to the markets, the bad road infrastructure, which contributes to high transport costs, and the high price of transport vehicles.

Table 23. Average total volume per trip (tons), by commodity

Commodity	Volume per trip (tons)
Papaya	5.95
Tomato and Lettuce	6.05

[7] A trucker may serve multiple routes.

Table 24 also shows the average distance per route and the cost of transporting the commodities over the said distance. **Table 24** indicates that the average cost of transporting these commodities, in general, increases with distance.

Table 24. Characteristics of truckers by route and by commodity

Route	No. Of Truckers	Volume of goods unloaded (ton)	Cost of transporting goods (Php)	Distance (km)
Papaya				
Palian-Polomolok	1	5	2500	27
Palian-Surallah	1	5	1800	40
Tupi-Polomolok	1	5	3000	27
Tupi-Gensan	7	5	4200	35
Tupi-Maitum	1	8	.	110
Tupi-Davao	3	6.33	18333.3	124
Tupi-Tagum	1	2	2000	250
Tupi-Tacurong	1	4	.	.
Tupi-Surallah	1	7	6000	40
Tupi-T'boli	1	7	6000	.
Tupi-Marbel	1	6	6000	20
Tomato and Lettuce				
Kibanansay– CDO	1	4.5	3500	160
Basac– Davao	4	7.5	8125	370
Basac– CDO	9	7.22	3944.44	160
Imbayao– CDO	1	3.5	2350	168
Imbayao– Malaybalay	1	2	660	12
Cawayan– Davao	2	8	8000	355
Basac– Valencia	1	5	3500	160
Kibangay– CDO	5	6	3700	160
Cawayan– Valencia	1	2	1200	50
Kibangay– Davao	1	6	7000	350
Kibenton– CDO	3	1.33	.	88
Hugpa– CDO	1	16.5	.	113
Intavas– CDO	4	2.45	2500	85.75
Cawayan– CDO	1	5	3500	160

Truckers have an important role in the supply chain. They provide both cargo handling and warehouse services to growers (**Table 25).** Only 7 out of the 11 truckers interviewed

provide handling services. The average cost of the handling service is about 660 pesos while for Tomato and Lettuce, 7 out of the 13 truckers provide handling services at the cost of 443.1 pesos on the average.

Table 25.Truckers providing handling services and warehousing services by commodity

	Handling Services		Warehousing services
Commodity	**No. of truckers**	**Average Cost (Php)**	**No. of truckers**
Papaya	7	660	3
Tomato and Lettuce	7	443.1	0

Among the 11 truckers for papaya, only 3 provide warehousing services and no trucker provides warehousing services for tomato and lettuce. These handling and warehousing services are important to farmers who need to ensure that their commodities will arrive at the destination at the best condition possible. Without these basic services provided by the truckers, farmers have to rely only on traders who are willing to purchase the agriculture produce at the farm gate at lower prices rather than buy these at higher prices in the markets for re-sale to other traders wholesalers or retailers above.

Truckers are required to be a part of a professional trade register, follow strict standards and have capable staff. However, **Table 26** shows that most of the respondent truckers do not follow standards for giving good services to their clients. Without properly-trained staff, mishandling of cargo during transport and later on storage will result in wastage of farm produce revenue losses of growers.

Table 26. Number of truckers who have certificates of conformity, are registered in professional trade register and have proof of staff capability, by commodity.

	No. Of truckers who have...		
Commodity	**certificates of conformity**	**registered in professional trade**	**proof of staff capability**
Papaya	6	3	2
Tomato and Lettuce	8	6	7
TOTAL	14	9	9

One of the reasons why there seems to be lack of quality service from the truckers is the absence of effective monitoring and regulation by the regulatory authority. For example, they are required to pay for permit to ply certain routes. However, among the respondents, one trucker admitted that he does not have the proper permit. Also, only 6 of the 11 truckers for papaya have a detailed business plan while 11 of 13 tomato and lettuce truckers have the said plan (**Table 27**). The business plan is important because it enables the local government, which is tasked to give the business permit, and the Land Transportation Franchising and Regulatory Board (LTFRB), which regulates the trucking business, to have an idea of the financial viability of the truckers and their capacity to maintain their trucks in good working condition. Dependable and safe trucking service is critical in transporting agricultural commodities from farms to markets.

