Analysis of the impact of the Sembrando Vida program in agricultural production in Mexico

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ABSTRACT

Objective: To determine the impact of the Sembrando Vida program on corn and bean production in the eight states where the program began to be implemented.

Design/methodology/approach: A total of 64 structural analysis tests were carried out with dichotomous variables (using control variables) to determine the impact of the Sembrando Vida program on corn and bean production in Puebla, Durango, Veracruz, Tabasco, Chiapas, Campeche, Quintana Roo and Yucatán, in the years 2019, 2020, 2021 and 2022. This type of test allows determining whether a variable changed its trend or its intercept or both, due to an event.

Results: The Sembrando Vida program has not been successful in impacting corn production in seven of the eight states examined and, in the case of beans, it did not impact in six of the eight states analyzed. The exception in corn was the state of Quintana Roo in 2022; and, in the case of beans, it was Quintana Roo in 2019 and 2022 and Durango in 2019, 2021 and 2022.

Limitations on study/implications: Fruit trees were not examined; each state was not characterized; and the states to which the program was expanded were not analyzed.

Findings/conclusions: The objective of the study was achieved because it was determined that, in general, the Sembrando Vida program did not impact the production of corn and beans (with exceptions); and that it is necessary to restructure government programs so that they have a greater effect.

Keywords: government programs; econometric analysis; agricultural production; and social support.

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INTRODUCTION

The programs destined to the agricultural sector take on relevance due to the importance of this sector for countries, since that is where the foods that society demands are produced, and it is a relevant economic sector. Some examples of these programs are the National Plan for Integrated Agriculture in Thailand or the International Fund for Agricultural Development in China (Zhu *et al.*, 2024; Yunez, 2020; García *et al.*, 2018; Hanpongpandh, 2003; Brambila *et al.*, 2014; Méndez, 2011; OCDE-FAO, 2011; Terrones and Sánchez, 2010; Hewitt, 2007).

Among the programs destined to the agricultural sector, there are the following: social, which are focused on improving the wellbeing of people in this sector; and those destined to improving or increasing production in the agricultural sector. These programs have the

purpose of generating a structural change in the production or the standards of living of recipients of the program (SADER, 2024; Gallardo *et al.*, 2020; Gómez and Tacuba, 2017).

In Mexico, various programs for the agricultural sector have been implemented since 1900, such as: Fertilizers for Wellbeing (*Fertilizantes para el Bienestar*), and Program for Support to Small-Scale Producers (*Programa de Apoyo a Pequeños Productores*). These programs have had different objectives, such as increasing the production, productivity and competitiveness of the agricultural sector; or social, such as contributing to improve the standards of living of people from the agricultural sector (Arriaga *et al.*, 2023; Gallardo *et al.*, 2020; Secretaría de Desarrollo Social, 2014; Gómez and Tacuba, 2017).

Likewise, to achieve these objectives, these programs have implemented different strategies, such as backing for producers to modernize the sector through the purchase of machinery; and, increasing their productivity by giving out fertilizers (Arriaga *et al.*, 2023; Gallardo *et al.*, 2020; Secretaría de Desarrollo Social, 2014). The social objectives of these programs destined to agricultural areas are the most important, especially poverty reduction. This is because it has been pointed out that in rural zones the percentage of poverty is higher than in urban areas (SADER, 2024; CIMMYT, 2023; Baca and Cuevas, 2018; Briceño, 2010; CONEVAL, 2024).

Additionally, the agricultural sector in Mexico has other challenges, such as: a group of producers lacks economic resources that allow them to modernize and increase their production, and that it is the most vulnerable to economic crises such as the one in 2008 (Ríos, 2020; Ayala and Chapa, 2017; Guzmán *et al.*, 2012; Becerril *et al.*, 2011; De Grammont, 2010).

The programs in Mexico destined to the agricultural sector have received criticism. Such was the case of the National Program for Farmland Modernization (*Programa Nacional de Modernización del Campo*), which was examined by Gómez and Tacuba (2017); the authors mention that the program did not improve the competitiveness of the sector. Another program studied is that of Fertilizers for Wellbeing, which has been called out for providing fertilizers that are more toxic than those habitually used (Díaz, 2008). For their part, Martínez (2023) and López-Villafañe (2020) have analyzed the Bienpesca programs directed to the fishing sector and Production for Wellbeing directed at the agricultural sector. They indicate that, in both programs, the expenditure on the operation is higher than the benefits they have caused. In turn, Delta (2019) indicates that the programs have had a significant impact because they increased agricultural productivity by 20%.

