MARKET STRUCTURE AND DISTRIBUTION OF BENEFITS FROM AGRICULTURAL EXPORTS : THE CASE OF THE PHILIPPINE MANGO INDUSTRY

by

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TABLE OF Contents

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ABSTRACT

To illuminate the role of agro-export industry in inclusive growth, this case study on Philippine mango focuses on the role of market structure in the distribution of export benefits. It is based on review of industry trends and related studies, open-ended interviews of key informants, and structured interviews of respondents situated along the value chain.

The distribution of trade benefits is hypothesized to depend on both vertical and horizontal market structure. The former implies that a contracting relationship or vertical integration is a mechanism to elevate product quality to export grade. The latter implies that economies of scale are a factor in mango exporting, at the marketing and processing stages. It is noteworthy that there are no discernible economies of scale at the primary level, which accounts for the prevalence of smallholder growing at the production stage.

Quantitative analysis offers preliminary confirmation that vertical linkages are an important factor in raising mango quality to export grade. Moreover, enterprise size is an important factor in producing or procuring export grade mango. This in turn accounts for the prominence of horizontal market structure in the export sector.

However, the importance of scale economies in the industry should not be overstated. Investment requirements do rule out small-scale operations, but are perfectly within reach of medium-size firms. Considerably more entry is possible with adequate and stable supply of quality raw material at reasonable cost. In fact entry has been recorded in both fresh and processed exports, though exits are also frequent; the largest firms, especially among processors, tend to be the longest-lived.

To facilitate entry, encourage diversity, and widen distribution of benefits from exporting, concerned stakeholders must focus on relieving the key constraint, which is availability of stable and affordable supply of fresh mango of export grade for either fresh or processed sectors. This requires regulatory reforms, reliable database of mango growers, investments in R&D, and improvements in the extension system to offer technical assistance and technology transfer.

Keywords: Agricultural exports, distribution of trade benefits, market structure, vertical linkages

1. INTRODUCTION

1.1 Overview

The Philippines derives considerable export revenues from agriculture. As of 2011, agricultural exports reached US$5.9 billion, equivalent to 10.7% of total exports. Among food exports, the single biggest source of earnings is edible fruits, valued at US$940 million.

The tropical fruit industry in the country has had a long history of globalization, both in terms of trade and foreign direct investment. Globalization critics have long suspected that the benefits of the world trading system are confined to only a few large companies, i.e. transnationals and their local allies. On the other hand the benefits from the export market may turn out to be widely diffused over the supply chain, reaching numerous small and medium enterprises and growers. A study of the role of market structure in the distribution of export benefits would illuminate the contribution of the agro-export industry in inclusive growth.

This study examines the case of the Philippine mango industry, the third largest fruit export of the country after banana and pineapple. A diverse set of market players are active in the export trade. The mango industry is a case study of a dispersed industrial organization, in contrast to banana and pineapple, which tend to be dominated by large agribusiness interests.

1.2 Aims and scope

The case study approach will rely on quantitative and qualitative information, derived from desk review, focus group discussions, and key respondent interviews, using both structured questionnaires and informal question guide. The objectives are three-fold:

1. Characterize the mango export industry at the institution, industry, and firm levels;
2. Provide qualitative analyses of the main determinants of the level and distribution of trade benefits among firms;
3. Undertake quantitative analyses of the main determinants of the level and distribution of trade benefits among firms.

Subject to data availability, characterization and qualitative analysis would cover the following:

- Identify the size of the tropical fruits export industry (in comparison with other agricultural exports); sources of the export ability of the industry (regulations, comparative advantage, or abundance in factor endowment);
- Describe the industry and its firms and their link to the country's agricultural sector and economic activity;
- Identify exporting firms; their input and output markets; degree of integration; input sources; market destinations; market shares;
- Determine the level of industry concentration; level of competition among firms; market power; entry and exit rates;
- Identify the exporters' strategies to 'win' over the importers and the strategies when dealing with inputs and service providers; the size and distribution of the trade gain.
- Document past experiences, if any, when these exporters' strategies worked and effectively enhanced trade gains for exporting firms and influenced the distribution of trade benefits.
- Discuss all possible factors, including organization and conduct, that influence the level and distribution of trade benefits among the heterogeneous firm;

- Describe how trade benefits spill from the trading firms to their upstream or downstream domestic links;
- Provide implications of the findings for the distribution of potential trade gains on upstream and downstream links.

Accordingly, the following will be discussed in relation to the quantitative analysis:

- Determine what influences the level and distribution of trade benefits among firms and industries; particular focus will be on the role of organization and behavior of trading firms.
- Discuss the implications of the findings for enhancing the ability of trading firms and their upstream and downstream links to capture trade benefits and opportunities.

The remainder of the report is organized as follows: Section 2 characterizes the industry and based on review of industry trends and previous research. The case study method is described in Section 3, which discusses valid and tractable indicators of trade benefits that arise from the data. Key findings are presented Section 4. Section 5 summarizes and discusses implications for enhancing ability of firms to capture benefits from exporting.

2. PHILIPPINE MANGO INDUSTRY: REVIEW OF PAST TRENDS AND STUDIES

2.1 Trends

The Philippine mango industry has been consistently expanding, judging by trends in area harvested (Figure 1). From below 80,000 ha in 1990, area has been increasing, approaching 200,000 ha by 2009. Initially, yield was also increasing, from 6 t/ha in 1990 to 8 t/ha in 1997, before plummeting to current levels of only 4 t/ha. Aggregate production reached 1 million tonnes in the late 1990s (Figure 2), and again in 2007, before dropping to below 800,000 tonnes in 2011. Climate and pests remain major drivers of production; in 2008 for instance the drop in production was traced to typhoons, wind damage, anthracnose, bacterial wilt, fruit flies, and leaf hoppers, according to Bureau of Agricultural Statistics or BAS (2008).

The climatic conditions for mango production are summarized as follows (Bally, 2006, p. 7):

Mango grows over a wide range of frost-free climates. The trees produce best in climates that have a well defined, relatively cool dry season with high heat accumulation during the flowering and fruit development period. Rain or free moisture (high humidity, heavy dew, and fog) during the flowering and fruiting period is conducive to the development of fungal diseases that cause flower and fruit drop.

Climate and geography of the Philippines is described in Box 1. Luzon possesses the climate ideal for mango growing; according to Figure 2, Luzon is by far the largest producer, with more than half of its output coming from Ilocos Region. The bulk of Luzon's output is harvested during the hot dry season of March to May. Year-round production is obtained from Visayas and Mindanao. Mindanao has the unique advantage of being mostly free from the typhoons, which routinely strike about twenty times a year in the rest of the country.

Exports of mango by volume took off in the 1990s (Figure 3). Even at peak exports, the domestic market still absorbed 95 percent of domestic production. Note that mango exports followed overall trends in production in the 1990s; however in the 2000s, mango exports fell off quite steeply in terms of volume.

