

Mexico's agricultural policy in the American context (1995-2020)

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ABSTRACT

Objective: To analyze the long-term relationship of two groups of agricultural policy instruments classified by the OECD-Producer Support Estimator (PSE) and General Services Support Estimator (GSSE)-OECD classification on Agricultural Gross Domestic Product (AGDP) in Mexico, USA, Canada, Chile and Brazil during the period 1995-2020, to generate information that contributes to the design of agricultural policies.

Design/Methodology/Approach: The information used in this work was developed by the OECD and was integrated into a time series for the 1995-2020 period. A quantitative analysis was carried out based on the econometric method, applying the cointegration test.

Results: The Canadian, Brazilian, and Mexican series are cointegrated, because the error of the model has a unit root (*i.e.*, individual variables are not of order I(0)); however, the combination of their variables show that the error is a process I(0), with a zero mean. However, the Chilean and USA variables were not cointegrated.

Study Limitations/Implications: An open market environment requires the development and implementation of policies that include the use of diverse and relevant instrument groups, guaranteeing that the resources transferred to the sector generate the expected results.

Findings/Conclusions: In comparison with the PSE, the GSSE has a closer long-term relation with the growth of the agricultural GPB in most countries; therefore, using this group of instruments to transfer resources to the sector is assumed to improve its performance to a greater degree.

Keywords: Cointegration, Producer Support Estimate, General Services Support.

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INTRODUCTION

The agricultural sector contributes to national income, employment, foreign trade, and its dependent and related industries (Escobar, 2016; OECD and FAO, 2019). This situation has laid the foundations for governmental intervention in agriculture, through national policies and support mechanisms (Schaelicke, 2019). Governments can adopt different measures to improve the productivity, sustainability, and resilience of the agricultural sector (OECD, 2020).

The OECD (2016) points out that the Producer Support Estimate (PSE), the General Services Support Estimate (GSSE), and the Consumer Support Estimate (CSE) quantify the subsidy transferred to the producers, general services, and consumers in the agricultural sector. This categorization system considers the following criteria for the implementation

and allocation of the transfers: producers, consumers, or the overall agricultural sector (Effland, 2011). The OECD does not only follow up the policies applied in each country, it makes recommendations that seek to provide policy makers with inputs for their decision-making (OECD, 2010). Among its policy prescriptions, the OECD (2001, 2013, 2022) has pointed out the importance of diminishing the application or even progressively eliminating PSE policies —because they include support mechanisms that directly distort production and trade— and increasing the use of GSSE (Morris *et al.*, 2020; OECD, 2018).

In recent years, the support for the agricultural sector (as a GDP percentage) has shown a downwards trend worldwide (Pawlak, 2018). From 2019 to 2021, the total support for agriculture in the 54 countries analyzed by the OECD amounted to an average of over \$817 billion dollars per year. Seventy-five percent of this total was transferred to the PSE, while the remaining 25% was transferred in almost equal measures between the GSSE and the CSE (OECD, 2022). The United States and Canada are two of the most important markets for the exportation of Latin American food products (Gurria *et al.*, 2016). These two countries are also the main corn and wheat exporters worldwide (Espinosa-Cortés, 2022). The support percentage they provide to their agricultural sectors regarding their production value (28.9% for the USA and 13% for Canada) is higher than other countries in the Americas (OECD, 2022). Morris *et al.* (2020) point out that almost 25% of the world's agricultural and fishing exports come from Latin America and the Caribbean (LAC). Brazil has consolidated as the biggest exporter of agricultural and food products in the region, followed by Argentina, Mexico, Chile, Ecuador, and Peru (Escobar, 2016). Additionally, Mexico is one of the world's major importers of corn, soy, dairy products, pork, and poultry meat, while Brazil is one of the major wheat importers of the world (OECD and FAO, 2019). Currently, Chile is the sixth most important fruit exporter of the world and is the South American leader in this sector (Boza *et al.*, 2020). For its part, Mexico has historically reported the highest support levels in LAC (Gurria *et al.*, 2016). The OECD (2022) reported that, regarding the value of its production, Mexico provided a 10.8% support to its agricultural sector, while Chile and Brazil provided a 9.7% and 3.8% support, respectively.

The relevance of each of the abovementioned countries for the global agricultural trade justifies the comparative study of their agricultural policies. The behaviour of the agricultural GDP has been found to have a long-term relationship with the general services support policy, unlike the producer support. Therefore, the objective of this work was to analyze the long-term relationship (1995-2020) between two sets of agricultural policy instruments (PSE and GSSE) and the agricultural GDP in Mexico, USA, Canada, Chile, and Brazil, in order to generate information that contributes to the design of agricultural policies. The CSE policy instrument was not taken into consideration in this analysis, since this group generally has a negative impact as an implicit tax on market prices, although it compensates the food subsidies for the consumer (OECD, 2004).

