

## *Full Length Research Paper*

# Comparative Advantage in Regional Agricultural of Guava

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On the state of Michoacán, México Guava production plays a key role among others factors because the incomes that it represents. The guava production chain generates more than two and half million in wages and an important annual gross economic benefit. However, this fruit has not been able to consolidate internationally such as Michoacán avocado. This make extremely important to know if the guava really has comparative advantage, which is the central aim of this work. An important part of the base of comparative advantage was that the production of guava presented acceptable profitability levels, so in this paper also investigated the profitability level in the guava production. In order to answer these questions the Policy Analysis Matrix (PAM) developed by Monke and Pearson (1989) was utilized. The main finding of the paper points to the existence of comparative advantage in the production of Michoacán's guava, allowing stating resources are well used in the production of this fruit because it generates wealth. Guava production is a productive alternative, although there was some degree of vulnerability.

**Keywords:** Comparative advantage, regional production systems, cost-benefit, sustainability.

## INTRODUCTION

The national economy has undergone major changes as a result of new trade relations with the outside world, which has generated a greater proximity between the countries. This proximity has created a more competitive environment so it can be very attractive to some sectors.

More than ever, economists now agree that gains from trade are a key source of national wealth, and that faster growth can be achieved by pursuing activities with greater comparative economic advantages. This applies particularly to the agricultural sector, the opportunity provided by the commercial opening to potential customers around the world (Masters, 1995).

Comparative advantage analysis is a first approximation to generate information that will guide policy and decisions makers and allocate resources to their most productive uses. Therefore the objective of this

study is determinate if the guava crops of Michoacán's region have comparative advantage.

The tool used in order to accomplish the objective is the Policy Analysis Matrix (PAM). These methodology has been applied to several countries (Barichello et al. 1998; Yao 1997; Yao and Tinprapha 1995; Nelson and Panggabean 1991) because involves the derivation of several important indicators of protection and comparative advantage.

## MATERIALS AND METHODS

In many countries have been defining food securities as grain security, bringing policymakers' active interference in grain markets and trade (Crook 1997, 1999). The Policy Analysis Matrix (PAM) is methodology provides a tool for identifying the problems of the production process, with a systematic vision, stretching from the inputs obtaining until the product finally reaches the consumer's hands, this matrix allows us to measure effects on the economy and the effects of the economy in the production system; so it is

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**Table 1.** Policy analysis matrix

| Concept                   | Total income | Production costs |                  | Profits       |
|---------------------------|--------------|------------------|------------------|---------------|
|                           |              | Tradable inputs  | Internal factors | (Net utility) |
| Valued at private prices  | A            | B                | C                | D             |
| Valued at economic prices | E            | F                | G                | H             |
| Policy effects            | I            | J                | K                | L             |

Source: Based on Monke and Pearson (1998).

useful for producing agents, implementers and decision makers (Monke and Pearson, 1989) and (Pearson et al., 1991).

In the PAM are provided two accounting entities:

1. Earnings are measured as the difference between revenue and production costs.

$$Ganancias = \sum P_i X_i - \left[ \sum P_j Y_j + \sum P_k Z_k \right]$$

Where:

Pi: price of product in the domestic market.

Xi: number of tons produced per hectare.

Pj: price of tradable inputs in the domestic market.

J: number of tradable and indirectly tradable inputs applied per acre.

Pk: price of domestic factors in the domestic market.

Zk: number of internal factors applied per acre.

The first accounting identity represented by  $\sum P_i X_i$  (price of the product by the number of tons produced per hectare) represents the producer's income received by harvest a given product, and the second identity represented by  $\sum P_j Y_j + \sum P_k Z_k$  (the sum of the price of tradable inputs by number of tradable inputs and the prices of domestic factors by the number of internal factors, everything in domestic prices) presents the costs borne by the producer in order to reap certain product (Kray, 2002) and (Winter and Aggrey, 2008).

2. Measures the effects of policy and market distortions and is determined by the differences between the private evaluations, i.e. income, gains and costs incurred by the producer, and the economics of revenues, costs and profits (Ramanovich, 2002) (Table 1).

Several coefficients can be determinate from the results of the PAM, such as:

#### A. Nominal Product Protection Coefficient (CPNP)

$$CPNP = \frac{A}{E}$$

This flag is set as the quotient of the product's income at private prices and estimated income at affordable prices, and allows setting the protection level or in case the lack of protection that shows the production due to the implemented policies since the terms of sales revenue.