Figure 1: Area (in '000 ha) and yield (t/ha) of mango, 1990 – 2010
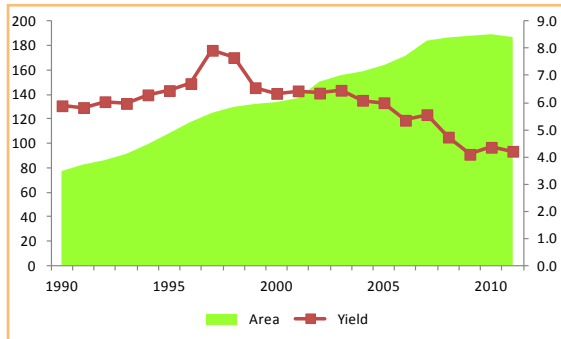
Source: CountrySTAT.

Figure 2: Mango production in the Philippines by island group, 1990 - 2011 ('000 t)
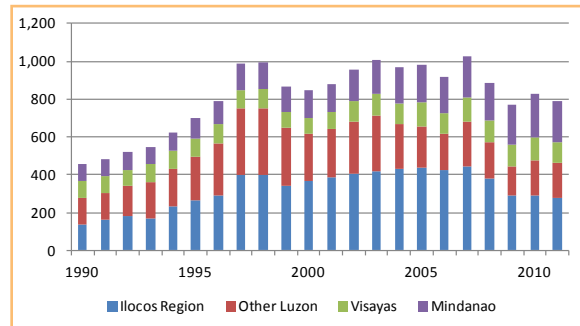
Source: CountrySTAT

Box 1
The Philippines

The Philippines is divided into three major island groups: Luzon, Visayas, and Mindanao, respectively: North, Central, and Southern Philippines. The north and central part is affected by monsoon rainfall beginning about May – June up to October – November, with a dry season from December to April. The northwestern part has a more pronounced dry and wet pattern compared to the rest of the country. The eastern part has no dry season but has a pronounced rainy season in December to February. Mindanao is characterized by uniform rainfall year-round. The rainy season is accompanied by typhoons (averaging twenty per year); which pass through a typhoon belt that basically bypass Mindanao.

Each island group is divided into administrative regions, the Ilocos Region highly suitable for mango growing. The list of regions of the Philippines is as follows:

Luzon
NCR: National Capital Region (Metro Manila)
CAR: Cordillera Administrative Region
Region I: Ilocos
Region II: Cagayan Valley
Region III: Central Luzon
Region IVA: CALABARZON
Region IVB: MIMAROPA
Region V: Bicol
Visayas
Region VI: Western Visayas
Region VII: Central Visayas
Region VIII: Eastern Visayas
Mindanao
Region X: Northern Mindanao
Region XI: Davao
Region XII: Central Mindanao (SOCCSKSARGEN)
Region XIII: Caraga
ARMM: Autonomous Region in Muslim Mindanao

Source http://kidlat.pagasa.dost.gov.ph/cab/climate.htm; Bally (2006)

Figure 3: Exports of mango in tonnes, 1962 – 2007 (includes guavas and mangosteens)

Note: Mangosteen and guava exports are negligible.
Source: FAOStat.

Figure 4: Value of exports by destination market, 2001 - 2011, in 1987 US dollars

Source: Trademap (www.trademap.org)

A different story emerges however from considering export value (Figure 4), which suggests a shift from exports of fresh mango towards the more rapidly growing p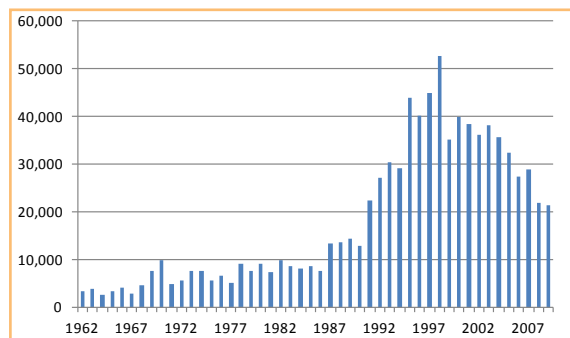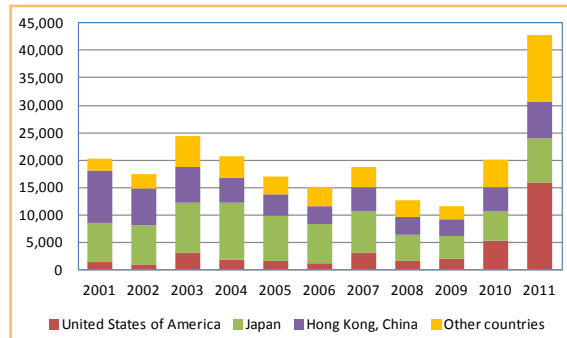rocessed sector (Digal and Concepcion, 2004). There is no clear declining trend in the 2000s, but rather one of fluctuation; the year of peak production (2007) does not coincide with the highest export earnings, which in fact peaked in 2011, approaching US$100 million. The country's mango industry has achieved such spectacular growth owing to a robust world market together with a shift in higher value products.

By destination, the biggest markets have traditionally been Japan followed by Hong Kong. In the last few years though, export markets have diversified quite dramatically, with the US now being the biggest market destination, though Japan and Hong Kong continue to command significant export shares.

2.2   Farming practices

Mango production is input-intensive (Table 1). Farm inputs take up nearly a third of production cost; imputed costs of labor and capital account for another third. Profit per kg is P10.00.

Production is typically small-scale; in the last agricultural Census (2002), average farm size nationwide was only 1.64 ha (Figure 5). There are however large variations across regions: the largest farm sizes are found in Mindanao (in the 2 to 4 ha range, except for Autonomous Region in Muslim Mindanao or ARMM). Farm sizes in Ilocos Region (1.2 ha) are even lower than the national average.

A mango industry survey reported in BAS (2002) covers 200 farms, found in all the island groups (Table 2). Nearly three-quarters have farms of under 1 ha, while only 6 percent farm above 5 ha. The vast majority (over four-fifths) own their own mango farms, whereas tenants account for only 12 percent.

Farmers enter into three main types of contracts (De la Cruz, 2007):

Leasehold – the owner agrees to lease trees to a producer, who undertakes all commercial activities from spraying to harvesting and marketing. The renter/producer shoulders all input and marketing costs. Payment per tree is estimated based on age and size of tree. Payment may be done in installment, i.e. 50 percent before fruiting, and 50 percent after harvest. For larger farms (over twenty trees) the terms of lease may be governed by a written agreement.

Table 1: Production cost of mango, 2010

	Cost per kg, in pesos	Share in total (percent)
Total cost	14.7	100.0
Cash cost	8.8	59.8
Farm inputs	4.8	32.9
Workers	2.5	16.7
Fuel, utilities	0.4	2.8
Other fees	1.1	7.4
Non-cash costs	1.0	6.7
Imputed costs	4.9	33.5
Family labor	1.1	7.5
Others	3.8	26.1

Note: yield = 4,359 kg per ha; farmgate price is P24.76 per kg. In 2010 the exchange rate averaged 45.11 pesos

Source: CountrySTAT.