MATERIALS AND METHODS

The analysis was performed with information from the OECD, which was integrated in an Excel[®] database, creating a 26-year time series (1995-2020) based on data from Mexico,

USA, Canada, Brazil, and Chile. The database includes information about the agricultural GDP and the amount transferred to the PSE and GSSE of the analyzed countries.

The amounts were determined at nominal prices and in national currency; therefore, the exchange rate and USA inflation rate available in the database of the World Bank (2021b, 2021a) were used to deflect the values to the 1995 Monetary Base. The Stata statistical software (Release 17) was used to carry out the statistical estimates (StataCorp, 2017).

Definition of variables

The support instruments of the agricultural sector are classified in three groups, based on the implementation methods and its type of users: producers, consumers, and services provided to the agricultural sector (Effland, 2011). This research only included the following variables: agricultural GDP, PSE, and GSSE (OECD, 2016). The GSSE is considered to be the agricultural support mechanism that less distorts the market, unlike the PSE (Table 1).

Times series – cointegration test model

One of the major problems with time series regressions is senseless or spurious results (Gujarati and Porter, 2010). A way to avoid this problem is to determine if the times series are cointegrated (Jordan and Philips, 2018). Additionally, cointegration can be applied with two series of order I(1), although their lineal combination is I(0) (Wooldridge, 2009). Consequently, the result of the regression is not spurious and the series has a long-term relationship (Gujarati and Porter, 2010). The GSSE is expected to be cointegrated, since the OECD (2018, 2022a) points out that supports for this kind of instruments do not have a direct impact on agricultural income or consumer expenses; however, they do affect long-term agricultural production or consumption. The following model was used to meet the objective of the analysis:

$$PIBAg_t = \beta_0 + \beta_1 EAP_t + \beta_2 LEASG_t + t + \mu_t$$

Where $PIBAg_t$ is the time series for the agricultural GDP; EAP_t and $EASG_t$ are the series of producer support and general services support policies, t refers to the lineal trend; and μ_t is the term of the error. Nevertheless, even if individual variables are assumed to be

Table 1. Description of variables. Source: (OECD, 2016).

Variable	Concept	Description
GDPAg	Agricultural GDP	Market value of all final goods and services produced by the agricultural sector.
PSE	Producer Support Estimate	The annual monetary value of gross transfers from consumers and taxpayers to agricultural producers.
GSSE	General Services Support Estimate	The annual monetary value of gross transfers arising from policy measures that create enabling conditions for the primary agricultural sector through development of private or public services, and through institutions and infrastructures.

Source: OECD (2016).

non-stationary [I(0)], a linear combination of two or more time series can still be stationary (Wooldridge, 2009). Therefore:

$$\mu_t = PIBAg_t - \beta_0 - \beta_1 EAP_t - \beta_2 LEASG_t - t$$

Consequently, the error of the model can be cointegrated, representing a long-term balance (Gujarati and Porter, 2010). The expression of the long-term balance relationship between the variables can prove that the clash in one of them alters the behaviour of the other to a similar degree (Rios, 2014). A simple test to analyze the cointegration is the application of the Augmented Dickey Fuller test to the residues estimated from the cointegrating regression (Gujarati and Porter, 2010; Jordan and Philips, 2018; Montero-Granados, 2013). Logarithms (both in the dependent and the independent variables) were calculated to limit the range of the variables to a smaller amount and to reduce the sensibility of extreme or atypical observations (Schuschny and Soto, 2009).

RESULTS AND DISCUSSION

Brazil has the most dynamic agricultural sector among the countries analyzed. Its initial annual growth was 5% (1995), but by 2020 it had reached 5.09%, which indicates an average annual growth of 0.63%. Meanwhile, the annual growth of other countries diminished throughout the same period. Overall, the support for the agricultural sector has diminished (Figure 1). However, Mexico and the United States recorded higher support levels (0.78% and 0.54%, respectively) than the other countries regarding their GDPs. Producers support is the instrument group with the highest amount (>70%) of the total support for the agricultural sector. Canada and Mexico allocated a little more than 13% of their gross agricultural receipts to this group of instruments (% PSE) from 1995 to 2020; for their part, Brazil and Chile provide the lowest support (2.9% and 4.5% of their gross agricultural receipts, respectively).