Table 27. Details of government regulation of truckers by commodity

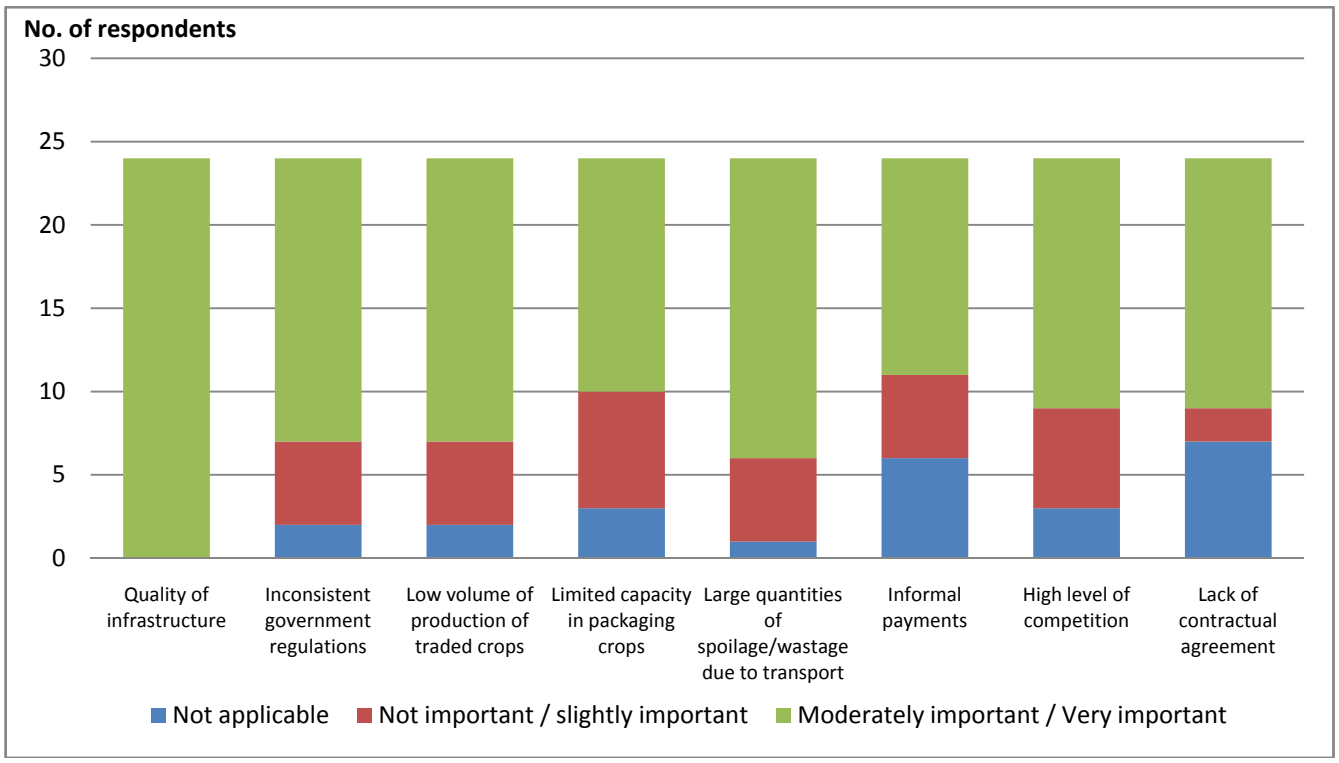
Commodity	No. of truckers who pay permit	No. of truckers who have detailed business plan	Minimum capital required for truckers (Php)
Papaya	11	6	834545.45
Tomato and Lettuce	12	11	600210.62

On the average, providing trucking services requires a large initial investment in vehicles and equipment. There is also the business and conveyance permits that truckers have to secure from the authorities. The minimum initial capital investment declared by the respondents amounts to more than 800 thousand pesos for Papaya truckers and 600 thousand pesos for Tomato and lettuce truckers. Obviously, this amount is very prohibitive for potential entrants in the trucking services who do not have the income capacity for such relatively huge investments. The prohibitive initial capital investment is one reason behind the limited availability trucking services and the absence of competition in this segment of the food supply chain. It is noted that the declared initial investments in trucks and equipment look understated considering the high price even of second-hand trucks in the country, not to mention the price of brand new vehicles. Both second-hand and brand new trucks are imported from developed countries.

Competition among truckers is beneficial because it will promote better services to growers. However, from the perspective of truckers limited competition in the sector is much

better for them because they will have a larger control over the market. Growers will have no option but to take their services no matter how inefficient or expensive these may be. **Figure 26** indicates the views of the respondent-truckers by degree of importance on the factors affecting their operations. What is notable is that all the respondent truckers viewed as highly important the quality of road infrastructure. Poorly constructed farm to market roads increase the incidence of truck breakdowns, lead to high maintenance costs, and increase road accidents. From the growers' perspective, bad roads increase the risks of spoilage and deterioration of the quality of the produce and increased road accidents.

Figure 26. Importance of different issues on operation



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A number of truckers also mentioned that the inconsistent government regulations have greatly affected their operations. The said truckers claimed that despite having the necessary permits, e.g. conveyance permit, some barangay[8] officials would not honor these permits while some other barangays allow them passage. The inconsistency has resulted in their trucks being

[8] A barangay is the smallest political unit. Several barangays comprise a municipality or city.

detained at the barangay for lack of proper permits. This practice of some barangays increases the cost of transportation and contributes to the spoilage and deterioration of the quality of farm produce.