Figure 5: Average farm size of mango farms by region, 2002, in ha
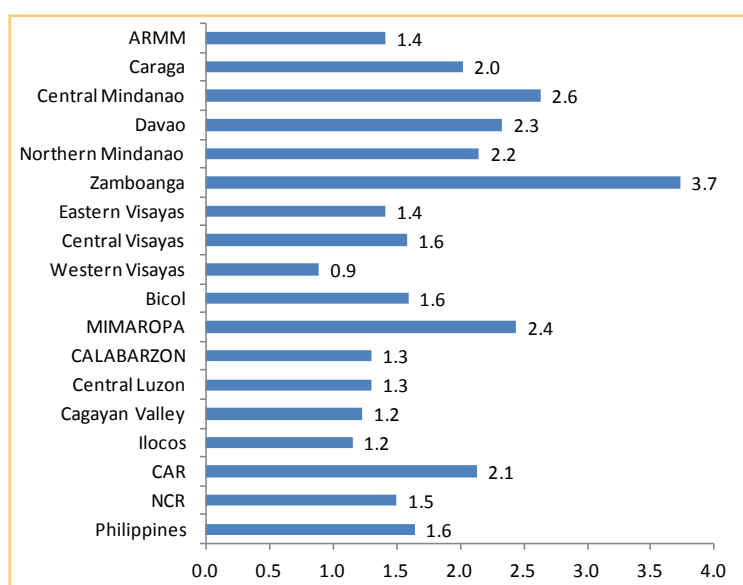
Source: Census of Agriculture and Fisheries (NSO).

Table 2: Distribution of mango farmers by size of farm and type of tenure, 2001 (percent)

Size of farm	Below 1 ha	1 to 4.99 ha	Above 5 ha
	74	20	6
Type of tenure	Owner	Tenant/Lessee	Other tenure
	81	12	7

Source: BAS (2002)

Output-sharing – the farmer agrees to share output with a contractor; the latter shoulders production inputs starting from spraying up to harvest. The sharing is typically 50:50; 60:40 in favour of the contractor may also be agreed if the location or production environment of the farm is unfavourable (i.e. entails higher cost per kg for the contractor).

Contract buying – the contractor simply purchases fruit from the farmer at pre-determined rates; however the buyer is not involved in production. The agreement may be reached at the fruiting stage, or around harvest season.

The contracts differ in risk exposure and asset protection. Leasehold offers the least risk to farmers, but also the least protection of their assets – the lessor may "abuse" the trees by over-spraying, while the lessee has difficulty monitoring such behavior. Contract buying offers maximum protection for the trees and land, but also shifts risk entirely on the farmer. Output sharing appears to be the middle ground to balance risk and asset protection, and has emerged as a "very popular" form of production contract.

2.3 Value chain

Summarizing previous studies, Digal (2005) describes the various marketing channels for the mango value chain (Figure 6). The farmer may sell directly to an exporter or even the consumer (especially for small local markets); however the most common route is through a contract buyer. From the buyer the product passes through either a wholesaler-retailer, or wholesalers, who then send the product to a retailer or to an exporter.

One complication is the introduction of processing (dried mango, mango juice, mango pulp), which caters to the export or domestic market. Furthermore between the farmer and retailer there may be multiple layers of traders as described in BAS (2002). The categories are:

- Assembler: focuses on procurement from farmers or other traders; typically sells to one (primary) buyer. Can be distinguished by geographic level of sources: barangay, municipal, provincial, regional, interregional.
- Distributor: focuses on selling to multiple buyers. Can be distinguished by size, i.e. small, medium, and large distributor.
- Assembler-distributor: equal attention to procurement and sales. Can distinguish both by level of procurement operation, and size.

Digal (2005) provides a simple breakdown of the price margins for mango, with a comparison with the export price (Table 3). Note that the export price has only a slight edge over the retail price. The price differential accounts for 27 percent of the retail price and as much as 44 percent of the wholesale price.

The differentials may be explained at least in part by marketing costs, described in detail in BAS (2002) based on a marketing cost survey. Marketing costs incurred by traders within a province (transportation, labor, materials, etc.) are shown in Table 4. The shares appear to be sizable relative to the farmgate price. Davao City has the highest cost owing to the airplane fare for transport to Metro Manila markets. Pangasinan cost is high owing to high cost of depreciation and labor; for Guimaras the largest cost components are miscellaneous expenses, materials, and labor.

A more recent survey on marketing costs is reported in Sarmiento et al (2012). Their study highlights the role of the export trader, as their pricing is higher compared with that of the local trader, inducing growers to improve the quality of their produce to export grade. The survey is limited to Davao City,

Figure 6: Marketing channels for the mango value chain
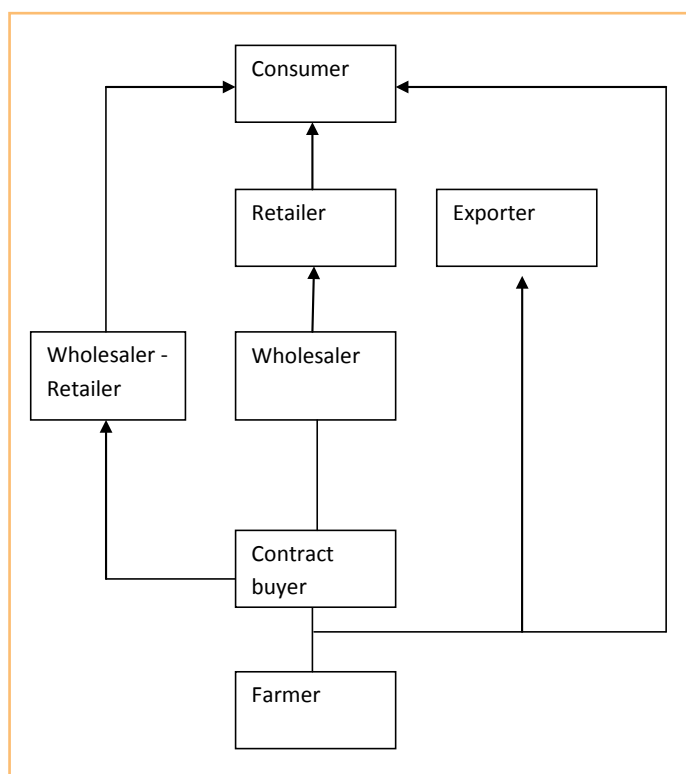
Source: adapted from Digal (2005)

Digos City (in Davao del Sur province), and Island Garden City of Samal (IGACOS, an island accessible by short boat trip from Davao City). The net margins by stage of the marketing chain are summarized in Table 5. In Davao City, retailers earned the highest margins; the city hosts large markets such as Bankerohan. In Digos City meanwhile, wholesalers earn the highest net margin owing to proximity to mango growers in Davao del Sur, reducing their transport costs. In IGACOS, it is the farmers which earn a higher net margin compared to retailers (no wholesalers operate in the area). The markets stalls in the area are still small; most of the mangoes are shipped directly to Davao City and other neighboring provinces.

2.4   Export business

Aveno and Orden (2004) describe the business of four exporters operating in Luzon. Peak export months are from March to May; canvassing for supplies begins in December. Procurement is done through roving agents, though growers/cooperatives are also entertained.

A farmer may opt for classified pricing, in which mango pieces are sorted for export and local grade; the alternative is straight pricing, in which no sorting is done and payment is made according to total quantity. Export grade mangos should meet quality requirements, i.e. maturity, absence of scabs, molds, burns, marks, and scratches; fruits are further distinguished by size, i.e. small, medium, large, and extra large.