#### B. Nominal Protection Coefficient for tradable inputs (CPNI)

$$CPNI = \frac{B}{F}$$

The nominal protection coefficient of tradable inputs sets the degree of protection or vulnerability to the particular case of tradable inputs, following the same dynamics as the previous rate.

#### C. Domestic Resource Cost Efficiency

$$DCR = \frac{G}{(E - F)}$$

This indicator is crucial in the investigation, since it measures the comparative advantage, which is the quotient of dividing the cost of domestic inputs valued at efficiency prices and economic added value. An indicator bigger than 1 –one-, would realize that the value of domestic resources used in the production exceeds the foreign exchange earned or saved, so that the country has no comparative advantages in production of guava, while a negative indicator is pointing to us currency waste, and therefore, more foreign exchange is used in the commodity production than the commodity value. It has been widely used in developing countries to measure efficiency or comparative advantage and guide policy reforms (World Bank 1991; Appleyard, 1987; Morris, 1990; Gonzales et al., 1993; Alpine and Pickett, 1993).

**Table 2.** Policy analysis matrix

| Concept                   | Total income  | Production costs |                  | Profits       |           |
|---------------------------|---------------|------------------|------------------|---------------|-----------|
|                           |               | Tradable inputs  | Internal factors | (Net utility) |           |
| Valued at private prices  | \$ 71,847.08  | \$ 10,829.69     | \$ 8,474.48      | \$            | 52,980.08 |
| Valued at economic prices | \$ 108,600.24 | \$ 10,880.09     | \$ 12,160.59     | \$            | 85,559.56 |
| Policy effects            | -\$ 36,753.16 | -\$ 50.40        | -\$ 3,686.11     | -\$           | 32,579.48 |

Source: Authors' calculations based on data obtained from questionnaires

**Table 3.** Protection, Efficiency and Subsidy to the Guava Production Relations

| <i>MAP derived relations</i>               |                 |         |
|--|-----------------|---------|
| Indicators                                 | Formula         | Results |
| Nominal Product Coefficient (CNPP)         | CPNP=A/E        | 0.66    |
| Tradable inputs Nominal Coefficient (CPNI) | CPNI=B/F        | 1.00    |
| Effective Protection Coefficient (CPE)     | CPE=(A-B)/(E-F) | 0.62    |
| Internal resources cost efficiency.        | ECRI= G/(E-F)   | 0.12    |
| Producer Subsidy Equivalent                | ESP = L/A       | -0.45   |

Source: Authors' calculations based on data obtained from questionnaires

#### D. Producer Subsidy Equivalent

$$ESP = \frac{L}{A}$$

The producer subsidy equivalent measures the level of transfer to or from producers in relation to other economy sectors. In the case of being positive, indicates the presence of transfers to the productive system, or to some of the agents that comprise it.

#### RESULTS

According to the comparative advantage theory, when resources are used in more efficient alternative the leveling of prices is achieved in both total income and production costs (tradable inputs and domestic factors) and international profits (Appleyard y Field, 2003) (Table 2).

In the above table shows that both private and economic prices gains are got in the production of guava, however there are greater profits with affordable prices than private prices, this result indicates

that higher income will be obtained for Michoacán's producers in international markets (Table 3).

CPNP coefficient is equal to 0.66, indicating that there is no protection for guava production. That is, in an undistorted price or trade market, the producers would get up to 34% more profit compared to the current situation in phytosanitary restrictions on exports of Mexican guava.

CPNI coefficient is equal to 1, which indicates that the markets for inputs (fertilizers, pesticides, insecticides) for the production of guava operate in a free trade area and there is therefore no protection or vulnerability to these inputs for production domestic policy and foreign exchange.

The domestic resource cost efficiency coefficient (ECRI) was 0.12, indicating that the value of domestic resources used in guava production is less than the value of foreign exchange earned or saved, therefore, the country has comparative advantages in producing that commodity, because of saves or earns foreign exchange with its domestic production. The ratio of social benefit to the producer (ESP) was -0.45, from which we deduce the presence of a tax, so that removing policy distortions, producers would increase their private gain level.

|                          |                                       | Ratio of domestic resources cost(RCR)        |   |
|--------------------------|---------------------------------------|--|---|
|                          |                                       | RCR < 1<br>(Advantage)<br>0.12               | RCR > 1 o RCR < 0<br>(No advantage)     |
| Private Cost Ratio (RCP) | RCP < 1<br>(Competitive)<br>0.14      | (I)<br><b>With advantage and competitive</b> | (II)<br>No advantage and competitive    |
|                          | RCP > 1 O RCP < 0<br>(No competitive) | (III)<br>With advantage and no competitive   | (IV)<br>No advantage and no competitive |

**Figure 1.** RCR and RCP relation

Source: Authors's calculations based on data obtained from questionnaires.