Figure 27. Distribution of main factors affecting truckers operations

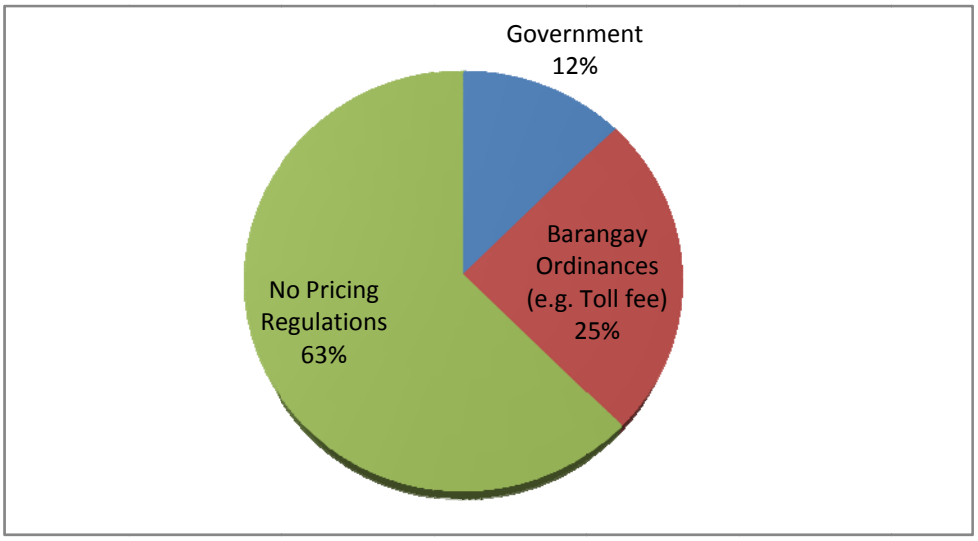

Table 28. Number of truckers who have experienced informal payments and the average cost of transporting goods, by commodity

Commodity	No. of truckers who experienced informal payments	Average cost of transporting goods
Papaya	9	7127.08
Tomato and Lettuce	6	4155.55

Finally, another thorny issue is the occurrence of bribery or "informal payments" at the local level. The culprits are local officials, e.g., barangay officials or local law enforcers who extort money from truckers and traders in exchange for passage through local roads.

iv. Wholesalers/Retailers[9]

The commodities are transported either to wholesalers or retailers in different areas in the country. To analyze the situation of the wholesalers and retailers of these commodities, the researchers conducted interviews in different areas of the country.

[9] The questionnaire was originally for wholesalers because as mentioned in the inception report, the retailers would be excluded from the analysis. However, during the course of the planning and actual field interviews, the study team observed that in a number of instances wholesalers also function as retailers. Thus, the questionnaire was tailored for wholesaler-retailers.

Based on the interviews, tomatoes and lettuce are seldom shipped to Metro Manila because of the stiff competition from produce grown in Benguet (in Luzon), which is near Metro Manila. It is only a typhoon hits Luzon growing areas that Mindanao tomatoes and lettuce find markets in Luzon, chiefly Metro Manila. Thus, Mindanao tomatoes and lettuce are marketed only as far as the Visayas, e.g, cities of Bacolod and Cebu.

There were 62 wholesaler-retailers interviewed in the Visayas who are about equally distributed between the two cities of Bacolod and Cebu. In Bacolod, most of the wholesaler-retailers interviewed were female and the same pattern can be observed in Cebu. In terms of age-distribution of the wholesalers-retailers, the sample was relatively skewed to the 30-60 years of age group (**Table 29**).

The observed skewed distribution to the older age bracket is not observed in Manila, where most of the respondents are younger. About 3/5 of the respondents belong to the 10-40 years of age bracket which is the lower half of the groups.

In terms of years in the business, most of the wholesalers and wholesaler-retailers in Bacolod and Cebu have been in the business for at least twenty years. About 22 of the 65 Manila respondents have been in business for less than 5 years (**Table 30**).

Table 29. Distribution of wholesaler-retailers by location, sex and age-group

	Wholesaler			Wholesaler-Retailer			Grand Total
	Female	Male	Total	Female	Male	Total	
Bacolod				**21**	**9**	**30**	**30**
10<20					1	1	1
20<30				7	1	8	8
30<40				4	2	6	6
40<50				3	3	6	6
50<60				6	2	8	8
NA				1		1	1
Cebu				**21**	**11**	**32**	**32**
<10yrs				1		1	1
10<20				1	1	2	2
20<30				1		1	1
30<40				8	5	13	13
40<50				6	4	10	10
50<60				3	1	4	4
NA				1		1	1
Manila	**10**	**8**	**18**	**31**	**16**	**47**	**65**
10<20					1	1	1
20<30	3	4	7	11	8	19	26
30<40	2	2	4	8	4	12	16
40<50	3	2	5	5	1	6	11
50<60	1		1	4	2	6	7
60<70	1		1	3		3	4
Grand Total	**10**	**8**	**18**	**73**	**36**	**109**	**127**

Table 30. Years of business operation

	Years in Business									Grand Total
	<5	5<10	10<15	15<20	20<25	25<30	30<35	35<40	>=40	
Bacolod	3	4	12	6	2	1		1	1	30
Cebu	3		7	7	7	2	4		2	32
Manila	22	14	10	4	6	1	5	2	1	65
Grand Total	**28**	**18**	**29**	**17**	**15**	**4**	**9**	**3**	**4**	**127**

Wholesalers and wholesale-retailers get their farm commodities from traders (**Table 31**). Some source the commodities from the market and only very, very few would actually go directly to the farmers. For Tomato wholesalers/retailer, 100 out of the 127 respondents source their commodities from traders. For Lettuce, it is almost the same story with about 122 respondents of the 127 total respondents for Lettuce sourcing their goods from traders.

