Modern Markets and Guava Farmers in Mexico

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Abstract. -- This paper analyzes the participation of small farmers in the fresh fruit and vegetable supply systems of supermarkets in Mexico, using the case of small-scale guava farmers in the state of Michoacán. Several findings emerge. The most important determinants of access of these farmers to "more modern markets" channels are their territorial context and the way in which those territories interact with different markets, and their quasi-fixed capital assets. Farm size, education, and participation in organizations are not significant determinants (except for farm size in the Central Region). Policies and projects aimed at promoting the inclusion in modern markets of small-scale farmers such as those producing guava in Michoacán, must act on the territorial dimension of the problem of inclusion/exclusion, and not restrict themselves to actions aimed at improving the supply chains or the capacities of the households or their farms and organizations.

Key words **–** Mexico, horticulture, supermarkets, wholesale, food markets, rural development.

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1. INTRODUCTION

Supermarkets have been diffusing rapidly in developing countries. The "take-off" was in the early 1990s, and proceeded in three "waves", with South America and East Asia (outside Japan) among those in the first wave with "take-off" in the early 1990s, Mexico and Southeast Asia among those with take-off in the mid 1990s, and China and India among the third wave with take-off in the late 1990s and early 2000s (Reardon and Berdegué 2007).

The effect of this retail transformation on farmers is only indirect for the roughly 85-90% of food sales of supermarkets which are constituted by processed and semi-processed foods (cereals, pulses, dairy, meat, edible oils, processed fruits/vegetables). For the latter, the supermarket chain's procurement decision affects flour mills, dairies, slaughterhouses, etc.; the latter then interact with the farmers. The literature is relatively advanced in studies of processors' relations with farmers in developing countries, and how modernization of processing with attendant quality standards affects farmers (see for example Gow and Swinnen 1998 and Dries and Swinnen 2004).

However, the effect of the retail transformation on farmers is potentially more direct for the 10-15% of supermarkets' food sales (in first and second wave countries, with a lower share in third wave countries; Reardon and Berdegué 2007) that are in fresh fruits and vegetables (FFV). The latter are marketed either via the wholesale sector or directly to supermarkets, without the processing step. The issue posed by the "supermarket revolution" for the farm sector analyst is then how supermarkets, or FFV wholesalers supplying domestic supermarkets, interact with farmers. While there has been already an emerging literature on how foreign supermarkets

(for example, US or UK supermarkets) affect developing country exporting farmers (for example, Costa Rican squash farmers, see Saenz and Ruben 2004), there have as yet been very few journal articles published on how domestic supermarkets affect FFV farmers. Part of the reason for this dearth is that supermarkets in developing countries sold very little FFV even as recently as 2000 (for example, in Mexico, FFV were only 1-2% of food sales of supermarkets in 2000); FFV sales have grown rapidly since then (in Mexico, FFV constituted by 2006 some 10-15% of food sales of supermarkets; Reardon et al. 2007).

There have been few articles to date on domestic supermarkets and FFV farmers. These include Rao & Qaim (2011), on vegetables in Kenya, Neven et al. (2009) for kale in Kenya, Blandon et al. (2008) for general FFV in Honduras, and Hernandez et al. (2007) for tomatoes in Guatemala. These studies have thus either not been product specific, or dealt with bulk vegetables like tomatoes, with only moderate perishability and quality differentiation. But all the papers tested for farm size and non-land asset effects – but came to mixed conclusions. Rao and Qaim (2011) and Neven et al (2009) show in Kenya that the larger the farm, the greater the probability of participation in the local supermarket channel; yet in Guatemala, Hernandez et al. (2007), and in Honduras, Blandon et al. (2008) show that farm size is not a significant determinant, and that small farmers sell to local supermarkets; this result is also shown in some export market studies, such as Minten et al. 2009 for Madagascar. Several studies show that non-land assets play a role, although which and how differ over studies. Most studies such as Rao and Qaim (2011) show that infrastructure cum transaction costs, for example in road access, is important; Blandon et al. (2008) show that membership in cooperatives is important; some like Rao and Qaim show that rural nonfarm employment (RNFE) plays a positive role, while Hernandez et al. (2007) show that irrigation plays a key role.

The present paper aims to contribute to the emerging literature on domestic modern market relations with FFV farmers. We focus on the case of Mexico, because it is second-wave country where supermarkets by 2006 dominate in the national urban market 56% of food retail and 28% of FFV retail (Reardon et al. 2007). Penetration is thus high enough to expect farm-level impacts. Moreover, we focus on the case of guava, a quality-differentiated, highly perishable, niche product, with high transactional requirements, but the production of which is nearly exclusively dominated by small farmers. We hypothesize, in contrast to a hypothesis favoring economies of scale that might be more valid for bulk, commodity products, that with highly perishable and labor demanding fruit, that small farmers will be "included" in domestic modern market channels, but that farmers more endowed in non-land assets will be more apt to be selling to domestic modern market channels. We further hypothesize, along with Rao and Qaim (2011), that the effect of inclusion in the domestic modern channel will have differentially positive effects of profit rates.

We address three research questions. (1) What are the determinants of guava farmer participation in the domestic "supermarket channel" (versus the traditional market channel)? (2) What are the technology correlates of farmer participation in the domestic supermarket channel, and thus the implied investments in productive assets to access this new channel? (3) What is the difference in the profit rate between farmers marketing to domestic supermarkets versus the traditional market? (Note: we use "domestic" as the location of the retailer, hence not export market; but the retailer can be of foreign or domestic capital.)

We address these three questions with author-gathered information from a farm household survey (a random-sample, cross-section survey with observations on current and lagged assets), a "rapid rural market appraisal", and a wholesale market survey in 2005. We note

that the combination of surveys of different market segments (here farmers and wholesalers), as well as a broad rapid-reconnaissance over all major actor types, is rare in studies of farmers participation in markets and allows interpretation and triangulation of findings.

The paper proceeds as follows. Section 2 describes the data sources. Section 3 describes meso (market level) and micro (farm level) patterns in household characteristics, production, marketing, and profits. Section 4 analyzes econometrically the market-channel participation and its technology correlates. Section 5 concludes with policy implications.

2. DATA

The study focuses on the state of Michoacán, with its capital city, Morelia, about 280 km northwest of Mexico City. This state was chosen among the states producing guava because our budget limited us to a geographic focus, 55% of Mexico's guava is produced in Michoacán, and it is a leading fruit-growing area with small farmers forming the majority.

