

The Role of Certification in the Brazilian Fruit Chain

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Abstract. Concerns about food safety and standards in the developed countries, particularly in Europe and the United States have made certification inevitable for worldwide fruit producers who target such export markets. The fact that certification is demanded by final consumers is increasingly making buyers, retailers and wholesalers buy certified products from the producers. For the fruit industry in Brazil, certification has important consequences as it ensures access to export markets. Using primary data obtained from interviews with 303 small, medium and large mango and grape producers in the regions of Juazeiro/BA and Petrolina/PE in Brazil, this paper aims at assessing the determinants of demand for certification among mango and grape producers. Empirical analysis using a logit model shows that grapes farmers have higher likelihood for certification than mango growers. The farmer's education level and years of experience producing fruits are the major positive determinants for certification. The factors which decrease the chances to adopt certification are small size of the farm, non-agricultural income, awareness and trust type of arrangement.

Keywords: Certification, fruits, logit model

1. Introduction

Several crisis and scandals (e.g. Bovine Spongiform Encephalopathy (BSE)) have shaken the European food sector over the last decade. In spite of regulations and government control, most of the cases were not detected until the crises occurred, consequently leading to a decline in consumer's confidence in the safety and quality of many food products (Hobbs, Fearn & Spriggs, 2002). As a result, many EU countries developed consumer protection strategies such as new quality labels based on neutral control throughout the value chain. Primarily, the labeling approaches seemed to be an adequate policy tool as they ensured high quality food and at the same time, relieved public authorities of an additional financial burden (Caswell & Mojduska, 1996).

Consumer concerns about food safety have led to an increased demand for information and transparency in food chains and have acted as the major driver for the development of traceability systems (Jahn, Schramm & Spiller, 2004b). Of particular concern is the potential impact of food safety standards on the ability of developing countries to both gain and maintain access to markets from high-value agricultural and food products, especially in industrialized countries. In part this reflects the growth of these standards, but also a more widespread recognition of the degree and manner in which trade flows can be affected. The greatest concerns are in the case of low-income countries, given their typically weaker food safety and quality management capacities, which might make efforts towards export-led agricultural diversification and rural development (Henson & Jaffee, 2007).

According to the Brazilian Fruit Institute (IBRAF, 2005), fruit exports to the European Union have been important for Brazil as they represent about 62 percent of the total fruit exports in 2005. The exports to the U.S. constituted only 4 percent of the total fruit exports in 2005. Figures from the same institution show that the production and area for mangoes and grapes in Juazeiro/Petrolina/BA regions is quite high. The total area produced in those regions in 2005 was 155 million hectares while the volume harvested was around 260 thousand tons of grapes and 550 thousand tons of mangoes.

The objective of this study is to identify the determinants of certification among mango and grape producers in Brazil. In particular, the study assesses whether there are significant differences in the characteristics between mango and grape producers and whether the impact of the determinants of certification are the same for mango and grape farmers. The paper is structured as follows: after this introductory section, some recent studies will be reviewed in the second section. Section 3 presents the primary database and methods applied for analysis by outlining the logit model used in the study. Section 4 presents the results which will be followed by the final Section with the main conclusions and policy implications.

2. Literature review

Similarly, "certification is the (voluntary) assessment and approval by an (accredited) party on an (accredited) standard" (Meuwissen et al., 2003:54). Schiefer (2003:4) mentions that "sustainable and effective certification must allow clearly identifiable segmentation through e.g., branding of products from clearly specified supply chains".

Standards can act to impede exports either because explicit bans are placed on imports of particular products or the cost of compliance with requirements diminishes export competitiveness. Thus, standards can be a source of competitive advantage for developing countries. However, the key is their ability to upgrade capacity and make the necessary adjustments in the structure and operation of their supply chains. For many high-value foods (including fruit and vegetables) the challenges of international competitiveness have moved beyond price and basic quality parameters to greater emphasis on food safety. Indeed, rising standards serve to accentuate underlying supply chain strengths and weaknesses and thus affect the competitive positions of countries and distinct market participants (Henson & Jaffee, 2004). While there is a great deal of literature on the role of certification in the international fruit export market, only a few studies have concentrated on certification in the Brazilian fruit production. Among them, Cintra et. al (2002) focus on the impact of certification adoption by mango and grape farmers in the Sao Francisco Valley. The results show that the process is considered advanced, if compared to the remaining exporter regions in the country and its adherence has not caused drastic changes in their productive system. Additionally, the producers seem to be aware of quality and food safety standards demanded by the international market. Producers having a certificate are preferred when buyers and traders are selected as potential exporters.