Table 31. Source of Farm produce for wholesalers and wholesale-retailers

	Trader	Market	Directly from farmers	Own grown	Grand Total
TOMATO	**100**	**25**	**1**	**1**	**127**
Wholesaler	**15**	**3**			**18**
Manila	15	3			18
wholesaler-retailer	**85**	**22**	**1**	**1**	**109**
Bacolod	24	6			30
Cebu	19	11	1	1	32
Manila	42	5			47
LETTUCE	**122**	**4**	**1**		**127**
Wholesaler	**18**				**18**
Manila	18				18
wholesaler-retailer	**104**	**4**	**1**		**109**
Bacolod	30				30
Cebu	28	3	1		32
Manila	46	1			47
PAPAYA	**118**	**8**	**1**		**127**
Wholesaler	**17**	**1**			**18**
Manila	17	1			18
wholesaler-retailer	**101**	**7**	**1**		**109**
Bacolod	30				30
Cebu	25	6	1		32
Manila	46	1			47
OTHERS	**122**	**5**			**127**
Wholesaler	**18**				**18**
Manila	18				18
wholesaler-retailer	**104**	**5**			**109**
Bacolod	30				30
Cebu	32				32
Manila	42	5			47

For Papaya, the observation is consistent with about 118 of the 127 respondents coming from traders as well. This points to an essential segment of the supply chain, namely the linkage between traders, wholesalers and end-consumers. **Tables 32** and **33** below show the source of farm produce of wholesalers-retailers and how they dispose of those produce to reach the end-consumer.

Table 32. Disposal of farm produce purchased by wholesalers-retailers

	Wholesaler	Wholesaler-retailer				Grand Total
	Manila	Bacolod	Cebu	Manila	Total	
TOMATO						
Bring personally to the bagsakan			2		2	2
Deliver to supermarkets			4		4	4
Sell to retailers	12	6	15	16	37	49
Others	1	20	10	17	47	48
Consumers	1	20	10	17	47	48
PAPAYA						
Bring personally to the bagsakan	1		1		1	2
Bring personally to other mkt	1					1
Deliver to supermarkets			5		5	5
Sell to retailers	4		9	8	17	21
Others	2	4	8	5	17	19
Consumers (1 hotel)	2	4	8	5	17	19
LETTUCE						
Bring personally to other mkt				1	1	1
Deliver to supermarkets			5		5	5
Sell to retailers	1	2	3	9	14	15
Others	1		5	8	13	14
Consumers	1	0	5	8	13	14

It seems that the incentive of getting the highest price possible is not the most important reason for bringing farm produce to final retail outlets (**Table 33**). Wholesalers-retailers in the production areas seem to have established a strong business relationship with other wholesalers-retailers in urban markets, e.g., Bacolod, Cebu, Metro Manila. This determines the flow of farm produce from wholesalers who purchase from traders or growers and then dispose of the produce to other wholesalers-retailers serving the end-consumers.

Looking at the Tomato wholesalers/retailers, only about 9 of the total number of respondents selected the economic reason of selling at the highest price but many more responded that they bring the produce to those where they have customarily brought them or to where it is most convenient to dispose of those farm produce. The same pattern can be observed for the other commodities.

Maintaining a stable business relationship ("it is customary") seems to be a pattern among growers, traders, and wholesalers-retailers and this is seen as a mechanism for addressing uncertainty in supply especially during the lean months.

Table 33. Reasons for disposal of farm produce

	wholesaler		wholesaler-retailer		
	Manila	**Bacolod**	**Cebu**	**Manila**	**Total**
TOMATO					
We get to sell at the highest price		3	4	2	9
It has been the custom	7	20	18	7	45
Most convenient	11	6	6	19	31
No other choice			1	6	7
Others	0	0	0	4	4
accessible market				1	1
most common				2	2
Safety				1	1
PAPAYA					
We get to sell at the highest price			7	1	8
It has been the custom	3	4	9	1	14
Most convenient	3		9	9	18
No other choice				2	2
Others					
LETTUCE					
We get to sell at the highest price		1	3		4
It has been the custom	2		6	4	10
Most convenient	1	2	5	10	17
No other choice				5	5
Others					

v. Ports and shipping

This sub-section discusses the issues concerning the shipping of farm produce from Mindanao to urban markets in Luzon (Metro Manila) and the Visayas (cities of Bacolod and Cebu)[10].