The study is based on three sources of information.

First, we undertook a "Rapid Rural Marketing Appraisal (RRMA)" (Crawford, 1997) in July-August 2005 to understand the structure of the market channels and farmer organization in the study zone. The RRMA was done in all the guava-producing municipalities of Michoacán, using a reasoned sample of guava farmers' organizations, *ejidos (*rural communities that originated in the Agrarian Reform, but with independent, family-owned and managed farms), field brokers (not taking possession but working only on commission), transporters (just taking a transport fee), and wholesalers (taking possession), government officials, and other informants.

Second, we undertook a survey in November-December 2005 in the Mexico City Wholesale Market to understand the market channel structure. This wholesale market, one of the

largest in the world, is also by far the most important market for Michoacán guava. The survey involved semi-structured interviews of a reasoned sample of 25 wholesalers (about 25% of the guava wholesalers) including 12 working directly for supermarket chains, others supplying the supermarket suppliers, and some supplying traditional retail systems. Interviews were also conducted with two guava buyers from supermarket chains, one small broker, and two truckers.

Third, we undertook a farm household survey in September-October 2005. The survey used a structured-questionnaire covering household and farm characteristics, production and marketing, participation in organizations, access to services, and current and lagged assets. The sample includes 300 (usable observation) households chosen in two stages. First, given there was no extant census, we carefully assembled a list of 3,337 guava farmers in the state from the lists of the various organizations, *ejidos*, projects, and programs. (Key informants judged that it is probable that very few guava farmers in the state were excluded from our list.) Second, we drew a random sample of 300 households, stratifying the sample by the true population weights of guava growers over regions, but selecting the main guava municipalities in the regions (and then using weighting in the statistics to render the results representative). This gave a usable sample of 232 in the Eastern and 66 in the Central Region.

3. DESCRIPTIVE ANALYSIS OF GUAVA FARMING AND MARKETING

(a) Patterns in guava farming

Patterns at the Meso Level. Guava production in Michoacán took off in 1997, after a very harsh winter in the then-leading production state (Aguascalientes) caused grave damage to the guava orchards and resulted in a sharp drop in production and in abnormally high prices. According to Mexico's Ministry of Agriculture statistics, in 1992 Michoacán produced less than 5% of the national guava supply. Since then, the Michoacán guava acreage grew by an average

19% per year, production by 31% per year, and yields by 9.4% per year. As a result, by 2005 Michoacán produced 55% of the total national supply.

Within Michoacán there are two distinct guava growing areas, at roughly similar distances from Mexico City: the Central Region, around the municipality of Taretan, and the Eastern Region, near the city of Zitácuaro. In 2005, 90% of the guava producers were in the Eastern zone. The Central lagged behind the Eastern region in guava diffusion by four years.

Patterns at the Micro Level. Table 1 shows characteristics of the households and their guava farms. In certain ways, the guava farmers are similar to the traditional, small semi-subsistence rainfed-maize farmers. Their farms are small: 4.2 ha in the East and 3.3 in the Center, on average. (This is similar to the average of 3.15 ha in the maize farmer sample of Taylor and Yúnez-Naude (2000)). Also like traditional maize farmers, most farmers are ejidal, education is low, and many households have a migrant in the US or Mexico City.

However, several characteristics distinguish guava farmers from traditional small farmers in Mexico. Their farms are mainly in high-value (compared to maize) irrigated horticulture, with only 10% of their land under rainfed maize. This allows them to have staggered production on several plots and market over the year rather than suffering the sharp seasonality of rainfed grain farms. The guava farmers also have relatively good access to road infrastructure (with East Region farms a scant 2 km to paved roads, and 5k for those in the Center Region). They have good access to organizational "soft infrastructure": 78% of the farmers are members of the Local Phytosanitary Organizations, and 38% of the guava producer organizations (with the East Region farmers tending more toward the former and less toward the latter compared to the Center Region). However, participants in the RRMA agreed that with very rare exceptions, these organizations are not marketing, input or technical assistance associations, and in fact are mere

formalities to be able to fulfill the requirements of the different government programs which mete out services only to organized farmers. A higher proportion of guava farmers in the East are members of the Local Phytosanitary Organizations, which are used to certify that farms are free of fruit flies and thus can market to the profitable markets in the Northern states of Mexico as well as export to Canada and Japan, although fresh export is still a tiny share.

The guava farming characteristics differ between the farms of the East and Center Regions. (1) The guava farmers in the East are somewhat more specialized. Their area averages 3 ha of guavas (71% of the average overall farm) in the East, compared to only 1.8 ha (55% of the farm) in the Center. (2) As the East Region embarked on the "guava boom" earlier, guava orchards in the East are twice as old, and the farmers with twice the experience, as those in the Central Region. This may be one reason for their higher yields. (3) The ratio of family labor to guava land is three times higher in the Center. We show below that this is part of the more labor-using and less capital-using guava farming in the Center compared to the East. (4) In both regions all guava orchards are irrigated. Water is cheap and abundant and irrigation requires little capital (in nearly all cases it is merely orchard flooding from a central pipe). (5) The purchase of guava land (done by 28% of the farmers) and planting of trees has been mainly "own-financed" - through the reinvestment of profits from previous crops (58% of households in the Central region, 36% in the East), sale of cattle, and remittances from migrants (about 20% of households in both regions). Less than 12% of the households in each region received credit, either from government or private sources. (6) Technical assistance and advice for guava farmers comes basically from two sources: neighbors and agricultural input shops.

(b) Descriptive Patterns in guava marketing at meso and micro level

Patterns at the Meso Level. By far the most important market for Michoacan guava is to the Mexico City Wholesale Market (MCWM). Our meso-level discussion thus focuses on the MCWM (based on our survey there) and intermediation in Michoacan (based on our RRMA).

The MCWM is quite concentrated per product – even more than a decade ago. A study done during 1987-1992 showed that in 11 of the main produce items, there were only 91 wholesalers – that is, only 4% of the total number of wholesalers in these 11 items – who controlled 76% of the total volumes of those items There is a second stratum of small-medium wholesalers who compose the rest, and mainly buy from the large wholesalers (Echánove, 2002). The guava sector in the MCMW, composed of 120 wholesalers, has a similarly concentrated structure. The brokers, wholesalers, and transporters from Michoacan deliver mainly to the subset of large/medium wholesalers in the MCMW, who then on-sell to medium and small wholesalers, small brokers and traditional retailers, and supermarkets or supermarkets' agents.