Gurria *et al.* (2016), the OECD (2022a), and other sources report that support for market price prevail in the PSE, influencing the said prices. This kind of instruments are considered the least efficient, because they influence the price that the producers obtain (Nguyen and Grote, 2018; Orden *et al.*, 2007; Pawlak, 2018). Additionally, they generate a reduction of importation products and increase subsidized exportations, diminishing world market prices (Dewbre *et al.*, 2001).

Subsidies for variable inputs (*e.g.*, energy and fertilizers) stand out among the PSE supports provided by Chile, Brazil, and Mexico. An important element of Brazil's producers support policy has been the Programa Nacional de Fortalecimiento da Agricultura Familiar (PRONAF), which has contributed to the strong expansion of the agricultural sector, through the strengthening of credits that stimulate agricultural investments (Guanziroli, 2014; Gurria *et al.*, 2016; Trentin and Quaresma, 2022). Overall, producers support is still relevant, while general services support still has minimal importance in the budget transfers of the countries analyzed.

The highest GSSE percentage regarding the total support for the agricultural sector was recorded in Chile (average: 30%) in the period under study. This group of instruments

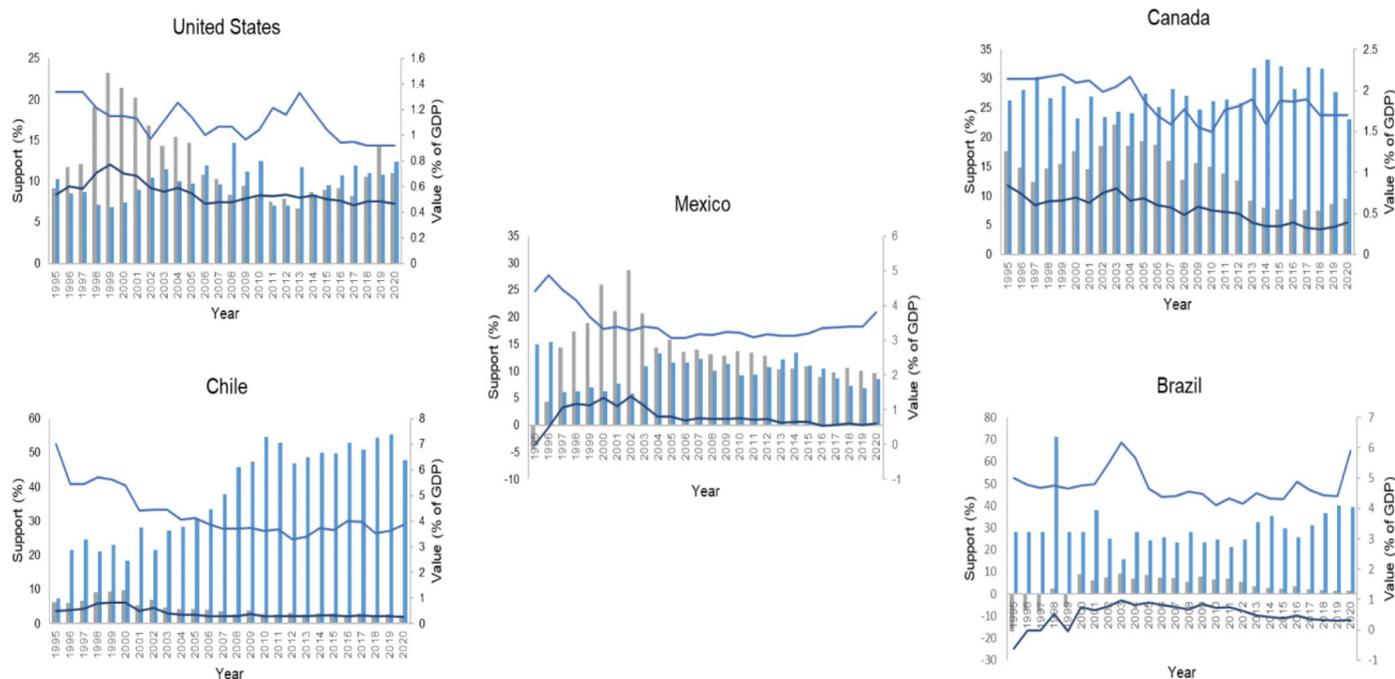


Figure 1. Agricultural GDP Growth, Total Agricultural Support (TSE), PSE (% of Gross Farm Receipts), and GSSE (% of TSE). Source: Figure developed by the authors based on data from the OECD (2022b).

diminished by 2% in Mexico, while in Chile the budgeted amount increased by 7% (annual average for 1995-2020). The OECD (2022a) points out that, with regard to the size of the sector, the general services expenses diminished from 5.4% to 3.5% of the agricultural production value; these results suggest that these expenses did not follow the growth pace of the sector. Morris *et al.* (2020) mention that the public expenditure in support of agriculture in Brazil and Chile has been focused on agricultural research, outreach services, and plant and animal inspection services.