The transport infrastructure for pineapples and bananas is more formalized and better managed than that for other agricultural produce. Pineapples and bananas are cash crops intended for the export market and big multinational and local companies are involved with the production, consolidation, packaging and transport of these commodities to various export destinations. Over time, those large companies have developed an efficient transport and logistics system for these commodities. Pineapples and bananas are loaded on refrigerated containers, which are shipped through the Mindanao International Container Terminal (MICT).

A number of foreign ships and three local shipping companies call on the MICT ports. MICT does business mostly with containerized cargo, which is a faster and more efficient way to transport goods. There are a few break bulk cargo that pass through MICT but this is not encouraged by MICT. The basic reason is that the turn-around time for containerized cargo, that is from MICT to a domestic port and back to MICT is around 12 hours, while break bulk cargo has a turn-around time of as long as 20 hours. MICT charge shippers fees for arrastre services and storage, and collects wharfage dues for the Philippine Ports Authority (PPA). The fee rates are based on PPA- approved fees and charges, which are imposed on PPA-owned ports.

In sum, the transport and shipping infrastructure for pineapples and bananas are more efficient, standardized, and predictable than those for other agricultural commodities. It is efficient because it is linked to international and local shipping schedules, which impose certain performance standards and discipline; otherwise, local shippers lose out to their competitors in a highly competitive markets for high value fruits in the international markets. It is predictable because of the observance of regular transport and shipping schedules, the assurance of space for those commodities in international and domestic container ships, and information on fees, charges, and other shipping costs.

[10] It is based on interviews with key informants from the Philippine Ports Authority (PPA), the Mindanao International Container Terminal and a shipping company based in Cagayan de Oro City.

We point out these characteristics of the transport and shipping situation for pineapples and bananas, both valuable export crops, to put in context the issues and concerns surrounding the inter-regional trade of other agricultural commodities whose main destinations are local urban markets. In this study, these are papaya, lettuce and tomato. Local growers, especially small growers producing papaya, lettuce and tomatoes do not enjoy the same efficient supply chain that pineapples and bananas have.

Access to shipping facilities does not seem to be a problem because several domestic shipping lines that serve major shipping routes from Mindanao to Metro Manila and the urban centers of the Visayas. PPA and a large shipping company operating in Cagayan de Oro noted that in general all perishables such as farm produce and fish products booked by shippers and traders are accommodated or loaded for shipment to Manila. There is a fixed schedule for departure. It is only a matter of timely booking of the transshipment to Manila and payment of corresponding fees.

Commercial crops such as bananas and pineapples are usually shipped as 'full container load' (FCL). Under a full container load shippers who have the proper consolidated volume of commodities or products can maximize all the space in the container usually a 20 or 40 footer container. Pineapple and banana exporters can easily ship FCL because of the well-coordinated transport and logistics systems for these commodities. They enjoy lower freight rates for FCL than for break bulk cargo, which is usually shipped as 'less-than-container load' (LCL)[11].

There is a need for a sufficient volume of goods to take advantage of the benefits of container shipping. A shipper who goes for LCL has to share space in the container with other shippers who may be transporting different kinds of goods. Small shippers usually go for LCL and share space and fees with other small shippers. Local shippers of papaya, lettuce and tomatoes in Mindanao find difficulty producing a consolidated volume that is sufficient for FCL shipping and most of them ship their farm produce under LCL. Thus, domestic shipping costs for papaya, lettuce and tomatoes tend to be much higher than shipping costs for commercial crops such as pineapples and bananas. Local shippers of papaya, lettuce and tomatoes can bring down their cost of shipping if they use FCL rather than LCL for transporting their farm produce.

[11] LCL is a shipping term for cargo that is insufficient either in quantity or in weight to qualify for the freight rates applied to a standard shipping container. http://www.businessdictionary.com/definition/less-than-container-load-LCL.html

The problem of producing a consolidated volume large enough for FCL leads local shippers in Mindanao to rely on LCL. The problem with LCL is that it is more tedious to undertake because there is a need for an area where the shipper assembles or aggregate commodities before loading them as LCL. The consolidation can be done in a container yard but there is the associated cost of paying fees for the use of the container yard. However, unloading in the container yards and then loading the produce in containers, which are then loaded to the container ships appear to be more costly and time consuming than transporting via RORO.

In contrast, for FCL shipments truckers/shippers load the containers in the plantation sites of bananas and pineapples and bring them to the port ready for loading to container ships. When the containers arrive at the port they are ready for loading unto the container ships. MICT operates two gantry cranes capable of loading 500 containers per day.

An alternative indicated in the interviews is the use of roll-on-roll-off (RORO) ships for small producers who want to ship their farm commodities directly to wholesalers or wholesalers-retailers in Metro Manila and the urban centers of the Visayas. In Cagayan de Oro, a private port operator allows RORO ships to transport lettuce and tomatoes to urban centers outside Mindanao. RORO ships seem more appropriate for farm produce destined for domestic markets. They are more affordable and convenient to local producers, traders, truckers or shippers. However, small farmers or growers who do not have transport equipment and are not properly organized are not able to take advantage of the RORO facilities in the area.