Our survey of the large and medium guava wholesalers in the MCWM showed that they buy from the following sources: (a) directly from guava producers with whom they often have had a long commercial relationship, obtaining the fruit via transporters who just collect a transport fee; (b) from other wholesalers based in the main production areas of Michoacán and other states; (c) from the field brokers (*coyotes*) who obtain the fruit either from farmers or other small brokers; (d) from wholesalers who, on their way to Mexico City from other production regions in the North of the country, detour to buy fruit in Michoacán; (f) from other wholesalers in the MCWM. Very frequently there are long-standing relations between the wholesalers in MCWM and the agents in these different supply chains. This "map" of sources was obtained in sensitive interviews in which the large wholesalers did not want to provide specific information

on how much they bought from each source, but just to give rough rankings of the sources. The average ranking is reflected in the order in our list.

We found that no more than 12 (large and medium) of the 20 interviewed are regular, direct suppliers of supermarkets. Even they (except one) sell to a variety of clients, including other wholesalers and traditional retailers. The supermarket and wholesaler interviews showed that supermarkets buy very roughly 90% of their guava from the large wholesalers (directly or via their specialized wholesaler agents) in the MCWM. (There are no reliable statistics on the absolute volume or value of this transaction to corroborate this.). A few medium-small supermarket chains with stores mainly or solely outside Mexico City keep offices and warehouses in MCWM. The large chains with stores in Mexico City also source almost all their guava from MCWM, from whence wholesalers deliver to the distribution centers of these chains.

Supermarkets source via the MCWM, rather than directly from farmers or specialized wholesalers in the production regions, for several reasons given by interviewees in the RRMA.

First, according to the wholesalers who are direct guava suppliers of these major firms, some of these chains have tried to source directly from producers, but have concluded that by working through MCWM they reduce costs. The costs include continuous selection and repacking that is required because of the very perishable nature of guava and the inconsistent grading done at the farm level. Guava, being a small volume (niche) fruit compared to others such as apples or bananas (that supermarkets in Mexico tend to be sourced direct from large suppliers, see Reardon et al. 2007), does not justify having special cold storage areas, and the fruit is quickly damaged if it is stored at the low temperatures that are adequate for these other fruits.

Second, the interviews also suggest that the supermarket chains source this niche fruit from MCWM because large wholesalers can absorb the price discounts imposed by the chains to compensate for damaged, unsold guava, a condition that the small or even the very few relatively "large" guava producers could not sustain. Also, according to these wholesalers, the chains can negotiate better prices with large-volume wholesalers than with the producers. It could be that in a product such as guava in Michoacán, where almost all of the production comes from a large number of small farms, supermarkets may have higher transaction costs that keep them reliant on the MCWM, compared to other crops in which medium and large farmers can, by supplying directly to supermarkets or to specialized wholesale agents working for supermarkets, meet a significant percentage of the supermarket's demands. A case in point is that for tomatoes, which supermarkets in Mexico mainly source from large grower-shippers (Reardon et al. 2007).

Third, supermarket chains are more demanding clients than traditional markets, for small farmers. Supermarkets require consistent delivery all year, with weekly volume conditions. They require invoicing from suppliers for legal reasons. They require fruit of a set of grades of quality standards that exceed the average in the traditional market. (The quality standards used by the supermarkets are those of the traditional markets, but they buy fruit that attains certain grades: 'extra' and 'first' size, of green color (not mature), and firm-fleshed). Moreover, while wholesalers pay within a week, supermarket chains tend to pay in a month.

While those conditions and requirements are very difficult for individual small farmers and even rural wholesalers, it turns out that they are also difficult for guava farmer organizations. The government, some supermarket chains, and several guava farmer organizations have held high hopes of small farmers organizations' supplying direct to supermarket chains, thus skirting intermediaries, and thus perhaps earning a better price. There have been a handful of experiences

– mostly failures- of supermarkets sourcing directly from producer groups. One case is that of PROGOMICH, an organization of small guava farmers active in the Eastern Region. It supplied guava to Wal-Mart in 2004. Despite the very favorable price conditions from the supermarket, and the strong technical and financial support from Michoacán government programs, the deal fell apart within one year as the farmers' organization was unable to coordinate sufficient producers to supply consistently.

However, it is possible that there is a shift afoot in supermarket procurement systems for guava. The RRMA revealed that some of the local brokers and the local (larger) wholesalers that collect guava from small farmers to take it to MCWM are also starting to provide the same service for some supermarket chains. This may be the start of the development of specialized guava wholesalers based in the production areas and dedicated to supplying supermarkets and obviate the MCWM. That is a phenomenon that has occurred in other products, such as tomatoes and lemons in Mexico (Reardon et al. 2007), and other countries (such as in mangoes and tomatoes in Indonesia; see Natawidjaja et al. 2007).

Patterns at the Micro Level. Table 2 compares farmer marketing patterns over regions. The salient results are as follows.

First, an average guava farmer in the East has nearly thrice the sales of a farmer in the Central Region – explained by their larger small-farms, higher yields, and as we show, higher quality sold and prices received.

Second, the East farmers market 74% of their guava graded, versus only 58% in the Central Region. Forty percent of the East's guava is top quality (super extra or extra), versus only 23% in the Center. The grading and quality differentiation is strongly rewarded by higher prices in the East, but is not in the Center, where there is little price differentiation over grades.

Third, the two leading marketing channels in the East (summing to 52% of marketing) are to "non-local wholesalers" (39%) and "local wholesalers" (21%), which we class below as parts of the "more modern markets" channel. Our RRMA found that these two channels were nearly absent a mere five years ago – when "local brokers" (coyotes) were nearly the exclusive market channel. This rise of (larger) wholesalers and decline of (small) brokers implies a transformation of the guava wholesale sector, with possible consolidation and capital-intensification, similar to some extent to the transformation of retail. For a similar recent trend in Indonesia for comparison, see Natawidjaja et al. (2007). By contrast, while the Center has also seen a development of the involvement of the non-local and local wholesalers (to 41%) the local traditional brokers still have an important share (38%). Note that in both regions, marketing via farmers organizations or to supermarkets agents are a tiny share, and only in the Center.

Fourth, farmers in the East sell 57% into Mexico City, and only 13% to the local market. By contrast, the Center sells 42% into the local market. There is no clear price differentiation pattern over the destination markets.

