Characterization and importance of the agricultural sector in the Ecuadorian economy

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Abstract
In recent years, agriculture has become the backbone of the Ecuadorian economy, playing a crucial role in the country's economic growth. As stated, this study aims to examine the impact of agricultural exports on Ecuador's economic growth during the period 1990-2021. The methodology used is based on an inductive reasoning under an empirical-analytical approach, a model of Autoregressive Vectors (VAR) was generated in order to analyze the existence of a causal relationship between the variables analyzed. The results allowed to demonstrate the non-existence of a causal relationship between the study variables, indicating that agricultural exports do not cause the economic growth of the country or vice versa.

Keywords: Agricultural sector, economic growth, agricultural exports, causal relationship.

1. Introduction
The Ecuadorian economy has been characterized by being agricultural, a fact that has led to focus on the production and marketing of primary products as the basis of its economy (García et al., 2019). Bula (2020), states that the agricultural sector is a vital part for the economic development of a country, and especially for those that are developing. In this regard, the World Bank (WB, 2022) states that the path to reduce poverty, increase family income and develop better food security is due to the prioritization of the development of the agricultural sector.

From the eighteenth century, agriculture and livestock as productive activities were strengthened, and began to be considered one of the most solid economic structures in the country (Carrión-Loaiza and Garzón-Montealegre, 2020). Quinde-Rosales et al. (2018), agrees with Carrión-Loaiza and Garzón-Montealegre (2020), and describes that,
during the last century, the agricultural sector has become the center of the country’s productive dynamics, supplying the domestic market generating income and giving way to the export of its products, integrating thus rural Ecuador to the world productive system.

Fiallo (2017), adds that agriculture is a main axis for the Ecuadorian economy, due to its significant contribution in several aspects, among which stand out: the increase in GDP, reduction of the trade balance deficit, generation of jobs at the national level and the country's food security.

Currently, agriculture has become the basis of the Ecuadorian economy and is closely related to the welfare of the population for its contribution to the country’s food security, hence the importance of the agricultural sector for the country to play a crucial role in its economic growth (Bula, 2020). In this regard, Quinde-Rosales (2015), states that the agricultural sector is a sector of vital importance for the economic development of a country, therefore, he adds that the state must empower and promote the agricultural sector as a strategic asset.

According to data provided by the last National Agricultural Census carried out in 2000, 40% of the population was constituted in rural areas, which is made up of 2 thirds of the families associated with agricultural activities that inhabit the very lands they produce. The Ministry of Agriculture and Livestock (MAG, 2022), states that currently around 25% of Ecuadorians focus on the agricultural sector and approximately 62% work in agriculture.

The National Institute of Statistics and Censuses (INEC, 2019), states in the labor indicators raised by the National Survey of Employment, Unemployment and Underemployment (ENEMDU) that the activity of agriculture, livestock, hunting, forestry and fishing concentrated in 2019 the highest participation in rural employment, contributing to 29.4% of the national EAP, this being higher than trade and manufacturing with 17.9% and 10.3% respectively in the same year.

However, in recent decades, the adoption of industrialization has led to internal and external migratory movements, the most obvious of which is the migration of the rural population to urban areas in search of better opportunities, leaving behind the pejorative living conditions of the countryside. (Consuegra et al., 2021). The Food and Agriculture Organization of the United Nations (FAO, 2016), mentions that the migration problem is somewhat detrimental to countries that base their economy on activityis primary, for this reason, governments must implement plans to reduce the migration of farmers to large cities, Governments should ensure the social protection of agricultural workers and promote the development of the agricultural sector.

Along the same lines, Garrochamba-Sánchez (2017), explains that public spending is a very important item to solve to some extent the needs of
disadvantaged and vulnerable groups through the investment of resources, through the provision of infrastructure and the provision of quality services. Anríquez et al. (2016), mentions that governments should allocate part of the general budget of the State to the development of the agricultural sector in order to finance rural infrastructure projects, restrict imports, and stimulate agricultural exports, scientific research that lead to safeguard food security.