Fatajo et al (2006) discuss the Hong Kong export market. One motivation to export to Hong Kong is the absence of tariff or taxes in that city state; its regulatory imposition is modest, requiring only certification of fitness for human consumption from the Department of Health. Prices are predetermined by the exporter and consignee (the importing agent) before shipment. The landed cost of the fruit in

Table 3: Price margins for mango by market level, in percent, 2002

	Price US$	Margin (over previous level)
Export (f.o.b.)	0.84	not available
Retail	0.81	27
Wholesale	0.59	44
Farm,	0.33	not applicable

Source: Digal (2005)

Table 4: Marketing costs and farmgate price of mango in selected provinces, in P/kg (2001)

	Cash cost	Non-cash cost	TOTAL	Farmgate price
Pangasinan, Ilocos	5.25	3.25	9.02	21.25
Guimaras, Eastern Visayas	5.77	3.25	9.02	24.51
Iloilo, Eastern Visayas	4.76	0.40	5.17	20.33
Cebu, Central Visayas	3.37	0.10	3.47	22.74
Davao City, Davao	10.02	0.01	10.03	14.41
Davao del Sur, Davao	4.16	0.04	4.2	21.35
General Santos, SOCCSKSARGEN	3.29	0.08	3.37	13.59

Note: the exchange rate in 2001 was P51/$1.
Source: BAS (2002)

Hong Kong was equivalent to P66 per kg in March 2002; at peak shipment (April and May) the price can drop to as low as P35 per kg, but can rise to 133 per kg from February to September.

A comprehensive value chain analysis is available for the processed mango industry as of mid-2000s (Pearl2 Project, 2004). The industry is composed of a variety of products including dried mango, puree, juice, nectar, slices, and halves. Processed mango exports are dominated by dried mangoes, accounting for 46 percent by value; this is followed by puree, accounting for 40 percent. Processors are actively introducing new products such as fruit blending (i.e. mango and tamarind), mango leather (dried puree), etc.

Most firms are small- and medium-sized. There are about 85 mango processing firms, majority of whom (66 percent) produce puree, and are clustered in Metro Manila. Thirteen firms, mostly processors of dried mango, are in Cebu. Numerous small processors specializing in other mango products such as sauces and preserves operate in and around Metro Manila and Metro Cebu. Fresh mango for processing is typically procured from the "open market". Only 23 percent of processors obtain mango from their own farm or by contract arrangements.

Philippine mango is well known worldwide for superior taste, which carries over into the processed product. This corresponds to a price premium over its major competitors, namely Thailand, followed by India, China, Malaysia, Vietnam, and Indonesia. However competitiveness can be improved by reducing the cost of raw materials, especially mangoes and sugar. The report identifies the major issue of the industry being the "lack of good-quality mangoes at reasonable prices".

Table 5: Net margins by stage of marketing chain, selected locations

		Price (P/kg)	Net Margins (P/kg)
Davao City	Farmer	21.66	2.83
	Wholesaler	40.00	14.96
	Retailer	50.00	19.72
Digos City	Farmer	22.83	6.35
	Wholesaler	35.00	17.35
	Retailer	52.50	16.15
IGACOS	Farmer	20.60	8.93
	Wholesaler	n/a	n/a
	Retailer	45.00	4.41

Source: Sarmiento et al (2012).

3. METHOD

3.1 Data collection

The case study collected qualitative and quantitative information based on informal interview of key respondents, and structured interviews of enterprise heads, classified as *growers*, *traders*, and *processors*. Growers are defined as mango producers (whether or not they own mango farm land) who do not engage in trading. Traders engage in trading, either for local and export markets (or both), whether or not they engage in growing, but are not engaged in processing. Processors produce dried mango for export (but may engage in other activities and markets). Distribution across geographic areas is shown in Table 6.

Mango processors are mostly concentrated in Cebu; in Ilocos Region, the province with the highest production and densest concentration of mango farmers is in Pangasinan. In all 46 respondents were interviewed using the structured questionnaire. Informal interviews as well were conducted with the same respondents as appropriate; in addition, several members of the National Mango Action Team, a joint public-private sector consultative body convened by the Department of Agriculture (DA), also served as key informants.

3.2 Quantitative analysis

Quantitative analysis adopts a two-step approach. The first step is to quantify the benefit from exporting; second is to examine the distribution of benefits from exporting.

For the first step, data collected from the enterprise survey could in principle provide an indicator of trade benefit if there can be a clear distinction between mango sold for export, and mango sold for the domestic market. This is possible however only at the level of the direct exporter, or its direct suppliers, i.e. the last and penultimate links in the chain.

Further up the chain, from the grower to the earlier layers of marketing agents or traders, it is usually impossible to make the distinction between mango for export and mango for the domestic market. This implies two things that hold throughout the chain at the enterprise level (except the last and penultimate stages):

- Participants would usually be unable to identify the share of exports in total production;
- Participants would be unable to segment prices between exported mango, and mango for the domestic market.

To address this, for the first step the study focuses on the market-level effects of export prices using supply-demand modeling rather than analysis of enterprise-level data. The analytical tool is

Table 6: Distribution of Respondents

	Cebu	Davao Region	Pangasinan (Ilocos Region)	Manila	Total
Growers	1	6	7	0	14
Traders	4	9	13	1	27
Processors	5	0	0	0	5
TOTAL	10	15	20	1	46

Source: Authors' data

the Agricultural Multi-market model for Policy Evaluation (AMPLE), an eighteen-sector model of Philippine agriculture which includes Mango as a distinct sector, described in Briones (2010). The scenario involves dropping the world price of mango to levels at or near the domestic wholesale price, to simulate a situation of zero mango exports; the resulting prices, quantities, and so on, represent a counter-factual to the baseline or reference scenario.

For the second step, distribution of benefit from export trade is analyzed at the firm level using micro-data from the enterprise survey. Analysis focuses on the relationship between an *indicator of benefit from exporting* and *indicator of enterprise size* – conditional on a positive relationship, the greater the impact of enterprise size on benefit from exporting, the less equitable the distribution of trade benefit.

The ideal firm-level indicator is the impact of export trading on enterprise income or profitability. However, within the limited time frame of the study, measuring profit at the enterprise level would be time consuming as this would require information on cost. This does not seem necessary for two reasons:

- There seems to be no separate production technology targeting the export market; rather a set of good practices that produce high quality mango either for domestic or export market.
- There is relatively adequate information from previous studies reviewed in Section 2 for production cost and returns throughout the marketing chain.

Instead of differences in profitability, the study focuses on the difference in revenue due to exporting. However this confronts another difficulty, the widespread practice of "all-in" pricing mixes together both domestic grade and export grade mango, under a single price. Hence high export prices can indirectly affect the average price along the chain. This implies market segmentation between export and domestic outlets, with the former commanding a higher price, but imposing more stringent entry barriers in the form of quality standards and sales networks. Larger firms may have greater capability to overcome these entry barriers, allowing them to sell a larger share of output to the export market.

