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THE CONTRIBUTION OF AGRICULTURE IN THE MEXICAN ECONOMY: A REVIEW

Miguel Ángel **Martínez-Damián**[1*], Adrián **González-Estrada**[2]

[1]Colegio de Postgraduados Campus Montecillo. Socioeconomía, Estadística e Informática. Programa de Economía. Carretera México-Texcoco km 36.5, Montecillo, Texcoco, State of Mexico, Mexico. C. P. 56230.
[2]Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias. Campo Experimental Valle de México. Carretera Texcoco-Los Reyes km 13.5, Coatlinchán, Texcoco, State of Mexico, Mexico. C. P. 56250.
* Author for correspondence: angel01@colpos.mx

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ABSTRACT

In the mid-20th century, the theory of economic growth predicted a gradual decline in the agricultural sector's share of the overall economy. This prediction is based on specific assumptions about the sector that are not necessarily true at all times. In the case of Mexico, to test this theoretical prediction, an empirical analysis was conducted using quarterly data covering the period from 1993 to 2024. The hypothesis to be tested was that the contribution of agriculture may follow its own trajectory, independent of the prediction of a secular decline in the sector. During the period examined, using a linear adjustment of the agricultural sector's contribution with a structural break, both a declining trend and a more recent increasing trend in its contribution were found, thus refuting the prediction of classical growth theory. Although the theoretical prediction points in one direction, the empirical result is different. The share of the agricultural sector may follow its own pattern in economic evolution. In the search for an explanation of the sector's recent trend, quantity and price indices were constructed to explore whether the aforementioned adjustment is due to price or quantity. The results indicate that the price component is the basis for explaining the observed phenomenon.

Keywords: economic growth, agricultural growth, price index, quantity index.

INTRODUCTION

In economic development, there has been a decline in the share of agricultural activity in the overall economy (Anderson, 1987; Gómez-Oliver, 1995; Byerlee *et al*., 2009; Baer-Nawrocka, 2016). This trend has been predicted in economic development models such as those by Lewis (1954), Johnston and Mellor (1961), and Ranis and Fei (1961). Among the reasons cited for this trend are the dual nature of the economy, the low marginal productivity of factors such as labor in agriculture, and low income elasticity for agricultural goods, among others.

Empirical tests show that these assumptions are sometimes false, allowing for agricultural development that can maintain or increase agriculture's relative share of

the economy. In other words, although a decline in the share is expected as economic development progresses, the latter may be questionable. This phenomenon has been observed empirically by Alston and Pardey (2014), especially if the process is accompanied by improvements in factor productivity, changes in tastes and preferences, and trade flows with the rest of the world. From an empirical perspective, the objective is to examine the trend in agriculture's share of the economy using quarterly data from Mexico. It is emphasized that economic development can be consistent with different patterns of agricultural participation and not necessarily with a secular decline, which constitutes the working hypothesis.

MATERIALS AND METHODS

Quarterly data on national gross domestic product (GDP) and the agricultural sector from 1993 to 2023 were used, obtained from the Bank of Mexico's website (Banxico, 2023). The two series were used at both current prices (without adjusting for inflation) and at 2018 prices, which implicitly eliminates the effect of inflation by using that year as the valuation base.

Based on current data prices, the share of Mexican agriculture in the overall economy was calculated. In this calculation, the following ratio was used:

$$R_t = GDPA_t / GDP_t$$

where *R* is the contribution of agriculture to the economy, *GDPA* is the agricultural gross domestic product, and *GDP* is the gross domestic product of the economy. Note that both the numerator and the denominator are value-based quantities (nominal MXN); however, *R* is a dimensionless number ranging from 0 to 1, which measures the proportion or contribution of agriculture to the total economy (Gómez-Oliver, 1995; Byerlee *et al*., 2009; Alston and Pardey, 2014).