Cointegration test

The results show that the Canadian, Brazilian, and Mexican series are cointegrated, since the error of the model has an unit root (*i.e.*, the individual variables are not of order $I(0)$). However, according to Gujarati and Porter (2010), Rios (2014), and Wooldridge (2009), the combination of variables shows that the error is a process $I(0)$ with a zero mean.

This phenomenon expressed the long-term balance relationship between the variables and indicates that a clash in one of the variables alters the behavior of the agricultural GDP to a similar degree. For their part, the variables in Chile and the USA were not cointegrated. The results show that the growth of the agricultural GDP of Chile and the USA has not been influenced by the PSE and the GSSE (Table 2); therefore, it could be subject to other elements that benefit the dynamics of the sector in those countries. In Mexico and Canada, the GSSE policies were closer to $p < 0.05$. In Brazil, the PSE and GSSE variables were significant ($p < 0.05$).

Table 1. Parameters obtained from the cointegrating regression.

Country	Variable	Coefficient	t	P>t	R ²	DW	DF	Portmanteau (Q)
Mexico	LnPSE	0.019	0.520	0.607				
	LnGSSE	0.049	1.160	0.260				
	Time	0.011	7.150	0.000				
	Constant	9.428	33.400	0.000				
	Error L.1	-0.756	-3.640	0.001	0.347	1.805	0.002**	0.062
	Constant	-0.001	-0.090	0.927				
Brazil	LnGSSE	0.113	2.890	0.010**				
	Time	0.496	8.900	0.000***				
	Constant	0.040	12.820	0.000				
	Error L.1	5.518	14.270	0.000				
	Constant	-0.815	-3.540	0.002	0.378	1.667	0.001**	0.167
	LnGSSE	-0.006	-0.300	0.767				
Canada	LnGSSE	-0.124	-0.680	0.503				
	Time	0.424	1.900	0.070				
	Constant	0.015	4.230	0.000				
	Error L.1	7.528	7.840	0.000				
	Constant	-0.723	-3.830	0.001	0.363	1.993	0.000***	0.309
	LnGSSE	-0.008	-0.350	0.732				
Chile	LnGSSE	0.391	2.090	0.048				
	Time	0.077	0.620	0.539				
	Constant	0.028	2.560	0.018				
	Error L.1	5.511	5.730	0.000				
	Constant	-0.399	-3.350	0.003	0.298	1.662	0.225	0.000
	LnGSSE	-0.020	-0.990	0.333				
USA	LnGSSE	0.016	0.060	0.956				
	Time	-1.555	-3.370	0.003**				
	Constant	0.048	3.430	0.002				
	Error L.1	23.781	5.070	0.000				
	Constant	-0.570	-2.590	0.016	0.192	1.748	0.091	0.574
	LnGSSE	-0.005	-0.100	0.920				

*p<0.05 **p<0.01 ***p<0.001. Source: Own elaboration with outputs from STATA.

Therefore, the design and application of policies focused on general services support (GSSE) are important, because the results indicate that they have the greatest influence in the behaviour of the sector —*i.e.*, a clash in this group of policy instruments alters the behaviour of the agricultural GDP to a similar degree. Bielik *et al.* (2007) and the OECD (2018) stress the importance of guaranteeing the availability of public services, because they benefit society as a whole (*i.e.*, producers and consumers). The services provided can include efficient systems that improve the sector, through agricultural innovation systems,

research, education, appropriate infrastructure, health, and quality control of agricultural products (Arisoy, 2020; Morris *et al.*, 2020; Sánchez *et al.*, 2022).

CONCLUSION

In most of the analyzed countries, the group of policy instruments for the general services support have a long-term relationship with the agricultural GDP. A clash in this group of policy instruments can alter the agricultural GDP to a similar degree. According to the OECD, this group of policy instruments has a long-term relationship with the behaviour of the agricultural GDP. Therefore, the use of this group of instruments should be emphasized within agricultural policy. The results can be taken into consideration for the redesign of national agricultural policies and for the compliance with the international commitment to deregulate the world's agricultural market. Further studies aimed at the identification of the dynamism factor of the Chilean agriculture should be carried out, since the variables employed did not show cointegration.

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