### Comparative Advantage and Competitiveness of the Crop to International Trade and the Elimination of Subsidies

In addition to the above analysis for each indicator, it is advisable to compare each other indicators, in order to obtain a more clear and deep analysis. By comparing the indicator Ratio of domestic resources cost (RCR) and the Private Cost Ratio and cross data yields a result within one of the four quadrants: quadrant (I) efficient and profitable crop (with comparative advantage and competitive), quadrant (II) not efficient and profitable crop (no comparative advantage and competitive), quadrant (III) and efficient and unprofitable crop (with comparative advantage and non-competitive) and quadrant (IV) inefficient and unprofitable crop (no comparative advantage and non-competitive).

In this research was obtained a result on the first quadrant of figure 1, which indicates that the product, in this case, guava, has comparative advantage and also is competitive, the interpretation of this result is that the crop is efficient and profitable, so we can say that the guava crop is a crop with good prospects as it generates resources for producers and allows or generation or foreign exchange save.

### Comparative Advantage and Crops Protection to International Trade and Subsidies Elimination

By taking again the indicator Internal Resources Cost Ratio (RCR) with Effective Protection Coefficient (EPC) and transpose the obtained indicators gives the Private Cost Ratio and crossing data we obtain a new indicator in one of the four quadrants of this matrix, these quadrants are: (i) efficient and not protected crop (with comparative advantage and unprotected), (ii) inefficient and unprotected crop (no comparative advantage and unprotected), (III ) efficient and protected crop (with comparative advantage and protection) and (iv) inefficient and protected crop (no comparative advantage and protection.)

Figure 2 shows that the results obtained corresponds to Quadrant I, indicating that the cultivation of guava is an efficient and unprotected crop, which suggests that the government policy exploits the crop's comparative advantage by keeping low prices.

### DISCUSSION

The main finding of the paper points to the existence of comparative advantage in the production of Michoacán's

|   |                                    | Ratio of domestic resources cost (RCR)        |   |
|---|------------------------------------|---|---|
|   |                                    | RCR < 1<br>(Advantage)<br>0.12                | RCR > 1 o RCR < 0<br>(No advantage)       |
| Effective<br>Protection<br>Coefficient<br>(CPE) | CPE < 1<br>(No protection)<br>0.62 | (I)<br><b>Advantage<br/>and no protection</b> | (II)<br>No advantage<br>and no protection |
|   | CPE > 1<br>(Protection)            | (III)<br>Advantage<br>and protection          | (IV)<br>No advantage<br>and protection    |

**Figure 2.** RCR and CPE relation

Source: Authors's calculations based on data obtained from questionnaires.

guava, allowing stating resources are well used in the production of this fruit because it generates wealth in addition to foreign exchange savings, indicating that guava production in that region is a productive alternative, although there was some degree of vulnerability. A policy that allows progress in reducing phytosanitary barriers to the export of fruit to the U.S. market would be highly profitable for local farmers.

Based to the obtained result by comparing the ratio of domestic resources cost with the private cost ratio, we conclude that the guava crop in the eastern region of Michoacán, is a crop that has comparative advantage and is also efficient. It is important to remark that the results of the study are consistent with Heckscher Ohlin model (Leamer1984; Bowen et al. 1987; Hayes et al. 1995). In the same way by contrasting the ratio of domestic resources cost with the effective protection coefficient, it is concluded that the studied crop has comparative advantage and is not protected or subsidized. Trade openness is an encouraging factor in the case of guava when market distortions affect the income (in particular the price) and therefore the producer profit in the production of guava. These distortions are directly related to the insertion of intermediaries in international marketing process, coupled with the guava's problem facing in some countries: non-tariff barriers. The current state of credit and land markets in Mexico makes the capitalization of agriculture difficult to venture on international markets and hence, a major challenge to Mexico policymakers.

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