A regression line was fitted to the ratio *R* to capture its trend over time (*t*), incorporating a breakpoint in the last quarter of 2006 to estimate the slope before and after that point. The break, however, is empirical in nature and is not associated with a specific event. Since both the numerator and denominator of the indicator consist of prices and quantities, the ratio of GDP to GDP_{2018} at 2018 prices was used to explore the explanation for this behavior, that is:

$$IGDP_t = \frac{GDP_t}{GDP_{2018}} \quad IGDPA_t = \frac{GDPA_t}{GDPA_{2018}}$$

where *IGDP* and *IGDPA* are the implicit price indices for *GDP* and *GDPA*, respectively, and GDP_{2018} and $GDPA_{2018}$ represent GDPs at constant prices at the 2018 base year. These indicators reflect price growth in the economy as a whole and in the agricultural

sector, with regard to the base year to which they are normalized (Garavito-Acosta *et al*., 2011). They also allow for a comparative analysis of the relative evolution of prices in each sector.

To analyze trends in quantities, an implicit quantity index (IQ) was constructed using GDP ($GDPA_{2018}$ and GDP_{2018}) and normalized to the GDP value for the first quarter of 2018 for each variable (Guerrero-de Lizardi, 2021). This produced a quantity index normalized to 1 for the base period:

$$IQGDP_t = \frac{GDP_{2018}}{GDP_{base}} \; IQGDPA_t = \frac{GDPA_{2018}}{GDPA_{base}}$$

where GDP_{base} and $GDPA_{base}$ are the respective gross domestic products for the first quarter of 2018, which was used as the base period. Tracking these indices helps understand the behavior of the agriculture-to-total-GDP ratio, with a focus on the quantity component.

RESULTS AND DISCUSSION

The trend in agriculture's share of the total economy (Figure 1) showed regression lines with a structural break. The regression of the first quarters through the last quarter of 2006 relative to the trend over time had a negative slope of -0.026, which is statistically significant (p = 0.0001). In contrast, for the subsequent quarters, the regression of this ratio over time showed a positive slope of 0.011, which is also statistically significant (p = 0.0001). Agriculture's contribution to the economy showed a downward trend;

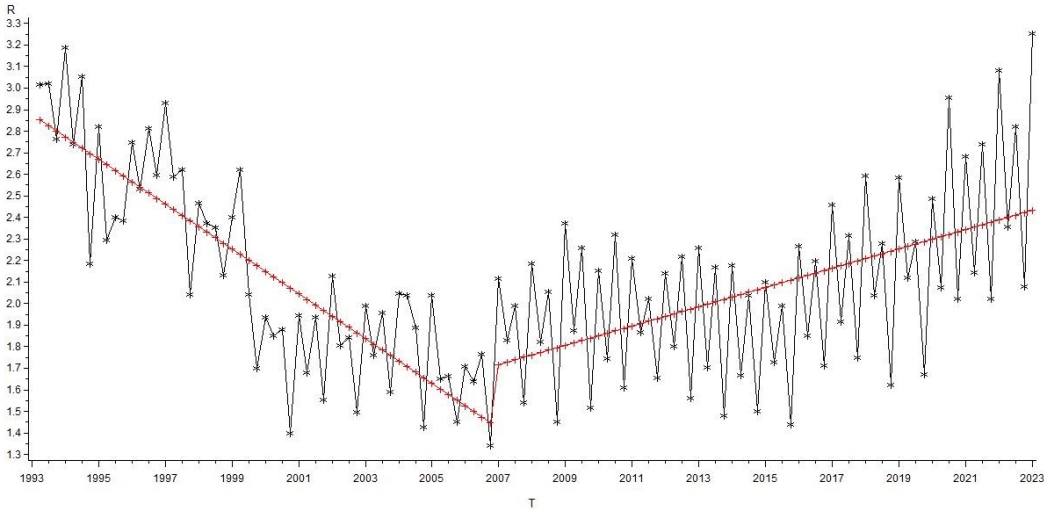

Figure 1. Agriculture's contribution to the total economy (R) in Mexico over time (T). First-period regression: R = 2.8778 – 0.0260T; second-period regression: R = 1.1379 + 0.0107T.

however, this trend breaks and gives way to an upward trend, which contradicts the predictions of agricultural development models.