In short, a suitable indicator of trade benefit is average price or unit revenue:

$$Unit\ revenue = \frac{Annual\ sales\ (in\ pesos)}{Mango\ input,\ in\ kg}$$

Given the cross-section nature of the data, the most important factor distinguishing unit revenue across firms, is access to the export market. Exporting allows the enterprise to gain access to a premium price, hence increasing unit revenue.

3.3   Hypotheses for quantitative analysis

The first key hypothesis of the study pertains to horizontal structure: *the bigger the firm, the greater the unit revenue.* The implication of this for equity is that the bigger firms are better able to gain access to a lucrative export market. The indicator of enterprise size is **value of fixed assets**.

The second pertains to vertical linkages: *relationship-based supply or purchase transaction promotes greater access to the export market and therefore higher unit revenue.* The indicator of vertical linkages, denoted "Relation", pertains to a relationship-based supply or buying arrangement, or outright vertical integration (i.e. a grower-trader). This is represented as a binary variable (value of 1 for vertical linkages and zero for spot market transactions.) The presence of vertical linkages allows greater control over product quality, which facilitates exporting.

The relationship between revenue per kilogram (RKG) and enterprise size and vertical linkages is initially explored using simple summary charts. This is complemented by multiple regression analysis, incorporating other control variables such as characteristics of enterprise head (years of schooling, and years of experience in mango business). With unit revenue as the dependent variable, an important set of controls relates to indicators of market segmentation, both horizontal (e.g. type of product or market destination) and vertical (portion of the supply chain specialized). The segmentation leads to differences in unit revenue that embody the joint effects of both supply and demand factors.

For horizontal segmentation the relevant variables are:

- Processor (binary)
- Fresh mango exporter to Japan or Europe (binary; "Freshnorth")
- Fresh mango exporter to other countries (binary; "Freshother")

The prices commanded by Freshnorth are expected to be the highest, followed by Freshother, and then Processor.

For vertical segmentation the relevant variables are:

- Trader of fresh mango (binary)
- Exporter, whether direct or indirect (binary)
- Percent of output exported (continuous; "Pctexp")

Traders and Processors are expected to earn greater unit revenue than growers. The Exporter category tags firms that sell directly to a foreign buyer, or to an exporter; this is further qualified by Pctexp that measures the degree of participation in the export market. For Exporters and for higher Pctexp the unit revenue is expected to be higher. As discussed previously, the last two variables may be prone to measurement error.

4. RESULTS

4.1 Benefits from exporting: national level analysis

As described in Section 4, the first step to analyzing benefits from exporting is a national level analysis using AMPLE. The AMPLE data set records exports of mango at 26,000 t (fresh weight equivalent), which is a 3-year average (2009-2011). This accounts for only 3 percent of total mango production of 795,000 t. Export price is about 210 percent higher than the estimated domestic wholesale price (P90 vs P43 per kg). As explained in Briones (2010), the supply for export and domestic markets are treated as differentiated goods, within a constant elasticity of transformation framework (fairly standard in computable general equilibrium models). Given the proportions involved, even a massive export price shock would likely have only small effect on market outcomes of the industry.

The AMPLE Reference scenario captures baseline trends for the agricultural sector and Philippine economy, similar to that of Briones (2012). Projection occurs over the horizon 2010 – 2020. World mango prices in real terms are assumed to rise gently (by 0.5% per year in constant dollars) over the horizon. The comparison scenario involves reducing export price to levels that drive exports to approximately

zero over the horizon. The shock introduced for 2010 is -32 percent, followed by fixed prices in real terms thereafter. The constant elasticity of transformation (CET) for mango is set at 2.0.

Results for mango exports are shown in Figure 7. Exports are projected to rise from 26,000 to 31,000 by 2020 corresponding to an annual growth of about 1.9 percent. Production is shown for both reference and no-export scenarios (Figure 8).

Production in the latter is uniformly lower by about 41,000 – 54,000 t or an average of 5 percent. Impact on producer prices is even less perceptible; on average producer prices are 0.3% lower in the alternative scenario. Clearly a more disaggregated analysis, focusing on the subset of firms that do gain significantly from exporting, is needed to better understand the importance and distribution of benefits of export trade. As a check, a sensitivity analysis is conducted by varying the CET for alternative values 3.0 (Figure 9, Figure 10) and 1.5 (Figure 11, Figure 12).

The reference scenarios (whether for output, exports, or producer prices) are almost identical regardless of the value for the CET. The differences appear in the impact alternative zero-export scenario. For CET = 3.00, export price needs to fall by only 19% (much smaller than the 32% decline with CET = 2); meanwhile for CET = 1.50, export price needs to fall by as much as 45% to approximate zero exports. For CET = 3.00, output under the alternative scenario rises to 888,000 tons (slightly above 880,000 tons projected under the alternative scenario when CET = 2.00). For CET = 1.5, output rises to 834,000 tons (slightly lower than when CET = 2.00). The differences in producer price between reference and alternative scenarios are likewise minimal regardless of the CET value.

4.2   The export market

Competitiveness of the Philippine mango industry is based on natural endowment. The Philippines is gifted with an exotic variety that thrives well in selected areas of the country. In fresh form a major limitation of the Philippine mango is its thin skin, imposing high freighting cost over long distances. This limits the fresh mango market to Asia, of which the two major markets are Japan and Hong Kong. The former is the most lucrative market by far but imposes the most stringent quality requirements, including maximum residue limits, and mandatory Vapor Heat Treatment (VHT).

The other major product category in the export market is processed mango; for this case study the focus is on dried mango. Logistics for processed mango is easier compared to fresh mango. Quality is also less of an issue; unlike fresh mango for Japan, processors are not particular about the quality of

Figure 7: Exports under the reference and alternative scenario, '000 t
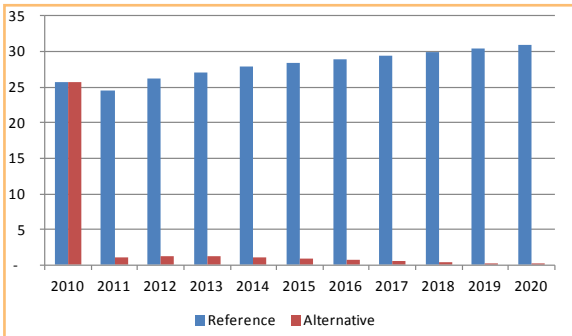
Source: Authors' calculations
Note: CET = 2.00; export price falls by 32%

Figure 8: Production under reference and no-export scenarios, '000 t
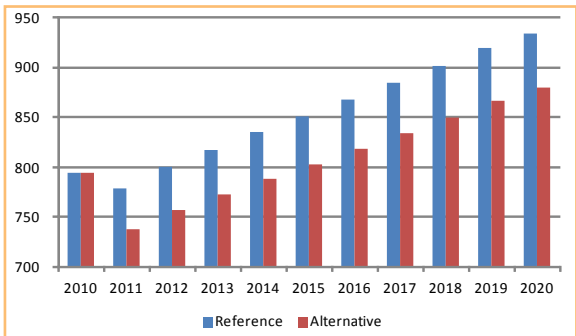
Source: Authors' calculations
Note: CET = 2.00; ; export price falls by 32%