The growers or producers will need a sizeable vehicle to carry farm produce on-board the RORO ships. For example, a ten wheeler truck with a full load of farm produce can simply be driven on board the RORO ship and off the same ship upon reaching designated ports of destination. This may be more cost effective for the grower or producer than shipping under LCL because of the problem of aggregation and individualized costs per shipper. It is also more cost effective than shipping under FCL because of the problem of filling a 10 footer or 20 footer container when volume is difficult to produce. Shipping through RORO ships may be more cost effective for small producers.

Transporting tomatoes, lettuce and other perishables from Cagayan de Oro to ports of destination may be done through 6 wheeler trucks, that is, trucks capable of transporting 12 tons of cargo, or 10 wheeler trucks with capacity up to 25 ton of cargo, which are loaded on RORO

ships. The freight or tariff rates are determined by the shipping company but these are regulated by PPA. Shippers or traders either buy from the farm site or from the AGORA bagsakan market in CDO, and bring the produce to the container yard owned by the shipping line for consolidation. The staffing and stripping (shipping terms meaning 'loading' and 'unloading,' respectively) are done in the container yards. Most perishables from CDO are loaded on RORO ships.

It is noted though that container shipping is cheaper than shipping via RORO vessels as shown in **Table 34** below. However, because of their lack of capacity to produce and consolidate the volumes of produce that will justify shipping through container ships, small growers or farmers has only RORO shipping as a feasible option if they themselves want to ship their produce to urban markets outside Mindanao.

Table 34. Comparison of shipping costs: RORO versus container ship

Cost of shipping via RORO using 10 wheeler trucks:	Pesos 40, 245.80
Cost of shipping 20 footer container:	Pesos 32, 596.77
Cost of shipping via RORO using 6 wheeler trucks:	Pesos 21, 340.60
Cost of shipping via 10 footer container:	Pesos 16, 302.40
Source of information: a shipping line based in CDO	

To take advantage of benefits of RORO shipping farmers have to invest in their own trucks for transport of farm produce rather than rely on shippers or truckers to pick up their produce from the farm gates. Farmers can drive their trucks loaded with farm produce in and out of the RORO upon reaching the ports of destination. Through this approach, small farmers or growers will have direct access to urban markets, which can offer better prices for their produce. PPA observes that most fresh produce are shipped using RORO, which is a more convenient, faster, cheaper alternative to container ships but the RORO users are mostly traders and shippers contracted by traders.

V. POLICY IMPLICATIONS

Our estimation of the gravity model found the following as significant determinants of inter-regional trade of high value agricultural products: distance between trading regions, demand for the traded products (proxied by markets), ports and ports facilities and quality roads. Geographic distance significantly contributes to the high cost of shipping products from Mindanao, which can be reduced with a good road and port network, and affordable shipping costs. In the model, distance is a proxy for transport costs. Investments in quality roads and in improved port infrastructure, e.g., port, transport terminal and cargo handling facilities tend to be lumpy and costly investments. The significance of markets for growers has also been demonstrated by the results of an empirical test.

The traditional approach to the development of such infrastructure is through government provision. There is ground for exploring public-private partnership in the development of road and port networks, and in improving ancillary facilities. The privately-operated Mindanao Container International Terminal is an example of PPP that can help bring down the cost of investments and the cost of transport and shipping of goods. On the other hand, the demand for road, ports and shipping services is a derived demand. The gravity model results show that the economic size of the trading regions is a significant determinant of inter-regional trade. This means that regional growth matters in stimulating greater inter-regional trade, which present business and economic opportunities to users and operators of infrastructure facilities. In short, a principal reason for investing is the demand for such facilities by a growing population and robust business activities.

The inference is validated at the field level. Our analysis points to the kind of market faced by small producers and how this impacts on their viability and profitability. The production of high value crops such as papaya, lettuce and tomato is largely in the hands of a large number of small, unorganized farmers who act independently and are faced with a few big buyers/traders and truckers who move the produce to wholesale and retail markets. It will be possible for small farmers to generate bigger profit margins if they themselves are able to bring their produce directly to urban markets in Mindanao such as the cities of Cagayan de Oro and Davao, Metro Manila, and urban centers in the Visayas. This will require an improvement in production to generate larger volumes of produce, getting organized to have a stronger bargaining power with traders and wholesalers, and making investments in transport and

equipment needed for moving produce from the farm gates to the container yards for assembly and consolidation prior to shipping by containers.

Alternatively, if they are finally able to consolidate the required volume of produce in the farms they can ask for containers to be loaded and filled with produce right in the farms for quick loading to container ships waiting in the ports. However, with limited options and capacity, small growers are dependent on traders and wholesalers-retailers for disposing or selling their crops. With the advantage of information, organizational capacity, and ownership of transport assets, traders are better prepared to structure purchasing arrangements more favorable to them at the expense of small producers/growers.