Since the value of agricultural production is the product of prices and quantities, its increase can be explained by rises in prices, quantities, or a combination of both. First, the behavior of aggregate prices was analyzed by comparing implicit price indices (Church, 2016). Both indices showed a similar trend; however, toward the end of the period, an increase in the *IGDPA* was observed, indicating a relative rise in agricultural prices (Figure 2). To reinforce this analysis, the difference between the two indices was examined, which turns positive toward the end of the period studied (after 2022).

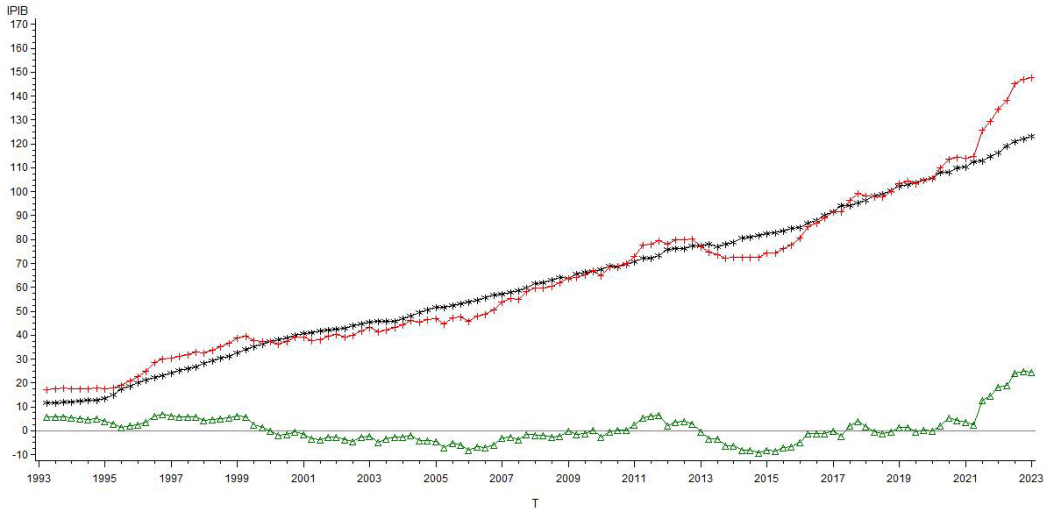

Figure 2. Implicit price indices for GDP and agriculture GDP in Mexico over time (T) (+: Agriculture, *: Total economy, Δ: Difference).

This result helps explain the recent increase in agriculture's contribution to the economy. If agricultural products become relatively more expensive, the value of production increases. This trend may be linked to factors such as changes in tastes and preferences and the effects of foreign trade (e.g., the increase in avocado exports and its impact on domestic prices) (del Moral-Barrera and Murillo-Villanueva, 2016).

Regarding quantities, the behavior of the quantity indices (Figure 3) and the differences between them were analyzed. A rising trend was observed in both indices, except for greater variability in the agricultural index. This implies that agriculture's share of the economy has a slight quantity component; however, upon examining the differences, no trend favoring one index over the other is found, but rather a slight predominance of negative differences around zero. This implies that the behavior of agriculture's share is dominated primarily by the trajectory of prices.