Figure 9: Exports under the reference and alternative scenario, '000 t

Source: Authors' calculations
Note: CET = 3.00; ; export price falls by 19%

Figure 10: Production under reference and no-export scenarios, '000 t

Source: Authors' calculations
Note: CET = 3.00; ; export price falls by 19%

Figure 11: Exports under the reference and alternative scenario, '000 t

Source: Authors' calculations
Note: CET = 1.50; ; export price falls by 45%

Figure 12: Production under reference and no-export scenarios, '000 t
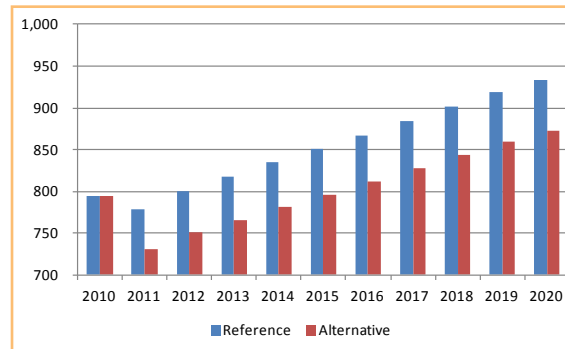
Source: Authors' calculations
Note: CET = 1.50; ; export price falls by 45%
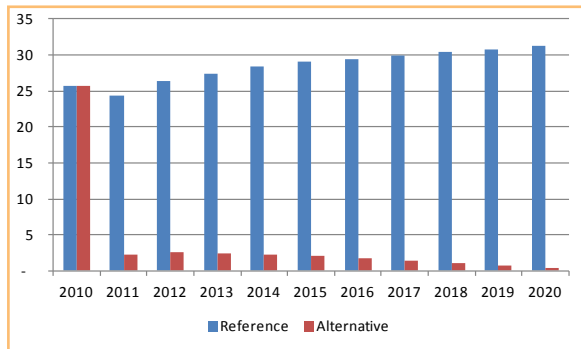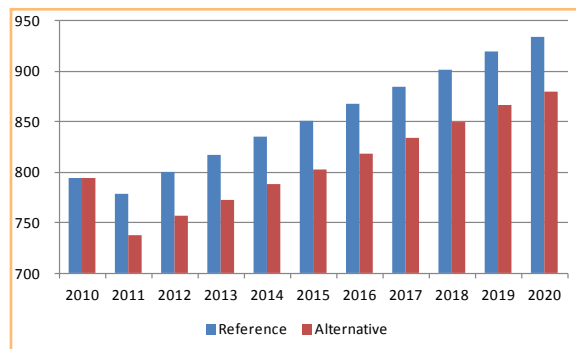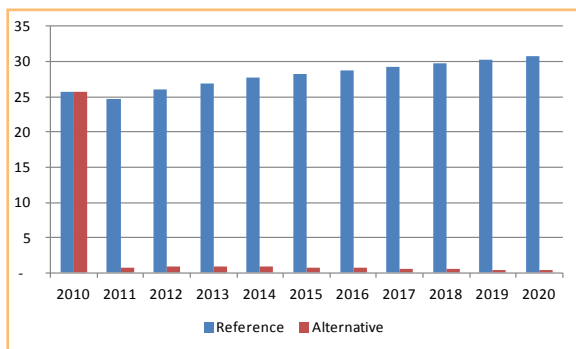
mango skin; however the flesh must likewise be free from blemish as these affect quality of dried mango. Processed mango is mostly exported, with about 85 percent of dried mango production sent abroad. It is easy to ship worldwide and a couple of suppliers mention buyers in Europe (almost inaccessible to fresh mango exporters) as being major customers.

Entry to the export business is subject to large volume requirement (to make shipping economical). In turn this requires considerable working capital outlay, beyond the reach of many small traders. In the case of the Japanese market this is compounded by the high fixed cost of complying with quality standards, such as investing in a VHT (which could run up to a million dollars depending on capacity and quality). Meanwhile in the case of Hong Kong exports, the main challenge is the risk imposed by the consignment scheme, in which the Filipino exporter absorbs loss from output not sold in the destination market. Many traders who could possibly meet the volume requirements of exporting to Hong Kong are deterred by risk involved, as well as need to form trust relations with Hong Kong importers. In the case of mango processing, the processing plant itself represents a significant fixed investment (about P50 million). Development of marketing contacts seems less of a problem once a firm has established its reputation for quality.

4.3   Profile of exporters

Exporters whose destination market is Japan must have a VHT; the biggest clusters of VHT plants are found in the agro-industrial park of Food Terminal Inc. (FTI), a government-owned corporation. The park is located in the Taguig, eastern part of Metro Manila, in which there are only three locators.

For mango processing, there is one cluster located in Metro Cebu. About a dozen processors remain active; there is a single dominant firm, accounting for roughly 85 percent of output. The dominant firm has a capacity is 1,000 t of fresh mango input a day, whereas other processors can handle only a tenth of this; The dominant firm also produces puree and juice.

Characteristics of enterprise heads are summarized in Table 7. Most have been at least two decades in the business; processors are the oldest firms in the business. Enterprise heads have mostly reached tertiary level of education, with majority having finished college; processors also tend to have the most years of schooling.

Nearly half of the respondents got their start in the mango industry as part of the family business; the proportion rises to 60 percent for processors. Two-thirds of the respondents are members of a mango business association; the proportion rises to 100 percent in the case of the processors.

Majority of enterprise heads received technical assistance, mainly for mango production; however none of the processors received technical assistance. Respondents were not always able to pinpoint whether the technical assistance was from government or not; however a significant number (5 out of the 26) specifically singled out chemical companies as source of technical assistance.

Two-thirds of enterprises were part of vertical commercial linkages. All the processors engaged in either or both contract buying and contract selling. As for the traders, as many as 21 out of the 27 are also growers, implying vertical integration between production and marketing; the rest of the 27 were engaged in informal contracts for purchasing mangoes.

Lastly, a small proportion (3 out of 14) of growers were also contracted as regular suppliers. Of these, only two out of the three receive advances for materials from the buyer. Many of the traders report having engaged in such "putting out" contracts in the past, but had discontinued these contracts due to difficulty in recovering their advances. Hence supply arrangements gravitate to either spot contract or outright integration.

Table 7: Characteristics of enterprises and enterprise heads

Category	Number	Years in business (average)	Years schooling (average)	Started in family business (number)	Membership in association	Had technical assistance (number)	With vertical linkage
Processor	5	31	15	3 [60]	5 [100]	0 [0]	5 [100]
Trader	27	19	13	12 [44]	15 [56]	16 [59]	10 [37]
Grower	14	26	15	7 [50]	11 [79]	10 [71]	4 [28]
Total	46	23	14	22 [48]	31 [67]	26 [56]	19 [46]

Note: Figures in square brackets denote percentages of each category.

Source: Authors' data.

4.4   Challenges of exporting

As discussed in Section 2 there is considerable benefit from exporting, for the few enterprises that manage to break through to the export market. Exporting however faces some daunting challenges. First, as in selling to the domestic market, mango exporting is subject to seasonality of supply. Luzon harvest season of March to May requires large capacity of VHT plant to handle deliveries; for the rest of the year though equipment is largely idle. During off-season, supplies must come from Visayas and Mindanao. Similarly, processors have to contend with seasonality. Capacity is expanded to accommodate the Luzon harvest (which arrives with little difficulty in Cebu). During the lean months however, processor's agents must comb the Visayas and Mindanao regions to gather enough raw material.