Field data show that the markets for high value crops such as tomatoes, lettuce and papaya are produced, collected and marketed in a supply chain with value addition at each node of the chain. The players in the chain are composed of growers/producers, traders, truckers, and wholesalers-retailers. Inefficiencies in road transport, inefficient packaging and handling of produce, and lack of market information drive up transaction costs of participants in the food supply chain, especially small growers or producers. There are opportunities for traders and truckers to exercise market power on growers who are dependent on them for marketing and transporting of produce.

Interviews with growers show the relatively lower level of education and technical training of these respondents compared with those in the marketing and distribution nodes of the supply chain. There is a need for more investment in education and technical training for growers or producers, and for the government to improve the accessibility of market information, modern inputs and technology.

To have an efficient supply chain that will yield benefits to supply chain participants, it is important to have the proper road and port network, and portside facilities and link these to production areas. The objective is to have a seamless transport and shipping service, which produces or generates value addition at each node of the supply chain for the benefit of players in the chain and ultimately end-consumers. On the other hand, availability of and access to market information will make the food market more competitive.

Field data show how poorly constructed roads negatively impact on transport costs of participants in the food supply chain. Our analysis also shows the critical importance of proper cargo handling and warehousing services, in short, logistics services to avoid wastage and undue

deterioration of the quality of produce, which impact on the bottom lines of growers. Improvements in the ports and in portside facilities, e.g. container yard, transport terminal, gantry cranes, etc. are crucial to seamless transport and shipping service. Our data also indicate the need for growers to have access to market information, which may provide them with better alternative for disposing of their produce. One problem that growers face is their relatively small production volume, which makes them dependent on traders who perform the consolidation function for urban markets. Access to market information, good infrastructure, access to inputs, technology and credit will improve the participation of small growers in the food supply chain.

Linking or integrating production areas to the destination areas or urban markets through efficient transport infrastructure and logistics facilities will improve the competitiveness of those economic agents and contribute to the availability of lower priced food to consumers. In particular, RORO shipping seems to offer market advantages to growers who properly equipped will be able to directly bring their produce to consumer markets. Government has to improve RORO ports and shipping.

Investments in hard infrastructure, specifically quality roads and ports, and development of trade-enhancing logistics such as efficient container and terminal yards and other port side facilities will reduce the time and cost of doing business of participants or economic agents in the food supply chain.

Major transport and logistical bottlenecks worsened by the poor condition of farm-to-market roads hampered the export of agricultural commodities from Mindanao, have impeded growth (NEDA 2007)[12].

Finally, the impact of regulation and good governance on the supply chain has also been highlighted in the interviews of truckers. Informal payments ('bribes') and inconsistent application of rules (the case of permits honored in one barangay but not recognized in another barangay) are hard realities in the supply chain. Corrupt practices by local officials, which increase the costs of transport and shipping of produce from production areas to the urban markets, may get translated into higher prices for the end-consumer. There is a case for improving governance on the part of government but as well, there is a need to strictly monitor

[12] See for example, Kimura, Fukunari and Mitsuhiro Maeda (2005), "Transport Development in Japan and Korea: Drawing Lessons for the Philippines," November. http://www.bnm.gov.my/microsites/rcicc/papers/s5.kimura.pdf (date accessed November 10, 2011)

and impose regulations especially those pertaining to safety and soundness of transport and shipping. Good governance is indispensable to reduce the cost of doing business and to ensure efficient market exchange especially for small players in the food supply chain.

V. CONCLUSION AND RECOMMENDATIONS

The estimated gravity model provided insights into the key determinants of inter-regional trade. As predicted by the model economic size of the trading regions is a significant determinant. Economic growth in both sending and recipient regions is necessary for inter-regional trade to flourish. Economic growth and inter-regional trade in particular are anchored on access to markets by various economic agents such as growers, traders, truckers, wholesalers and shippers, and on the necessary hard and soft infrastructure that make inter-regional transactions and exchange possible. Because distance drive up transport and marketing costs the necessity of a good network of roads and ports that links production areas to consumer markets cannot be underestimated. The lack of an efficient transport and distribution system increases the cost of transporting agricultural produce, reduces the quality and quantity of those goods, and diminishes the profitability of actors involved in the supply chain. Inadequacy of infrastructure has been a major reason for the country's lack of competitiveness and attraction as a viable and profitable business destination.

There is a scope for government intervention two levels. At the macro level government has a critical role to play in increasing investments in roads and ports, portside facilities, and related investments, in improving monitoring and coordination of markets, and in ensuring effective regulation at the national and local level. At the level of participants in the food supply chain the government should work on making market information accessible to all, especially small producers, providing a package of assistance to small growers to address small production volumes, e.g., access to modern inputs, technology and credit,

In view of the foregoing, the study recommends the following:

- Government has to invest in road and port infrastructure that connects producing areas to markets that can absorb the farm produce. In particular, the government has

to improve the RORO services for greater connectivity of markets and mobility of people.