The overall image is that the East Region guava market is more developed, and the Center still more traditional. This difference may be due to the East getting started earlier in guavas, and having a richer and longer history of horticultural development than the Center Region (which has been mainly maize and sugar-cane for a century). There may also be (as suggested by respondents in the RRMA) a vicious circle now for the latecomer Center Region. The continued importance of the local brokers, and the overall relative lack of price differentiation and grading, may reduce the incentive for farmers to produce top quality. But the relative lack of top quality guava might deter wholesalers from operating in the Center Region.

Table 3 shows farmer marketing patterns comparing over "clusters." A non-hierarchical cluster analysis was performed with the household survey data. The cluster analysis used k-means, and least Euclidean distances among the observations. The number of clusters is defined as two, a priori. The analysis uses "average linkage within groups" as the procedure for agglomeration of clusters. The households were classified into two clusters according to the percentage of guava sold to buyers in the "more modern market" (MMM). The latter is binary (MMM or traditional). The farmer is classed as MMM if he/she sells more than half his/her guava to: (1) local wholesalers; (2) non-local wholesalers; (3) supermarket-servicing '*introductores*'; and (4) farmers' organizations. The farmer is classed as "traditional channel" if he/she sells more than half to (1) the farmer /her/himself as own marketer; (2) the local small-scale informal, traditional intermediaries ('*coyotes*'); and (3) local informal brokers-truckers ('*fleteros*'). We cannot be certain to which final client the guavas go because we only have information about the first buyer. However, the RRMA and the MCWM survey gave us some information about where each type of trader generally sells his/her product, thus allowing a rough classification of intermediaries into the MMM (with a higher probability of a supermarket as a end client) and the traditional channel (with a low probability of the end client being a supermarkets). Finally, keep in mind that the cluster analysis shows mere correlation, not causality.

The traditional and MMM clusters have 154 and 137 households respectively. The MMM cluster is larger than we expected given that supermarkets only dominate about one-quarter of fruit retail in Mexico; but the large size of the MMM cluster is explained by the relatively diffuse market structure, wherein modern intermediaries like large wholesalers are marketing both to a wide spectrum of clients.

First, the Eastern zone's sample is split evenly over the clusters, while in the Central Region the sample is 63% traditional. This shows a significant but modest difference in market structure over the regions, with the modern channels having further penetrated the East, as discussed above when comparing regions.

Second, an important finding is that the overall farm size is not significantly different between the clusters, but guava area is significant and some 15% larger on the MMM farms. This area difference, combined with greater yields, means that the volumes on offer from MMM farms are 28% greater than the traditional channel farms. This may mean that MMM farms present lower transaction costs to larger wholesalers. Moreover, as the data show that an average farmer (in either channel) tends to work with only one intermediary, a farmer with a larger output would want to reduce transaction costs for him/herself by choosing a larger intermediary who can handle larger volumes at one go.

Third, an important finding is that holdings of quasi-fixed capital are 18% higher among MMM farms. One would expect this to be mirrored in greater credit receipt, but credit does not differ over the clusters, and is very minor. Rather, it is own-financing that predominates by far, and farmers in the MMM cluster tend more to have financed guava start-up from savings from other horticultural crops and livestock. Here is what appears to be a link to the regional differences, as revealed in the RRMA: farmers in East have a history of prior horticultural and livestock booms that generated surpluses that were invested in guava land, trees, and equipment. This was much less true in the Central Region.

Fourth, however, as expected, technical assistance and guava producer organization and Phytosanitary organization membership are some 10-15% higher (and significant) in the MMM farms. Technical assistance is mainly from government and input suppliers, and somewhat from

farmers organizations, but not from market intermediaries or retailers. Moreover, yield, quality, grading frequency, and price are all roughly 10-15% higher among MMM farms. These patterns go along with both the greater propensity for the MMM farms to be in the East (where the marketing system is more advanced and price differentiation and grading rewards quality) and the greater technical assistance received by the MMM farms.

Fifth, the farm technologies, measured as average factor ratios, differ between the clusters. The labor to land ratio for the MMM group is 429, and for the traditional group, 562. The capital to land ratio is 25 for the MMM group, and 20 for the traditional group. The image that emerges is that the MMM group's technology is, in factor bias terms, capital-using, labor-saving, and land-using, while the traditional group's is capital-saving, labor-using, and land-saving. This substitution of labor by capital is common during the shift from semi-subsistence to commercialized agriculture (Pingali and Rosegrant, 1995). As the guava farmers are already commercialized (only 10% of their land to maize) and specialized in horticulture, the results here depict a further differentiation of the commercialized with the MMM undertaking further capital-led intensification.

Finally, household guava income per hectare (value of output – all variable costs except family labor) is 1.8 times higher on MMM compared to traditional farms. Profits per hectare (household guava income – the imputed value of family labor) are 2.2 times higher. These differences are due to the higher quality and yields, and lower variable costs of the MMM farms. The profit difference would however, decline somewhat should amortization of capital be netted out. Moreover, these results are only cross-sectional. We do not have data on profit rates before the MMM farms entered the modern channel, and so cannot prove the profits are greater because of the latter; the currently MMM farms might have had greater profits five years ago, compared

to the farms which are now in the traditional channel. That issue cannot be resolved with our time-limited data. We have, however, presented evidence suggesting that the East region in general, and MMM intermediaries in particular, tend to reward quality differentiation more than the traditional informal brokers. Given that all the farmers were a decade ago only selling to the informal brokers, it is probable that those who could make the shift to the MMM over time have been rewarded with higher profits, controlling for other variables. That is a hypothesis to test in future work should panel data be generated.

4. ECONOMETRICS OF MARKET CHANNEL CHOICE AND TECHNOLOGY

We first model market channel participation (presenting a conceptual model, then econometric specification, then results), and then model technology correlates by market channel group, controlling for the conditional probability that a given farmer is in the MMM or traditional channel group.

(a) Market Channel Participation

Heuristic Conceptual Model. Given that guava is only marketed (with negligible home-consumption), we do not model the choice of home-consumption versus marketed surplus (as in prior market participation work such as Goetz 1992). In this case, the marketed surplus function is equivalent to the supply function. The latter can be derived from the profit function (without requiring the assumption of profit maximization; Sadoulet and de Janvry, 1995), as a function of relative prices of outputs and inputs, risk, and a set of quasi-fixed capital assets, as well as various context-specific shifters. The determined variable (supply) can be specified as a decision about a binary variable, in our case, whether to supply to the MMM (instead of the traditional channel).