Yannuzzelli et al. (2018), stated that, despite the importance of the agricultural sector in the national economy, the contribution of the state to the development of sector a has been decreasing over time; however, agriculture continues to make an important contribution to the country's economic growth. Given this perspective, Quinde-Rosales (2011) adds that the Ecuadorian State must understand the importance of the agricultural sector in terms of production for domestic consumption and its contribution to the economy through exports, surpassing the other economic sectors of the country.

Sandoval et al. (2020), state that in the different economies of the world, the Central Bank is the entity in charge of increasing or decreasing the money supply by printing money, but in the case of Ecuador, this is impossible, since the Central Bank of Ecuador lost this capacity when the country dollarized. Zambrano (2010), referring to the subject, concludes that, in the Ecuadorian case, the Banco Central is conditioned by the decisions taken by the different governments, generating that this entity sees its technical and decision-making capacity diminished, making it impossible for it to act in the generation of working capital in the economy.

Soto (2018), describes the money supply as the total money circulating in the economy of a country, likewise, Calderón et al. (2019), added that the money supply is composed mainly of demand or bank deposits of high liquidity in the hands of the public. Authors such as Llaguno et al. (2021), affirm that the money supply is closely related to the country's inflation; therefore, increasing the amount of money circulating in the country generates an increase in the price of its products and services. In this context, Araujo et al. (2021) and Torres (2020), point out that the Ecuadorian money supply is determined by several factors, among which are foreign trade operations, the amount of deposits in the national financial system and sources of external financing.

In Ecuador, agriculture plays a vital role in economic growth. For this reason, this study aims to analyze the behavior of exports of the Ecuadorian agricultural sector and its contribution to economic growth. In relation to the above, this study is based on the assumption of the dichotomy between the money supply (M1) and the real sector of the Ecuadorian economy, this assumption is based on the contribution of agricultural exports in the generation and injection of foreign currency to the country's economy.
Under this premise, this research aims to establish the existence of causality in the long term between agricultural exports and the money supply of Ecuador during the period 1990-2021. To carry it out, it is intended to analyze the degree of contribution of agricultural exports in economic growth and how this has influenced the country's money supply (M1). To achieve this, the evolution of the proportion generated by agricultural exports and the historical evolution of M1 are evaluated.

2. Methodology

The research design of the document established a 32-year study period of the variables that make up the typology of the agricultural sector, understanding exports as stimulants for the economic growth of the country, in terms of the generation of foreign exchange. The research determined through inductive reasoning under an empirical-analytical approach. For the development of the research, a unimethod process was carried out based on the positivist paradigm according to Ricoy (2006), cited by Ramos (2015), this type of paradigm contributes to testing a hypothesis through processes and statistical models.

The methodology of the research is oriented towards an analysis that determines the stationarity of the variables through the use of the Augmented Dickey-Fuller test. In order to avoid spurious results, we proceeded to generate a VAR model that captures any type of causality in Granger's sense, understanding it as the existence of a relationship between variables.

The development of this study focuses on determining the relationship between Ecuador's agricultural exports and the money supply, in order to establish the importance of agriculture in the Ecuadorian economy, so that the analysis of the background of the agricultural sector focuses on its evolution and as it promotes an increase in national economic growth. Then, in tabla 1 shows the characterization of the variables studied.

<table>
<thead>
<tr>
<th>Table 1.- Characterization of the study variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural Sector</td>
</tr>
<tr>
<td>• Agricultural Exports (X_A)</td>
</tr>
<tr>
<td>• Economic Growth (OM)</td>
</tr>
</tbody>
</table>

Prepared by: The Authors.