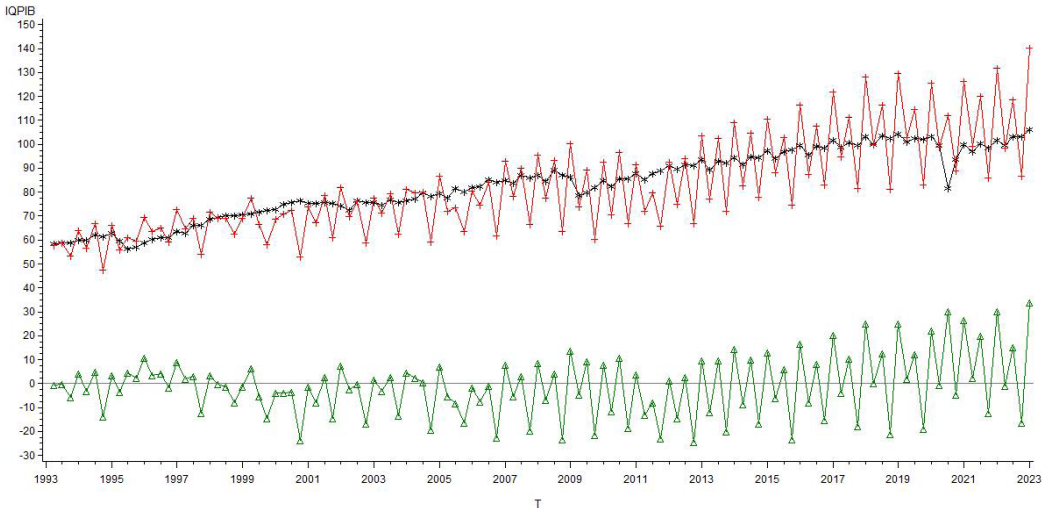

Figure 3. Quantity indices of GDP and agriculture GDP in Mexico over time (T) (+: Agriculture, *: Total economy, Δ: Difference).

A third possibility that has not been explored is a shift in crop patterns resulting from changes in relative prices, technological advances, and/or changes in agricultural policy. This goes beyond the scope of this study; the current approach assumes that such effects are already factored into changes in prices and quantities, without compromising the rigor of the analysis.

It is important to note which factors can influence prices. Assuming a constant supply, a higher price may be due to changes in tastes and preferences; that is, a greater willingness to pay for certain products such as chicken breast (Téllez-Delgado *et al*., 2016), beef, or certain fruits and vegetables like avocados and lemons (Barrera-Rojas *et al*., 2022). On the other hand, access to foreign markets can lead to shortages in the domestic market and drive prices up, as is the case with avocados. The foreign market also presents an opportunity to produce goods that would otherwise not be produced or would have limited supply, such as asparagus (Valenzuela-Romero *et al*., 2022) and cranberries (Martínez-Barajas and Torres-Zambrano, 2022).

The central idea is that, with economic development, the agricultural sector may exhibit its own distinct behavior, differing from the relative decline posited by classical theories. As early as 1961, Johnston and Mellor (1961) noted that one of agriculture's contributions to economic development is the generation of surplus for industrial development. For his part, Lenin (1992) indicates that this transfer is possible due to the existence of a large non-capitalist peasant sector. However, González-Estrada (2016) shows that, since 1970, Mexican agriculture has been characterized by a predominance of capitalist forms of enterprise production, meaning that the possibilities for continuing the transfer of economic surplus from agriculture to other sectors have come to an end.

This means that the role of agriculture in countries' economic development changes over time.

In Mexico, agriculture's contribution of economic surpluses to the development of industry and cities has already served its purpose. The capitalist sector of agriculture requires, in order to exist, an average rate of profit similar to that of the rest of the economy. The decline in agriculture's share of GDP is not an inexorable law, but rather a trend; therefore, it may well happen that, in certain periods and under certain circumstances, agriculture's contribution increases. This study presents statistical evidence of this behavior.

From 2008 onward, with the elimination of tariffs and duties on agricultural products in Mexico and the United States under the North American Free Trade Agreement, Mexican exports of fruits and vegetables to the United States began to grow rapidly, as did their prices. This explains the change in the slope of the agricultural price index trend. In this regard, Obstfeld and Rogoff (1996) showed that the dynamics of economic sectors integrated into foreign trade are greater than those of sectors not participating in such trade, and that the greater the relative participation, the higher the growth rates. Agriculture is one such sector; fruit and vegetable production is largely exported to the United States, while the staple grain sector imports over 20 million Mg from that country (USDA, 2023).

CONCLUSIONS

In Mexico, starting in 2007, there has been an increase in the contribution of agriculture to the overall economy, following a downward trend, as predicted by classical models of agricultural development. This result contradicts those predictions; without presenting an agricultural development model for Mexico, we conclude that the behavior over time of agriculture's share of the economy does not necessarily follow a pattern of secular decline in the agricultural sector's contribution to the overall economy. The observed agricultural development is consistent with an increase in its share, which is primarily due to price changes rather than changes in quantities.

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