There have been two recent additions to the above conceptual model of market participation that are particularly relevant to the (straightforward) extension of the market participation model into a market channel choice model.

The first is the addition of "proportional transaction costs," such as transportation and imperfect information, to the agricultural supply function, as in Key et al. (2000). While they model these costs as relative to the alternative of autarchy, one can view them as showing transaction costs in one channel (such as MMM) relative to another market channel (such as the traditional channel).

The second is the addition of fixed cost thresholds to the agricultural supply function, as in Holloway et al. (2005). This is analogous to the threshold adoption model literature (see Aker et al. 2005). The fixed costs can be fixed transactions costs or quasi-fixed capital thresholds.

Econometric Specification. We estimate the probability of market channel participation using the (well-known) probit model for the regression of channel choice (with a binary variable, one for choice of MMM versus zero for choice of traditional channel) on regressors. The latter are chosen broadly informed by the above conceptual model that has the categories of regressors: (1) output and input prices; (2) risk; (3) assets and other exogenous production shifters, which also reflect threshold or fixed costs; and (4) transaction costs (fixed and proportional). Because this is a small sample and a cross section in a relatively small geographical area, price and market risk variation was small over space and thus prices were not used in the regression. The regressors used are the following, with the expected sign in parentheses; the observation is for 2005 unless noted; observations were included lagged if endogeneity were a potential issue.

Assets:

(1) An index for holdings of quasi fixed productive capital, the lagged observation for 2000, the year before the emergence of the MMM according to the RRMA (positive); the variable is constructed by summing the holdings of these assets (motorized cart, tractor, small trucks, cars, sorting machine, spray pumps (manual or motorized), weed-whacker, sorting table, field-warehouse) using index prices with base being the tractor price.

(2) overall farm area in 2000 (positive);

(3) age of the household head (positive);

(4) household head is female (negative);

(5) years of experience of the household head (positive);

(6) size of the household (positive, as own-labor endowment)

(7) irrigated farm land in 2000 (positive);

(8) holdings of livestock in 2000 (positive, to finance investments and reduce risk sensitivity to entering new markets)

(9) education of the household head (positive); these are binary variables for completed elementary or some high school; complete high school or higher education; the intercept is some elementary education or no education).

Transaction costs:

(1) distance of the farm to a paved road (negative);

(2) membership in guava producer organization in 2000 (positive)

(3) whether the producer is located in "more commercially developed districts" or "less commercially developed districts in the eastern region, with intercept the central region;

Regression Results. Table 4 shows determinants of market channel choice. Several results are statistically significant.

First, the most striking result with respect to the debate in the literature is that farm size has a significant effect, but only in the relatively underdeveloped market region (the Center). In the East, farm size is not significant. The latter could be because the market is "thicker", with a higher density of wholesalers with larger trucks, combined with good road infrastructure, that reduces the importance of reducing transaction costs by finding the larger (but still small scale) farms, as is the practice in the Central Region. That explanation may be further corroborated by the significance of the variable concerning sub-region location: being located in the commercially more-developed sub-region in the East increases the probability of participating in the MMM.

Second, households with more quasi-fixed capital assets have a higher probability of participating in the MMM. The effect is non-linear, allowing for diminishing returns on quasi-fixed capital assets, as expected. This could be interpreted as implying the existence of a threshold of quasi-fixed capital assets that is needed to access MMM. This is reasonable because the majority of these assets are useful to meet requirements that the MMM imposes (beyond those imposed by traditional channels): delivery (trucks, cars), grading and packing (warehouse, sorting table, sorters), and quality control in the orchards (cart spay pumps, weed-whacker).

Third, there is a negative relationship between participation in MMM and distance to paved roads, indicating that farmers and wholesalers in the MMM are sensitive to transaction costs. This effect is non-linear, i.e., beyond a certain distance, the marginal negative effect of the

extra kilometer is less important. This also suggests a threshold transaction-cost effect on participating in MMM.

Finally, note that participation in guava producer organizations is not significant. This tentatively suggests a corroboration of our RRMA finding that these organizations are for the most part not playing substantive roles (neither bulking nor transporting nor marketing) but rather are mere formalities to access funds. Recall that roughly a third of the farmers are in the guava producer organizations. But almost no farmers market their guava through the organizations, and few receive services from them.

(b) Technology Correlates of Market Channel Participation

Conceptual Model and Econometric Specification. To measure the technological differences among the producers who sell to different channels, the production functions of the two groups were estimated and compared. We use a log-log production function:

$$Y_i = \beta_o * X_1^{\beta_1} * X_2^{\beta_2} * X_3^{\beta_3} ..... * X_k^{\beta_k} \ , \qquad (3)$$

where

Y represents the total guava production in 2005 of each producer (i = 1, …, 268);

X is the set of the inputs used in 2005, as follows:

(1) Area to guava;

(2) quasi-fixed capital (defined in the same way as above);

(3) labor (aggregated over tasks, weighting by wage per task) to guava production;

(4) chemical fertilizers (aggregated over types, weighting by price) to guava;

(5) other chemical inputs (fungicides, herbicides, and insecticides) (aggregated over types, weighting by price);

Z is the set of other exogenous shifters in the production function, as follows:

(1) age of trees in the orchards;

(2) tree density in the orchards;

(3) farm location (in high or low commercial districts of the Eastern region, with the intercept the Central region),

(4) soil type (sandy, clay, lime, with the intercept loam).

As the production function is estimated separately for each of the two strata, there is endogenous stratification. To control for the conditional probability of a farmer being in a particular (endogenous) stratum, the inverse Mills ratio (IMR) is included as a regressor in the production function regression. The IMR is calculated (for each farmer) from the market channel regression, the first stage as in the Heckman (1979) two-stage method. To correct for the slight over-sampling from the Central Region, we used weighted regressions (WESML) as in for example Pitt and Khandker (1998). As in the market channel regressions, we tested each variable for endogeneity (and rejected it) using the test from Rivers and Vuong (1988). The coefficients were compared using a Chow test. The latter test works under the homoskedasticity assumption; thus we performed the Breusch-Pagan, testing for heteroskedasticity, which was rejected at a 10% significant level. The Chow test confirmed a structural difference between the two groups' technologies. A Cobb-Douglas functional form was used because of the small sample, after having tested alternative forms. Constant returns to scale was tested for and not rejected.