We proceeded to evaluate the relationship between both variables using the model of vectors author regressive, as mentioned above. Giving as representation the following equation:

\[ Y_t = \beta_0 + \lambda_1 Y_{t-1} + \cdots + \lambda_p Y_{t-p} + \alpha_0 \]

Therefore:
\[ Y_t = \beta_0 + b_1Y_{t-1} + b_2Y_{t-2} + b_3Y_{t-3} + b_4X_{t-1} \ldots + b_pX_{t-p} + \epsilon_1 \]
\[ X_t = \beta_0 + b_1Y_{t-1} + b_2Y_{t-2} + b_3Y_{t-3} + b_4X_{t-1} \ldots + b_pX_{t-p} + \epsilon_2 \]

The variables that were selected for the realization of the VAR model are detailed below:

\( Y_t = \) Economic Growth (Money Supply)
\( X_t = \) Exports to farmers

3. Results

Ecuador is a country internationally recognized for basing its production mainly on agriculture, thus this sector is indispensable to maintain the country’s economy. It should be noted that despite the importance of the sector, it has not been exploited correctly, because poverty is concentrated in rural areas, which are mostly agricultural areas.

To determine the deterministic or stochastic trend criterion, the Augmented Dickey-Fuller (DFA) test was performed. The result of this test shows that both the variable OM and \( X_A \) approve the null hypothesis, concluding that these variables are series that have unit root being these non-stationary (Table 2).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Order of Integration</th>
<th>T-statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO</td>
<td>0</td>
<td>0.091802</td>
<td>0.9957</td>
</tr>
<tr>
<td>( X_A )</td>
<td>0</td>
<td>0.082536</td>
<td>0.9591</td>
</tr>
</tbody>
</table>

Prepared by: The Authors.

A modification of the variables was generated, taking them to their first difference; We proceeded to modify the variables in the first difference (establishing the difference between each data and the previous one) establishing a new variable:

\[ D_X = X_t - X_{t-1} \]

The execution of the DFA to the variables in first difference allowed to reject the null hypothesis proposed by the test, establishing that these variables for the period under study are stationary or are series that do not present unit root (Table 3).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Order of Integration</th>
<th>T-statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO</td>
<td>1</td>
<td>-6.394472</td>
<td>0.0001</td>
</tr>
<tr>
<td>( X_A )</td>
<td>1</td>
<td>-5.653445</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Prepared by: The Authors.

For the process of estimating the autoregressive vector (VAR) it is necessary to establish the maximum lag length on which the relationship...
of the variables under study is determined, understanding this criterion as the optimal lag. For this we will use the likelihood ratio test, the Final Prediction Error criteria and the statistics of Akaike, Schwarz and Hannan-Quinn. To prioritize the prediction, lag will be selected first as the optimum, taking into consideration the parsimony criterion (Table 4).

Table 4.- Selection criteria in the VAR order

<table>
<thead>
<tr>
<th>Was</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-374.9409</td>
<td>ON</td>
<td>5.89e+11</td>
<td>32.77747</td>
<td>32.87621</td>
<td>32.80231</td>
</tr>
<tr>
<td>1</td>
<td>-368.1029</td>
<td>11.89217*</td>
<td>4.62e+11</td>
<td>32.53069</td>
<td>32.82691*</td>
<td>32.60519</td>
</tr>
<tr>
<td>2</td>
<td>-365.6201</td>
<td>3.886149</td>
<td>5.33e+11</td>
<td>32.66262</td>
<td>33.15631</td>
<td>32.78678</td>
</tr>
<tr>
<td>3</td>
<td>-359.7582</td>
<td>8.155779</td>
<td>4.65e+11</td>
<td>32.50071</td>
<td>33.19188</td>
<td>32.67454</td>
</tr>
<tr>
<td>4</td>
<td>-353.7466</td>
<td>7.318451</td>
<td>4.09e+11*</td>
<td>32.32579*</td>
<td>33.21444</td>
<td>32.54928*</td>
</tr>
<tr>
<td>5</td>
<td>-350.8179</td>
<td>3.056021</td>
<td>4.88e+11</td>
<td>32.41895</td>
<td>33.50507</td>
<td>32.69210</td>
</tr>
<tr>
<td>6</td>
<td>-350.2144</td>
<td>0.524740</td>
<td>7.47e+11</td>
<td>32.71430</td>
<td>33.99790</td>
<td>33.03712</td>
</tr>
<tr>
<td>7</td>
<td>-342.3265</td>
<td>5.487285</td>
<td>6.55e+11</td>
<td>32.37621</td>
<td>33.85729</td>
<td>32.74870</td>
</tr>
<tr>
<td>8</td>
<td>-337.7567</td>
<td>2.384220</td>
<td>8.67e+11</td>
<td>32.32667</td>
<td>34.00523</td>
<td>32.74882</td>
</tr>
</tbody>
</table>