Vitti & Cintra (2003) mention that 2003 was the beginning of the discussions at the national level regarding the increasing concern on issues like food safety, security standards, contaminants and regulations already known at the international market. Supermarkets in the EU would start to require the certificate GlobalGAP from Brazilian fruit exporters at the end of the year aiming to meet the Good Agricultural Practices (GAP). Regarding this concern, the Ministry of Agriculture, Livestock and Food Supply (MAPA) began to develop the Integrated Fruit Production (PIF) certification system as a response to increase the share of national fruits at an international level. Cavichioli et. al (2005) highlighted that certification is considered a passport to access international markets. The authors' analysis relates to responses of fruit

producers in different regions in Brazil regarding positive and negative aspects of having certification.

Dörr & Marques (2005) conducted three case studies on Brazilian companies that export apples to the EU with the objective of gaining a better understanding on the production of these fruits. It was observed that the challenge of the sector is to ensure that the fruit is acceptable to the European consumers. The biggest problem the companies face is to export the fruit through consignment apart from attending to the clients' requirements. These requirements are certification, quality programs, the maximum residual of pesticides allowed, sanitation, hygiene, traceability, among others. According to Frutas e Derivados (2007) the benefits of having certification include (i) the enrichment in terms of the experience by the producer, (ii) better farm organization, (iii) training, among others. It could be possible that the short run economic analysis between investments and benefits of a certification process cannot capture all gains in terms of productivity, efficiency, lesser environmental damages, concern about consumers' health etc, which are maintained in the long term. Nevertheless, certification guarantees quality and traceability, which enables Brazilian fruit producers to reach new international markets. However, it is not the guarantee for receiving higher prices.

3. Data and methods

3.1. Data collection

A survey of 303 farmers was conducted between July and October 2006 in the Sao Francisco Valley, on the surroundings of Petrolina (state of Pernambuco) and Juazeiro (state of Bahia) in Brazil. A multi-stage sampling procedure was used: first, the two regions were purposely sampled because they are the leading producers of grapes and mangoes. The next step involved using a two-stage stratified sampling technique as outlined by Levy & Lameshow (1999). The first stratum included small (<12 ha), medium (>13 and <49) and large producers (>50 ha) in each of the two regions.

The final step involved the identification of producers with certification, without certification and those in the process of becoming certified. A total of 18 strata from which the data was collected were identified. The sample size of each stratum was calculated using the program Russlenth¹ (power =1). For the purpose of this paper, producers without certification and those in process were considered as one group (82 percent or 249) and certified producers as another (18 percent or 54). For the quantitative analysis of the descriptive statistics in this survey, t-test and the correlation analysis have been applied at 90% confidence level. All quantitative analysis were performed using SPSS software. Regarding the empirical analysis applied to mango and grapes, the STATA software was used. The analysis involved the use of logistic regression, i.e., an econometric analysis involving a dependent variable that signals a probability condition. The probability of adoption was measured using a set of independent variables that were hypothesized to be relevant in the context of this study.

4. Results and discussions

Descriptive Analysis

The descriptive analysis focuses on the differences and similarities between certified and non-certified producers. It is structured according to the characteristics of the producers and their farms and trading. Regarding education, it was expected that certified producers would have more years of schooling than the non-certified ones. However, the results reveal the opposite: on average certified producers presented 7.7 years of schooling compared to 8.7 of non-

¹ Available on the website: <http://www.cs.uiowa.edu/~rlenth/Power/>

certified farmers. The amount of years of experience producing fruits can lead the producers to decide whether certification is adopted or not. It is expected that certified producers have more years of experience than non-certified ones. The figures show that certified producers have, on average, 7.3 years of experience in grapes and 9.2 years in mangoes production while non-certified producers have only 5 years and 7.5 years respectively.

Regarding the farm characteristics, the survey also collected data from all producers considering the production cost (kg/ha), ha, volume (kg) and price sold (kg). With these variables, it was possible to calculate net income through the total revenue and total cost, as well as the productivity using the volume produced and the area in hectares of each fruit. Besides, data on land dimension, type of irrigation system and labor intensity were also collected.

The productivity of mangos is, on average, 19.7 tons per hectare and 26.9 tons per ha for non-certified and certified producers respectively. Concerning grapes, the productivity for non-certified producers is nearly 17 tons per hectare, while the certified ones present 23 tons per hectare. Regarding the average net income of grapes, it was found around R\$138,462¹ for non-certified farmers and R\$ 281,977 for the certified ones.