Regression Results and Analysis of Allocative Efficiency. The production function estimations are presented in Table 5. The production function regressions show that the technical elasticity (the coefficients in the Cobb-Douglas) for labor is lower for traditional channel farmers, explained by diminishing marginal retailers combined with their already using much more labor per ha than the MMM farmers. By contrast, for reasons analogous to the labor result,

the land coefficient is higher for traditional farmers. No comparison was possible for quasi-fixed capital or chemical inputs or fertilizer because several coefficients were insignificant.

From the production functions significant coefficients and sample averages, plus average prices, we calculated the marginal value products (MVPs) of the factors that had significant coefficients in the production function (labor, quasi-fixed capital, and land) and show them and the market prices for those factors in Table 6. Economic theory holds that utility-maximizing, factor-allocative efficient households equate the MVP of a factor to its prevailing market price. If the MVP of the factor is above its price (for a given household), the household could profitably use more of the factor, and with diminishing returns, would use more until its MVP dropped to equal the factor price.

However, Barrett et al. (2008: 3) note: "An extensive literature suggests, however, that in the presence of multiple market failures (e.g., land and insurance) households' marginal valuation of factors of production routinely deviates from prevailing market prices in a structurally predictable manner." From an allocative efficiency viewpoint, the farmer would be "under-using" the factor. The converse is interpreted as the farmer "over-using" the factor. For example, Carter and Wiebe (1990) show that smaller Kenyan farmers (relative to large farmers) under-use capital and over-use labor. They interpret that as being a constraint on access to capital, and a constraint on sale of labor. That deviation is potentially due to idiosyncratic market failure or simple allocative inefficiency. One might observe the deviation of MVP from the factor price, but the farmer is rationally allocating capital, because of price or yield risk, factor market search or transaction costs, non-cooperative intra-household factor allocation, and work location preferences (Barrett et al. 2008; Skoufias 1994) and constraints on access to capital ex post (Carter and Wiebe 1990). It is beyond the scope of our analysis to analyze the determinants

for the gap between MVP and the factor price, and thus cannot tell whether it is driven by factors internal to the households, or market characteristics, or both. The analysis of the causes for the gap is left to future research on the nature of the factor and output markets. Following Barrett et al. (2008), we purely descriptively call the gap "allocative inefficiency" and thus do not imply that farmers are not welfare-maximizing (as evidence of the gap does not imply that) nor any shortfall of managerial capacity.

We note the results and, informed by the above conceptual discussion, hypothesize reasons for them. (1) First, the MVP of labor is higher than the wage – but only for MMM farmers, possibly implying that there is a labor constraint for that group. This could be because of the labor requirements associated with quality assurance for the MMM channel, coupled with what appears to be "tautness" in the Michoacán labor market (due to the state's being a main supplier of migrant labor to the US as well as competition from other labor-intensive fruit and vegetable crops and sugarcane). (2) The MVP of capital exceeds the quasi-fixed capital price for MMM farmers. This possibly implies that they are also quasi-fixed capital-constrained. (3) The MVP of one hectare of land under guava production is above the factor cost (proxied by the rental price) for both strata. This has the possible implication of a land constraint. The results thus identify interesting hypotheses that require further research.

4. CONCLUSIONS AND POLICY IMPLICATIONS

This paper sought to contribute to the debate about whether small farmers access modern markets, in particular fresh produce growers and domestic supermarkets in developing countries.

The focus was on a very perishable "niche" fruit (guava) in Mexico (a relatively advanced case of supermarket diffusion). Several key points emerge from the analysis.

First, up to present supermarkets in Mexico are procuring guavas from the wholesale system. Direct procurement from farmers has so far not been widespread or successful although the trend points to a continuation of efforts to pursue it. This is partly due to small farmers organizations in horticulture areas in Mexico generally being mere conduits for government subsidies, and not offering substantial services of bulking, transport, credit, cold chain, sorting, and other collective assets that are required by modern market channels. The findings here imply that development programs' fomenting organizational approaches that provide these collective assets will be useful to help farmers to access modern markets.

Second, the wholesale system for guava is itself transforming – with consolidation and differentiation in the Mexico City wholesale market (one of the largest in the world) from wholesalers sourcing from traditional field brokers toward large wholesalers starting to buy direct from farmers and specialized supermarket agents emerging. The wholesale sector is also transforming in the rural area, with a rapid shift in only a half decade from a system dominated nearly exclusively by traditional small field brokers (coyotes) to large wholesalers from the local area, Mexico City, and other large cities. (There is evidence of similar rural wholesale sector transformations in other dynamic horticulture areas in Asia; for the Indonesian case see Natawidjaja et al. 2007, Huang et al. 2007 in China, and in Central America, see Hernandez et al. 2007.) The findings here imply that it would be fruitful to explore policies and programs to attract and promote modern wholesale market and sector development both at the consumer-market level, but also in the production areas.

Third, the differences over regions are crucial to modern market participation by farmers. The East region (the more market-developed region) built on its earlier horticultural booms and has more developed wholesale systems and technical assistance. The Central Region is well behind in market transformation. The farmer's region, controlling for the farm characteristics, played a role in modern market access. This result contributes an empirical case to the emerging literature on "territorial development strategies" (Schejtman and Berdegué, 2003). The results here imply that farm-level, and even cooperative level programs are necessary but not sufficient to help farmers' access modern markets. A regional territorial development approach can be an important complement.

Fourth, an important result is that while, overall, farm size has an effect on modern market channel participation that must be qualified in two ways. On the one hand, the whole sample is of small farms, so small farms are participating in the modern channel. However, there is a differentiation of farm size with in the category of small farms. In the Central Region (where market development and transformation is the least), only the larger small-farmers sell to modern channels. In the market-developed Eastern Region, no size differential effect is significant. The regional difference thus conditions the farm size effect.

Fifth, controlling for farm size, quasi-fixed productive assets count a lot in determining modern channel participation. This echoes findings in the extant published literature on produce growers and domestic supermarkets cited in the introduction. There is indirect evidence in our paper that own-liquidity sources, in particular past high-value product activities (horticulture and livestock) as well as migration, figure prominently in funding investment in productive assets – while credit does not. However, farmers without the own-liquidity sources to make these investments are in turn constrained in access modern channels. That implies that financial

services access is an important future research and policy agenda item for these dynamic horticultural areas.

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Table 1. Guava Farm Household Characteristics by Guava Region of Michoacán, 2005.