In general, the main constraint identified by the Pearl2 (2004) report, applies even today and for both fresh and processed mango: exporters and traders mostly identify adequacy of supply of export grade mango as a constraint. Processors in particular are unconstrained by lack of orders from importers; rather lack of raw material compels them to turn down purchase orders from their buyers. Likewise growers mention difficulties in maintaining output levels, mentioning pest infestation and bad weather as culprits.

The second main problem is high cost of inputs. One trader was vocal in attributing high cost of inputs to government regulation, mainly in the form of regulatory barriers imposed by the Fertilizer and Pesticide Authority (FPA, an attached agency of DA). Among processors, high cost of sugar (a major input in dried mango production) has also been cited as a problem. This in turn is traced to high tariffs and regulatory barriers to sugar importation. Moreover, destination countries (such as China) would themselves maintain trade barriers against Philippine mango products, as reciprocity to similar trade barriers imposed by the Philippines on destination country exports (such as vegetables from China).

Lastly, for the processed sector, recognition in a crowded world market for preserved fruit requires more than just capitalizing on the superior taste of Philippine mango. Processors need to maintain high quality and offer variety of export items, which entails continuous research and product development. This is most evident in the dominant firm, which produces a wide array of products in its dried line, not to mention extensive offerings in its juice and puree lines.

4.5   Distribution of benefits from exporting: enterprise-level analysis

The following presents findings on distribution of benefits from exporting based on a more systematic quantitative analysis. Consider first a scatterplot between enterprise assets and unit revenue (Figure 13). Most enterprises are relatively small (assets of P10 million and below). Nevertheless there is a tendency for asset size to be associated with increasing RKG. The plot suggests important non-linearities, which we can adjust by performing a scatterplot on the natural logarithms of RKG and assets (Figure 14). The positive relationship is much clearer; also drawn is a linear trend line which suggests a strategy for multiple regression.

As indicated in the Methods section, other variables that may also be correlated with unit revenue are enterprise head characteristics, enterprise category variables, and a binary variable for vertical linkages (whether forward or backward). Summary statistics and pairwise correlation coefficients are shown in Table 8 and Table 9. The average of Assets is large (equivalent to about US$1.4 million at current exchange rates), but the standard deviation is also large (5.7 times as large as the mean). A sizable proportion of the respondents have vertical linkages, are traders, and export directly or indirectly; only a small proportion are processors; an insignificant fraction export to the North or even to other overseas markets.

Table 8: Summary statistics of the enterprise variables

Variable	Average	Standard deviation	Minimum	Maximum
RKG	40.32	33.29	9.64	178.50
Asset ('000 pesos)	59,729	338,578	0.00	2,300,000,000
Relation	0.41	0.50	0.00	1.00
Experience (years)	22.54	9.85	0.00	42.00
Schooling (years)	13.81	2.89	5.00	18.00
Processor	0.11	0.31	0.00	1.00
Trader	0.59	0.50	0.00	1.00
Exporter	0.67	0.47	0.00	1.00
Pctexp	0.34	0.31	0.00	1.00
Freshnorth	0.02	0.15	0.00	1.00
Freshoth	0.07	0.33	0.00	1.00

Source: Authors' data.

Table 9: Pairwise correlation coefficients of selected enterprise variables

		1	2	3	4	5	6	7	8	9
1	Unit revenue	1.00								
2	Asset	0.27	1.00							
3	Relation	0.41	0.20	1.00						
4	Experience	0.11	0.18	0.20	1.00					
5	Schooling	0.05	0.07	0.00	-0.03	1.00				
6	Processor	0.26	0.45	0.42	0.31	0.15	1.00			
7	Trader	0.02	-0.18	-0.10	-0.44	-0.25	-0.41	1.00		
8	Exporter	0.24	0.12	0.49	0.25	-0.25	0.24	0.08	1.00	
9	Pctexp	0.50	0.27	0.68	0.31	-0.09	0.41	-0.16	0.77	1.00

Source: Authors' data.

Figure 13: Scatterplot diagram between unit revenue (RKG) and enterprise assets
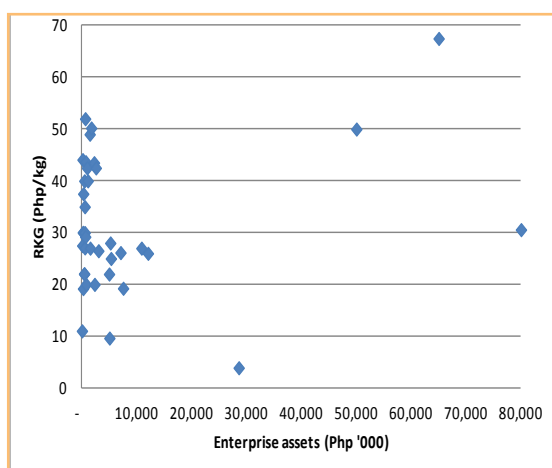
Source: Authors' data

Figure 14: Scatterplot diagram between unit revenue (RKG) and enterprise assets, in natural logarithm

Source: Authors' data

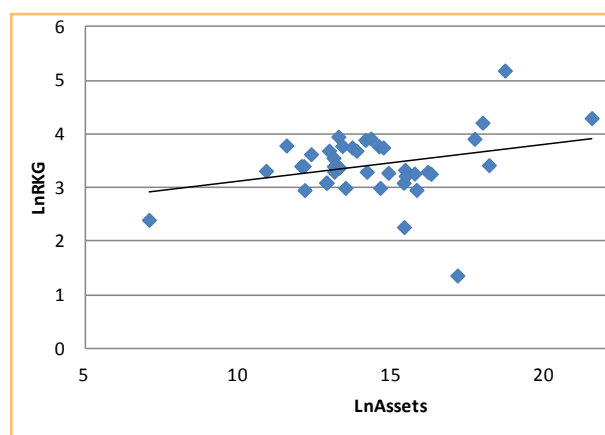These variables are dropped in the pairwise correlation matrix. Unit revenue is noticeably correlated with Asset, but only moderately so for Relation. The latter though is strongly correlated with Exporter and especially *Pctexp*. This may complicate econometric analysis owing to possible multicollinearity.

Ordinary least squares regression isolates the importance of enterprise size and vertical linkages by incorporating various potentially influential variables. The following regressions and statistical tests are performed using STATA. The first specification directly applies the variables in Table 8 directly as independent variables in the regression. The results are shown in Table 10.

The coefficient of Assets is both quantitatively and statistically insignificant. In fact none of the coefficients are statistically significant, except for the Vertical linkage variable. The regression passes the F-test for joint significance, with a moderate goodness-of-fit based on adjusted R^2 of 0.25.

The mediocre fit of the simple linear model to the data suggests a specification problem, namely failure to account for non-linearities in the data, which is already evident from the scatterplot of Figure 14. This failure is corrected by running a log-linear regression, results of which are shown in Table 11.