Concerning mangoes, the average net income is approximately R\$ 71,067 for non-certified farmers and R\$ 752,882 for certified ones. The results show a significant difference between both groups.

The results related to the number of years the producers have been selling to a specific buyer, either individually (directly to a buyer, middleman, and exporter company) or to a group, such as a cooperative or an association, were also analyzed. The non-certified producers have been operating with their respective buyers for an average of 6.5 years, while the certified ones on average only 3.2 years. Moreover, the type of relationship between producer and buyer can be divided into three categories: written contracts; verbal contracts with trust; and verbal contracts only. In the study it was expected that producers who are certified would have more written contracts than the producers without certification.

However, the findings are contrary to our expectations. In particular, almost 87 percent of certified farmers and 73 percent of non-certified reported dealing with the buyer through a verbal trust contract². Further, about 24 percent of non-certified producers have a mere verbal contract with the buyer and surprisingly, only 13 percent of certified producers have a formal written contract.

Estimation procedures

Logistic regression is used to investigate the determinants of the producers' decisions whether they certify or not. The decision may be influenced by a range of different variables. Thus the logistic model is used for the analysis of binary responses and allows one to examine how a change in any independent variable changes all the outcome probabilities (Hosmer and Lemeshow, 2000). In general, the results are reasonably robust to changes in the set of independent variables included in the regression.

The analysis also includes the Hosmer-Lemeshow goodness-of-fit test and the model discrimination assessed by examining the area under the Receiver Operating Characteristics (ROC) curve. The area under the ROC curve measures the likelihood that the predicted coefficient will be higher for observations where the outcome of interest is observed than for observations where the outcome is not observed. The last test conducted was the link test,

¹ 1US\$ = R\$2 at the time of data collection

² The verbal contract with trust relates to settlements, between producer and buyer, after a certain number of successful negotiations.

which is used to detect a specification error. It was issued after running the logistic regression (STATA, 2003).

Econometric results

The logistic regression results from the econometric analysis (odds ratio, standard deviation, p-values and 95% confidence intervals) for grapes are presented in Table 1 and for mangoes in Table 2. The dependent variable is a dummy variable reflecting the decision of the producer to adopt certification or not. The results reveal that the adjusted Wald test for the model indicates that it is highly significant at 1 percent level. The R^2 is 0.13 and 0.14 for grapes and mangoes respectively. Thus the Hosmer-Lemeshow test shows that both models present a good fit.

The area under the ROC curve for the regressions is 0.75 for both cases, which reveals that the model presents adequate discrimination. Likewise, the link test presents results according to the expectations meaning that the model does not have relevant omitted variables. The correlation tables have shown that there is no case of coefficient higher than 0.4. Although the Hausman test revealed that the variable productivity is exogenous but not significant. The decision whether to certify or not is discussed below.

The first variable to be analyzed is the type of fruit that farmers have been harvesting. Comparing the results of mango and grapes farmers, mango and grapes present an odd ratio of 0.43 and 2.05, statistically significant at 1 and 5 percent level. The results indicate that producers have 2 times more chances to certify if they are grapes growers. Producers with higher level of education are more likely to adopt certification.

The odds are the same for both fruits: 1.08 and also the differences between the groups are highly significant. This is not consistent with the findings of Hattam & Holloway (2005)¹ where their education variable was found to have a negative influence and in their case, not significant on the adoption decision of small-scale producers of avocado.

The small size of the farm of mango and grapes growers have an odd ratio of 0.50, which means that those farmers have 2 times more chances to adopt certification if they have a medium or large land size. Due to both economies of scale and the cost to certify compared to the returns, farmers do not have an incentive to certify.

Thus the dependence on the income obtained from non-agricultural sectors has also a negative impact on the decision. It indicates that the higher the dependence on non-agricultural income, the less specialized they are. According to the expectations, more experienced farmers have more chances to certify.

Having a sophisticated type of irrigation system shows a positive effect, although it is insignificant. An explanation could be that an irrigation system is simply needed in the surveyed region due to climate and soil conditions.

The awareness of certification by both set of farmers play a negative significant role. The odds ratio of 0.29 indicates that farmers who were informed through cooperatives, associations and individual buyers have lower chances to certify at 5 percent level. The contract arrangement based on trust also contributes to decrease the level of producers to certify. The uncertainty of favourable arrangements and payment conditions may influence the decision making.

¹ A similar model was employed by Hattam & Holloway (2005) in their study on the determinants of organic certification among small Mexican producers of avocado.