	East Region		Central Region		Total		Signif.-test[1]
Number of Observations (households)	**232**		**66**		**298**		
Variable	**Mean**	**CV**	**Mean**	**CV**	**Mean**	**CV**	
1. Household Characteristics							
Farm size (all crops) (ha)	4.2	0.90	3.3	0.89	4.0	0.90	*
Farm has "Ejido" land tenure (0/1)	0.94	0.25	0.95	0.22	0.94	0.25	
Distance of farm to paved road (km)	2.1	1.72	5.0	1.14	2.8	1.58	***
Farmers with no or incomplete primary education (0/1)	0.53	0.95	0.56	0.89	0.53	0.94	
Household dependency ratio (number of persons below 15 and above 65 divided by total)	0.28	1.68	0.48	1.50	0.32	1.67	***
Member of *Ejido* organization (0/1)	0.87	0.39	0.85	0.43	0.86	0.40	
Member of local phytosanitary organization (0/1)	0.81	0.48	0.65	0.74	0.78	0.54	***
Member of guava producers organization (0/1)	0.30	1.52	0.64	0.76	0.38	1.29	***
Number of migrant household members	1.1	1.43	1.8	1.09	1.3	1.34	***
2. Guava farming characteristics							
Total guava area of the farm (ha)	3.0	0.78	1.8	0.75	2.7	0.81	***
Household members working in own-production of guava (number)	1.5	0.68	2.7	0.54	1.7	0.70	***
Number of orchards (guava plots) in the farm	1.4	0.49	1.6	0.57	1.4	0.52	**
Average Orchard age (years)	8.3	0.42	4.1	0.53	7.4	0.50	***
Experience in guava farming (years)	9.5	0.49	5.4	0.74	8.6	0.56	***
Guava orchard yield (kg/ha)	17,289	0.70	9,030	0.98	15,564	0.77	***
Share of orchards irrigated (%)	100	0.09	100	0.00	101	0.08	
Farmers who bought their guava land (0/1)	0.26	1.68	0.34	1.41	0.28	1.62	
Guava orchard financed by:							
a) Income from other crops (0/1)	0.36	1.33	0.58	0.86	0.41	1.20	***
b) Sales of cattle (0/1)	0.31	1.48	0.23	1.86	0.30	1.55	
c) Remittances from migrants (0/1)	0.21	1.94	0.24	1.78	0.22	1.90	
Source of technical assistance:							
a) Farm input suppliers (0/1)	0.54	0.93	0.27	1.65	0.48	1.04	***
b) Other farmers (0/1)	0.44	1.13	0.47	1.07	0.45	1.12	
c) Government-supported services (0/1)	0.52	0.96	0.42	1.17	0.50	1.00	

(1) T-test between East and Central regions: * = significant at 10%, ** = at 5%, *** at 1%; and "---" when the test was not possible to compute because of insufficient observations.

Table 2. Patterns in Guava Marketing by Farmers in the Eastern and Central Regions

Variable	East		Central		Total		T-test[1]
	Mean	CV	Mean	CV	Mean	CV	
Average sales of guava per farm (Kg)	52,521	1.13	18,803	1.55	45,477	1.23	***
1. How guava sold:							
Before harvesting (0/1)	0.16	3.38	0	---	0.15	3.83	---
Packed ungraded (0/1)	0.10	4.03	0.42	1.79	0.13	3.42	***
Packed graded (0/1)	0.74	1.50	0.58	2.59	0.72	1.65	***
Price of Guava sold:							
Before harvesting (US$/Kg)	0.21	0.30	---	---	0.21	0.30	---
Packed graded (US$/Kg)	0.40	0.74	0.20	0.18	0.28	0.75	***
Packed ungraded (US$/Kg)	0.29	0.49	0.23	0.15	0.28	0.48	*
2. At what quality grades guava sold:							
Super extra (avg. of % of guava per farm)	13	2.03	2	4.45	12	2.31	***
Extra (%)	27	1.92	21	3.49	26	2.11	**
First (%)	47	1.70	62	3.30	48	1.88	***
Second (%)	13	1.77	15	2.00	13	1.89	***
Price of graded guava:							
Super extra (US$/Kg) (the highest quality)	0.41	0.62	0.19	0.22	0.40	0.63	*
Extra (US$/Kg)	0.33	0.45	0.22	0.19	0.32	0.46	***
First (US$/Kg)	0.27	0.48	0.21	0.16	0.26	0.47	***
Second (US$/Kg) (the lowest quality)	0.15	0.54	0.20	0.21	0.16	0.50	***
3. To whom (first-buyer) guava sold:							
Marketed by farmer him/herself (% of guava)	8	5.62	3	5.96	8	6.16	***
Local transporter (%)	18	3.26	13	4.10	18	3.49	***
Local broker (%)	21	2.92	38	2.31	23	2.91	***
Local wholesaler (%)	13	3.76	4	4.36	12	4.14	***
Non-local wholesaler (%)	39	2.12	37	3.55	39	2.29	
Broker for supermarket (%)	0	15.20	2	4.96	1	12.56	---
Guava producers organization (%)	0	---	3	4.76	0	10.59	---
Price of graded guava sold to first-buyer:							
Marketed by farmer him/herself (US$/Kg)	0.31	0.43	0.25	0.12	0.30	0.42	**
Local transporter (US$/Kg)	0.27	0.53	0.18	0.10	0.26	0.53	*
Local broker (US$/Kg)	0.24	0.38	0.20	0.16	0.22	0.34	
Local wholesaler (US$/Kg)	0.22	0.33	0.23	0.09	0.22	0.31	
Non-local wholesaler (US$/Kg)	0.34	0.60	0.21	0.20	0.32	0.61	**
Broker for supermarket (US$/Kg)	---	---	0.25	0.24	0.25	0.24	---
Guava producers organization (US$/Kg)	---	---	0.23	0.29	0.23	0.29	---
4. Where (farmer says) first-buyer sells:							
Local market (avg of % of guava per farm)	13	1.00	42	0.88	15	1.36	***
Mexico City (%)	57	1.00	3	0.21	54	1.01	***
Other main city in Central Mexico (%)	23	0.83	50	1.06	25	0.95	***
Other main city in Northern Mexico (%)	7	1.23	4	---	7	1.26	---
Price of graded packed guava sold in:							
Local market (US$/Kg)	0.29	0.89	0.22	0.16	0.25	0.77	**
Mexico City (US$/Kg)	0.27	0.46	0.25	0.19	0.27	0.46	

(1) T-test between East and Central regions: * = significant at 10%, ** = at 5%, *** at 1%; and "---" means insufficient observations. The processor category was cut due to no cases.