- Improving RORO services will require the adherence of shipping companies to the prescribed safety and soundness standards of the shipping industry.
- Government can also help small producers to get the best possible price for their produce by the provision of timely and accurate market information through various means of communication. Linking the barangays, especially those in the hinterlands to the world wide web is the last mile in telecommunications where government and private sector investments and cooperation will be necessary. Small producers face problems not only of access to transportation facilities but also of organization and market information.
- There is scope for government coordination of non-price factors such as organization of small producers, strengthening regulatory institutions, and improving regulations for more efficient markets.
- Government should also ensure that regulation affecting the supply chain, e.g. system of permits and licensing, safety and soundness standards for road and sea transport be properly implemented.

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Appendix 1: Background on Vegetable and Fruit Production in Mindanao

The Mindanao region is the second largest regional group in the Philippines. Its more than 97,000 sq kilometer area is broken down into 7 regions, namely, Zamboanga Peninsula (Region IX), Northern Mindanao (Region X), Southern Mindanao (Region XI), Western Mindanao (Region XII), CARAGA and the Autonomous Region of Muslim Mindanao (ARMM). Despite negative perception on the region because of insurgents and armed conflict in some of the areas, the region is still perceived as an important contributor to the nation's total output. In terms of agricultural production, the region has consistently been the source of some of the country's supply of fruits and vegetables. Table A1.1 and Table A1.2 present the top agricultural commodities produced by Mindanao.

Because of the relative importance of Mindanao in terms of fruit and vegetable production, a number of studies have been conducted which has tried to identify the different areas where interventions can be made in order to make certain crops more competitive (Digal et al. (forthcoming); World Bank 2010). As part of the Component 5 of this project, Digal et al. analyzed the value chain of a number of selected fruits and vegetables including cabbage, durian, eggplant, jackfruit, lettuce, mango, papaya, potato, and tomato.

The choice of papaya, tomato and lettuce in this research were made as follows: (i) the need to investigate factors that help expand the market of the commodities covered by the ACIAR Program HORT/2007/067; (ii) financial and time constraints dictate the need to limit the commodity coverage to three; (iii) final selection is based on the relative importance of the selected fruit and vegetables to the Philippines' and Mindanao's total production as shown in Tables A1.1 and A1.2, respectively. Cabbage and eggplant were eliminated because of their relatively low volume of production, leaving lettuce and tomato the selected vegetables for this transport policy study. For fruits, potato and jackfruit were eliminated because of their non-inclusion in the ACIAR Program HORT/2007/067. The choice was then left to the 3 remaining fruits, mango, papaya and durian. Durian is still largely an unpopular fruit to the Filipino palate, especially those outside of Mindanao. Papaya, on the other hand, outranks mango in terms of volume of production as shown in Table A1.2.

Table A1.1. Volume of production of some fruits and vegetables, 2009 (intons)

Crop	Luzon	Visayas	Mindanao
Asparagus	0.48	5.64	7,115.23
Banana	932,034.02	797,465.23	7,283,686.45
Cacao	320.49	262.54	4,550.74
Cassava	248,600.71	240,239.32	1,554,879.38
Coffee	18,230.81	6,380.12	71,822.00
Durian	93.49	361.69	55,271.45
Lanzones	1,013.88	1,263.79	13,063.27
Mangosteen	53.51	228.54	1,284.99
Pineapple	233,466.91	27,767.20	1,937,263.22
Rubber	34.59	-	390,926.93
Abaca	19,040.67	23,190.03	23,594.71
Coconut	3,666,265.27	2,689,835.11	9,311,464.47
Cotton	2.65	61.68	63.04
Ginger	13,508.18	5,246.33	8,660.79
Kangkong	20,463.02	25,041.78	37,540.20
Lettuce	1,513.17	193.18	1,870.42
Rambutan	5,031.75	228.21	4,175.48
Tomato	121,043.82	13,961.18	63,942.60

Table A1.2. Top 25 Commodities Produced in Mindanao

Crop	Volume produced in Mindanao	Ratio to Total Volume Produced
Rubber	390926.93	99.99%
Asparagus	7115.23	99.91%
Durian	55271.45	99.18%
Cacao	4550.74	88.64%
Pineapple	1937263.22	88.12%
Lanzones	13063.27	85.15%
Mangosteen	1284.99	82.00%
Banana	7283686.45	80.81%
Cassava	1554879.38	76.08%
Coffee	71822	74.48%
Papaya	124417.44	70.43%
Coconut	9311464.47	59.43%
Lettuce	1870.42	52.29%
Cotton	63.04	49.49%
Kangkong	37540.2	45.20%
Rambutan	4175.48	44.25%
Abaca	23594.71	35.84%
Tomato	63942.6	32.14%
Ginger	8660.79	31.59%
Orange	1440.17	30.89%
Mango	214536.39	27.81%
Brocolli	690.33	25.71%
Radish	2454.3	25.31%
Camote	129041.39	23.02%
Gabi	26517.15	23.01%