The goodness-of-fit dramatically improves with adjusted-R^2 of 0.56. The Breusch-Pagan test for heteroscedasticity (null hypothesis of constant variance) yields $\chi^2 = 0.010$ corresponding to $P(\chi^2 > \chi^2_c) = 0.75$, i.e. failure to reject the null. The Ramsey reset test (null of no omitted variables) yields an F-value of 1.98 or $P(F > F_c) = 0.25$, i.e. failure to reject the null at 0.05 level of significance. That is, standard tests fail to detect fundamental problems in model specification.

Moreover the asset variable is now significant with high t-value. The coefficient value implies that every 1 percent increase in assets increases RKG by 0.1 percent. In short, the quantitative analysis based on enterprise-level data confirms the first hypothesis, that larger enterprises tend to earn higher average revenue due to greater access to export markets.

However there is no confirmation of the second hypothesis, that vertical linkages contribute to gaining

Table 10: Results of least squares regression on unit revenue

Variable	Coefficient	t-value	$P(t > t_c)$
Assets	0.000002	-0.15	0.88
Relation	2.013	0.20	0.84
Experience	0.043	0.10	0.92
Schooling	0.645	0.49	0.63
Processor	28.358	1.53	0.14
Trader	15.158	1.64	0.11
Exporter	-24.904	-1.91	0.07
Pctexp	68.049	2.99	0.01
Freshnorth	-28.327	-1.06	0.30
Freshoth	-18.681	-1.32	0.20
Constant	9.534	0.39	0.70

Note: F-test of joint significance of coefficients yields an F-value of 2.39, $P(F > F_c) = 0.03$; adjusted R^2 of 0.25.
Source: Authors' data.

Table 11: Results of log-linear least squares regression on logarithm of unit revenue

Variable	Coefficient	t-value	$P(t > t_c)$
Assets, in logs	0.095	2.60	0.01
Relation	0.165	0.95	0.35
Experience	-0.007	-0.94	0.35
Schooling	-0.013	-0.53	0.60
Processor	0.120	0.33	0.75
Trader	0.240	1.52	0.14
Exporter	-0.331	-1.50	0.15
Pctexp	0.025	2.38	0.02
Freshnorth	0.635	1.38	0.18
Freshoth	-1.301	-5.30	0.00
Constant	2.126	3.97	0.00

Note: F = 6.27; $P(F > F_c)$ = 0.00; adjusted R^2 = 0.56.
Source: Authors' data.

Table 12: Results of log-linear least squares regression on logarithm of RKG (Pctexp dropped)

Variable	Coefficient	t-value	$P(t > t_c)$
Assets, in logs	0.103	2.63	0.01
Relation	0.387	2.46	0.02
Experience	-0.007	-0.88	0.39
Schooling	-0.010	-0.4	0.69
Processor	0.190	0.49	0.63
Trader	0.173	1.04	0.31
Exporter	0.019	0.11	0.91
Freshnorth	0.644	1.31	0.20

Note: F = 6.27; $P(F > Fc)$ = 0.00; adjusted R^2 = 0.56.
Source: Authors' data.

access to export markets. The coefficient of Relation is positive but not significant at the 5% level.

Other significant coefficients pertain to Pctexp (positive) and Freshoth (negative). The significance of the former suggests a multicollinearity issue affecting the coefficient of Relation. Moreover there is the possibility of Pctexp being prone to measurement error. As a check, another least squares regression is implemented with Pctexp dropped (Table 12). Coefficient values are similar, except for Relation, whose magnitude as well as t-value rises; it is now statistically significant (at 5% level). This may be seen as preliminary but inconclusive confirmation of the second hypothesis. The mechanism is likely to be the improved enforcement of quality standards and volume requirements, compared to spot market, consistent with the authors' qualitative impressions from field interviews. The second hypothesis is

indeed plausible and certainly cannot be ruled out, though unequivocal confirmation is not found.

5. CONCLUSION AND IMPLICATIONS

The case study has found that benefits of exporting are relatively small at the industry level; nevertheless for a subset of firms who are able to consistently supply or procure export grade of mango, exporting offers a very lucrative option.

Vertical market structure, i.e. contracting relationship or vertical integration, was hypothesized as a mechanism to improve product quality to export grade. The case study offers tentative confirmation of this hypothesis. Vertical linkages are a mechanism of ensuring mango supplies comply with quality and quantity requirements acceptable to the export market. Clearly, the private sector should take the lead in developing effective vertical linkages to increase value-adding in the mango supply chain. However other stakeholders such as the national and local government, and other members of the development community, should direct their efforts and resources to support the development of tighter links along the chain, such as providing better transport infrastructure, technical assistance, community organizing farmer registry (see below), and credit support.

On the other hand, horizontal market structure does appear to be an important factor in exporting. Economies of scale and ability to bear risk are present at the level of marketing and processing. These take the form of volume requirements (for shipping), the risk of poor sales or rejection by regulators in the destination market, and large fixed investments (treatment plant or processing plant).

However, there are no discernible scale economies at the level of primary production. This possibly accounts for prevalence of small farms in the mango production sector. Moreover large agribusiness interests who have ventured into mango farming (e.g. Dole Philippines) have failed to replicate the success of their other fruit ventures.

Even in marketing and processing, the importance of scale economies in the industry should not be overstated. Investment requirements, while they do rule out microenterprise-scale operations, are perfectly within reach of medium-size firms. Considerably more entry is possible with adequate and stable supply of quality raw material at reasonable cost. In fact entry has been recorded in both fresh and processed exports, though exits are also frequent; the largest firms, especially among processors, tend to be the longest-lived.

The Pearl2 Project (2004) report recommends creation of a database of suppliers with track record in supplying good quality mango; this is particularly timely as the DA is preparing a nationwide farmer's registry   (http://www.da.gov.ph/index.php/2012-03-27-12-04-15/2012-04-17-09-30-59/1087-farmer-database-to-aid-aggie-sector-in-program-dev-t.)   This database may also benefit private sector traders and processors, particularly new investors in mango exporting and processing.

Regulations and trade protection (on the side of the Philippines) have been cited as factors in elevating cost of chemicals and processing inputs (i.e. sugar). Importing countries have also refused to relax trade barriers as reciprocal treatment to high trade barriers imposed by the Philippines. These factors should be reviewed for possible ways to reduce cost through better policy.

A more stringent constraint however appears to be erratic yields and quality due to environmental factors (i.e. weather, pest, and disease). It appears that the level of technology of mango production has not matured to the point of comprehensive management and control of environmental risk, even for large-scale and technically sophisticated agribusiness firms. This suggests that R&D may continue

to offer enormous gains for mango production and address the problems faced by small farmers. Past research success in the Philippines, home of the revolutionary flower induction technology, augurs well for investments in this area (see e.g. http://beta.searca.org/searca/index.php/45-dl-umali-award/45-2011-dl-umali-awardee).

Furthermore, as discussed in the Pearl2 (2004) report, lower production cost can already be realized under existing technologies, such as: property fertilizer management informed by soil testing; and reduction of pesticide use (through bagging and integrated pest management). Propagation of current and new technologies should be promoted through a responsive extension system in which public and private extension agents are key partners.

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