Table 3. Cluster analysis on market channel

Variable (sample average per farm)	Traditional	MMM	Total	T-test[1]
Number of producers in cluster (Channel)	154	137	291	NA
Guava sold to modern channels (%)	3.3	0.96	52	**
Central Region farmers distribution over clusters (%)	63	37	100	
East Region farmers distribution over clusters (%)	50	50	100	
a) Assets				
Farm size (Has) (all crop land, plus bushland and pastures)	3.9	4.2	4.0	
Guava share in farm area	0.75	.80	0.78	
Maize share in farm area	0.12	0.1	0.10	
Total Guava area (ha)	2.6	3.0	2.8	**
Producer (household head) experience (years)	8.3	9.1	8.7	
Producer (household head) education (years)	1.8	2.0	1.9	
Distance to paved road (Kms)	3	2.3	3	
Index of value of quasi-fixed capital	52	74	63	**
Receives technical assistance (TA) (Yes=1)	0.84	1.0	0.87	**
TA from Government (yes=1)	0.39	0.6	0.51	**
TA from input suppliers (yes=1)	0.43	0.6	0.49	**
TA from producer organizations (yes=1)	0.14	0.2	0.16	
Membership in Guava Producer org.. (yes=1)	0.36	0.4	0.37	**
Membership in Local Phytosanitary Org. (0/1)	0.71	0.9	78	**
Received credit (Yes=1)	0.33	0.34	0.33	
Source of own-finance for initial investment in guava				
Income from other crops (yes=1)	0.36	0.46	0.41	**
.. from Livestock sales (yes=1)	0.25	0.34	0.30	**
… from Migrant remittances (yes=1)	0.20	0.23	0.22	
b) Output, quality, yields, costs, net income, profits				
Total production per farm (Kg)	40,308	51,660	45,633	**
Yield (Kg/ha)	14,549	16,819	15616	
Quality ratio (super extra + extra / total)	0.37	0.41	0.39	
Sold Packaged graded (0/1)	65	0.70	67	
Average Guava price (US$/Kg)	0.24	0.28	0.27	*
Value of output (US$/Ha)	3644	4925	4249	**
Total cost of guava including family labor (US$/ha)	2934	2480	2718	**
Total cost of guava excluding family labor (US$/ha)	1691	1391	1555	
a) Total Cost of Labor (US$/Ha)	1462	1299	1384	**
Labor cost in pre-harvest activities (US$/ha)	671	605	640	**
Labor cost in harvest activities (US$/ha)	790	744	769	**
(hired labor costs (%))	0.15	0.16	0.16	
b) Non-Labor variables inputs (US$/Ha)	884	693	794	
Cost of fertilizers (US$/Ha)	367	259	316	
Cost of chemicals (US$/Ha)	518	434	478	
c) Packing (US$/Ha)	526	449	489	
d) Transport (US$/Ha)	62	39	51	*
Guava income (output – all variable costs except family labor) (US$/ha)	1953	3534	2694	
Profits (Household guava income – the imputed value of family labor) (US$/Ha)	710	1560	1531	*

(1): ** = T-test significant at 5%, * at 10%

Table 4. Probit estimation of determinants of access to more modern market channel

Variable	Coefficient	(SE)	Significance
Lagged guava area in the East region (hectares)	-0.025	0.056	
Lagged guava area in the Center region (hectares)	0.510	0.220	**
Age of producer (years)	-0.007	0.008	
Household head is female (yes =1. no=0)	-0.042	0.437	
Household head experience (years)	-0.025	0.022	
Household size (units)	-0.063	0.078	
Distance to paved road (kms)	-0.120	0.075	*
Distance to paved road squared	0.010	0.005	**
Lagged membership in guava producers' organization (yes=1, no=0)	0.179	0.199	
Lagged irrigation (yes=1, no=0)	-0.214	0.448	
Lagged livestock (yes=1, no=0)	0.112	0.192	
Lagged capital assets index	0.012	0.006	**
Lagged capital assets index squared	-5.9E-05	3.0E-05	**
Producer is located in high commercial east districts (yes=1, no=0)	1.322	0.447	***
Producer is located in low commercial east districts (yes=1, no=0)	0.656	0.463	
Producer education level is elementary school or less(yes=1, no=0)	0.025	0.216	
Producer education level is middle school, high school or technical (yes=1, no=0)	-0.099	0.291	
Constant	0.149	1.838	
Observations	270		
Wald chi2	40.130		
Prob>chi2	0.010		

*,**,*** = Statistically significant at 10,5,1% significant level.

Table 5 Production Function Estimates

	More Modern Market			More Traditional Market		
Variable	Coefficient	(SE)	Significance	Coefficient	(SE)	Significance
LN of Labor	0.523	0.148	***	0.275	0.125	**
LN of fertilizers	0.005	0.022		0.015	0.022	
LN of chemical inputs	-0.002	0.068		-0.048	0.071	
LN of quasi-fixed capital	0.197	0.069	***	0.019	0.057	
LN of size of guava orchard	0.448	0.163	***	0.840	0.148	***
LN of age of trees	0.445	0.168	***	0.509	0.134	***
LN of tree density	-0.158	0.228		0.709	0.209	***
Producer is located in high commercial east districts (yes=1, no=0)	-0.069	0.304		0.338	0.259	
Producer is located in low commercial east districts (yes=1, no=0)	-0.291	0.307		0.314	0.217	
Soil – sandy	0.383	0.275		-0.386	0.242	
Soil – clay	-0.136	0.282		-0.013	0.238	
Soil – lime	0.024	0.245		-0.224	0.215	
Inverse Mills Ratio	-0.049	0.348		0.072	0.215	
Constant	6.323	1.329		2.794	1.215	
Observations	123			145		
R squared	0.677			0.696		
F statistic	17.59			23.06		
Prob > F	0.000			0.000		

*,**,*** = Statistically significant at 10,5,1% significant level.

Table 6. Marginal Value Products of Factors versus Factor Market-Prices in Pesos

	More Modern Market				More Traditional Market			
	MVP		Factor cost		MVP		Factor cost	
Labor (unit)	$ 20.55	>	$ 9.85		$ 6.78	<	$ 9.85	
Fixed capital (cost)	$ 40.55	>	$ 36.81					
Land (hectares)	$ 2,265	>	$ 185		$ 3,218	>	$ 185	