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The inverse root of the autoregressive polynomial of the VAR was examined (Figure 1). This acts as a check of the stability of the estimated model. The graphical representation of eigenvalues shows that all values lie within the unit circle. This result indicates that there is a common trend, so you only have to wait for a cointegration vector.

Figure 1.- Inverse roots of the autoregressive polynomial VAR

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Under the use of the cross-correlogram – Q statistic of the estimated residues in the VAR for a certain number of delays, a residue test will be established to establish the existence or not of autocorrelation. Figure 2 does not exhibit significant autocorrelation. The null hypothesis of absence of autocorrelation is approved by finding that 95% or more of the bars fall within the confidence interval.

**Figure 2.** Residual test-Correlogram

![Residual test-Correlogram](image)

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White’s heteroskedasticity test without Cross Terms, allows to establish if the errors of the model are homoscedastic otherwise they are heteroscedastic. The test results show that the residues are homoscedastic (Table 5).

**Table 5.** Heteroskedasticity test

<table>
<thead>
<tr>
<th></th>
<th>Chi-sq</th>
<th>df</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.331076</td>
<td>12</td>
<td>0.8350</td>
</tr>
</tbody>
</table>

Prepared by: The Authors.

To establish causality, a Granger test was performed, the results of which show the absence of causality of any kind in the Granger sense between the variables money supply (DOM) and agricultural exports (DX_A), rejecting the null hypothesis that indicates that the DX_A does not cause in the Granger sense to the variable DOM. This is evidenced by observing the p-values, taking into account the Fischer probability (Prob), which is at the minimum rejection value (Table 7).
Table 6.- Granger causality test

<table>
<thead>
<tr>
<th>Dependent variable: DOM</th>
<th>Excluded</th>
<th>Chi-sq</th>
<th>df</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DX_A</td>
<td>1.302186</td>
<td>1</td>
<td>0.2538</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>1.302186</td>
<td>1</td>
<td>0.2538</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent variable: DX_A</th>
<th>Excluded</th>
<th>Chi-sq</th>
<th>df</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HOUSE</td>
<td>0.703075</td>
<td>1</td>
<td>0.4018</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>0.703075</td>
<td>1</td>
<td>0.4018</td>
</tr>
</tbody>
</table>

Prepared by: The Authors.

Figure 3 shows that in the long run confidence intervals tend to shrink and are very close to 0 and the response of the money supply to changes in agricultural exports and vice versa are not very significant; The opposite happens in the short term, where these effects are positive, that is, in the face of possible changes in exports, the money supply responds immediately to this eventuality.

4. Conclusion

The analysis of the relationship between agricultural exports and the money supply is fundamental for the development of economic policies aimed at resolving the dichotomy of the assumption that revolves around their presumed relationship. In this sense, it was determined that both variables show a positive trend and turned out to be non-stationary.
Finally, the hypothesis was contrasted based on the data obtained from the established VAR model, the results demonstrate under the criterion of causality the absence of a causal relationship of any kind in the sense of Granger between the variable agricultural exports ($X_A$) and the money supply ($OM$). This indicates that agricultural exports do not cause the money supply or vice versa. Therefore, Ecuador's economic growth is not due to agricultural exports but to another more important item for the country, such as oil exports or tax collection.

**Bibliography**


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