Table 1. Logistic regression results on the certification decision for mangoes producers

Variables	Odds ratio	Robust Std. Err.	Z	P> z	95% CI	
Mango	0.438	0.135	-2.66	0.008***	0.239	0.804
Gender	1.180	0.440	0.44	0.657	0.568	2.450
Education	1.088	0.333	2.78	0.005***	1.025	1.155
Manager	1.088	0.377	0.24	0.807	0.552	2.146
Size	0.509	0.157	-2.18	0.029**	0.278	0.934
Non_agri_income	0.406	0.142	-2.57	0.010***	0.204	0.807
Years_experience	1.104	0.040	2.70	0.007***	1.027	1.187
Type_irrigation	1.037	0.327	0.12	0.908	0.559	1.924
Irrigated_area	0.540	0.294	-1.13	0.258	0.185	1.570
awareness	0.288	0.145	-2.48	0.013**	0.115	0.776
Trust_rel	0.449	0.156	-2.30	0.022**	0.227	0.889

Dependent variable: certified and non-certified producers; n=303

*** Significant at 1% level; ** 5%; * 10%

Adjusted Wald Test

$F(11, 303) = 59.96 \quad p < 0.0000$

Pseudo R2

0.1428

Hosmer-Lemeshow goodness-of-fit test

$\chi^2(9) = 4.53 \quad p < 0.8735$

Area under the ROC curve

0.7514

Source: Own calculations

Table 2. Logistic regression results on the certification decision for grapes producers

Variables	Odds ratio	Robust Std. Err.	z	P> z	95% CI	
Grapes	2.051	0.626	2.36	0.018**	1.128	3.731
Gender	1.204	0.459	0.49	0.626	0.570	2.545
Education	1.085	0.336	2.65	0.008***	1.021	1.154
Manager	1.142	0.392	0.39	0.699	0.582	2.241
Size	0.506	0.155	-2.22	0.026**	0.277	0.923
Non_agri_income	0.378	0.135	-2.72	0.006***	0.188	0.761
Years_experience	1.100	0.041	2.56	0.010***	1.022	1.184
Type_irrigation	1.033	0.324	0.10	0.917	0.558	1.911
Irrigated_area	0.535	0.296	-1.13	0.258	0.180	1.582
awareness	0.298	0.147	-2.44	0.015**	0.113	0.787
Trust_rel	0.455	0.159	-2.25	0.025**	0.229	0.904

Dependent variable: certified and non-certified producers; n=303

*** Significant at 1% level; ** 5%; * 10%

Adjusted Wald Test

$F(11, 303) = 36.39 \quad p < 0.0001$

Pseudo R2

0.1381

Hosmer-Lemeshow goodness-of-fit test

$\chi^2(9) = 3.91 \quad p < 0.9170$

Area under the ROC curve

0.7526

Source: Own calculations

Conclusion and policy recommendations

This paper has shown that while there are marked differences between certified and non-certified producers in some aspects, both groups share some similarities. The descriptive statistics have revealed that there are significant differences between the two groups with

respect to variables divided as characteristics of the farms [area irrigated, productivity, net income for both mangoes and grapes, type of irrigation system, among others]. The marketing channel chosen by the farmers is also highlighted in this study. Non-certified growers are trading with individual buyers while certified ones are trading with groups, associations and cooperatives. The result indicates that both groups of farmers are operating with completely distinct type of buyers which lead them to operate under different contract arrangements.

The econometric analysis has shown that the determinants of the probability to obtain certification have different impact for mangoes and grapes farmers. Based on the results, adoption of certification is driven by key variables. Grapes farmers have higher probability to certify compared to mango growers. Further, the results have shown that the number of years of schooling and years of experience have a positive impact on the probability to have certification. On the contrary, the awareness of farmers as regards certification has a negative effect if they were informed through organizations such as EMBRAPA, SEBRAE and CODEVASF.

Thus the small land size and the income from non-agricultural sectors also have a negative impact to certify. The type of agreements between buyer and farmers based on trust arrangements has a negative effect. Therefore, there is a need to make farmers aware of the losses and the gains comparing this agreement with more restricted ones. Finally, certification excludes the less capable growers from the market, meaning that, the increasing level of requirements per se selects the farmers who are able to comply with them. Cavichioli et al.(2005) highlight that certification is considered a passport to access international markets. In this line, the fruit sector in the Petrolina-Juazeiro regions has a huge potential to grow and expand by accessing new markets and producing new varieties.

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