Specifically, Sembrando Vida was one of the proposals from President López Obrador in 2018, under a modality of plots of corn, bean and fruit trees. It seeks to generate employment for the population at risk of migration, by promoting agricultural productivity and improving the rural per capita income. Likewise, it is a program that is included in the proposal from 2018 called Integral Development Plan for Central America. The program consists of generating jobs offering a wage of $6,000 pesos and giving benefits such as a savings register and fund. Sembrando Vida started in 2019 in Campeche, Chiapas, Durango, Puebla, Quintana Roo, Tabasco, Veracruz and Yucatán. By 2022, it had nearly 450,000 employees and at the end of 2023 it already operated in 21 states (SADER, 2024;

Arriaga *et al.*, 2023; López, 2021; Gallardo *et al.*, 2020; Santiago, 2023; Montes and Sánchez, 2024; Ortiz and Sánchez, 2024; Santiago, 2023).

This program was a change in the federal government's policy in Mexico compared to prior periods. Since the reform to Article 27 and the entry into force of the North America Free Trade Agreement in 1994, this sector has suffered disloyal competition, lack of support and an increase in poverty. One of the novelties is that the Sembrando Vida program covers several areas, seeking to create employment, give technical support, and include women (Montes and Sánchez, 2024; Santiago, 2023).

In this sense, Montes and Sánchez (2024), Cortez *et al.*, (2022), Santiago (2023), and Ortiz and Sánchez (2024) conclude that the Sembrando Vida program has the novelty of placing peasants at the core; it offers monthly backing; it is necessary to improve the registration requirements; the people have a good perception of the program; problems with technical support and for inputs persist; the impact in the socioeconomic area is negative; the resources granted are not sufficient to achieve the goals of the program and to cover its basic needs; and it should encompass beyond the rural level to address the predicament of migration.

Therefore, the objective proposed for this study is to determine the impact of the Sembrando Vida program on the production of corn and beans in the eight states where the program started to be implemented. Likewise, the research hypothesis is that the Sembrando Vida program impacted corn and bean production in the eight states where it started to be implemented.

MATERIALS AND METHODS

To reach the objective of the study and to test the hypothesis, 64 structural analysis tests with dichotomous variables were conducted. These tests, according to Gujarati and Porter (2009) and Wooldridge (2010), allow to determine if a variable changed its trend or its intercept, or both, because of an event. That is, with these tests, it will be possible to establish whether the Sembrando Vida program caused a change in the trend or in the intercept of corn and bean production in the eight states where it started to be implemented.

The databases that were used in this study are the agricultural production from the eight states where the program started to be implemented (Puebla, Durango, Veracruz, Tabasco, Chiapas, Campeche, Quintana Roo and Yucatán) and the yield per hectare of the eight states, which were extracted from the Agrifood and Fishing Information Service (*Servicio de Información Agroalimentaria y Pesquera*, SIAP) website (SIAP, 2024).

In addition, the Trimester Index of State Economic Activity (*Índice Trimestral de Actividad Económica Estatal*, ITAEE) was used, which was obtained from the National Institute of Statistics and Geography (*Instituto Nacional de Estadística y Geografía*, INEGI) website (INEGI, 2024). The three databases have a temporality of 1980 to 2022, they are annual data (an annual average was obtained for ITAEE), and there are 43 data.

Regarding the databases, according to Gujarati and Porter (2009) and Wooldridge (2010), it is necessary to have a broad database for this type of tests that require conducting regressions. This is because, according to the authors, based on the Gauss Márkov theorem and the assumption of normality, which allow, among other things, for a model to be a

best unbiased estimator (BUE) and to conduct hypothesis tests. In this sense, because the production data are only in annual data, and to fulfill the test requirements, the decision was made to use the temporality available from SIAP (2024), which was 1980 to 2022.

Structural analysis tests

To analyze the impact of the Sembrando Vida program on corn and bean production in the eight states where it started to be implemented, 64 structural analysis tests with dichotomous variables were used. To conduct them, the methodology presented by Gujarati and Porter (2009) and Wooldridge was employed. With this methodology, the existence of a structural change could be determined, and whether that change was in the intercept, the slope or both.

In this sense, and according to the authors, the dates when the event took place should be chosen, and with that determine where the tests will be applied. Because the program started to be implemented in 2019, the tests for 2019 would be applied; however, considering the delay that the effect of the program could have on corn and bean production, the tests for 2020, 2021 and 2022 were conducted.

It should be noted that, as indicated before, these tests require conducting regressions and therefore it is necessary to have abundant robust data. Likewise, because the data are annual, the temporality available was used, which is 1980 to 2022 (there are only 43 data). The information from the 64 tests that will be made is summarized in Table 1.

Table 1 shows that for each of the eight states examined (Puebla, Durango, Veracruz, Tabasco, Chiapas, Campeche, Quintana Roo and Yucatán), two tests will be conducted because there are two products which are analyzed (corn and bean), and four years will be examined (2019, 2020, 2021 y 2022). Therefore, the 64 structural analysis tests that will be conducted will have the form of Equation 1.

$$Y = \alpha_1 + \alpha_2 D_t + B_1 T + B_2 \left(D_t T\right) + x_1 B_3 + x_2 B_4 + \mu_1 \quad (1)$$

Where: Y=corn or bean production from one of the eight states; α_1=intercept value; α_2= differential intercept value; D_t=dichotomous variable, where 0 are the observations before the cut and 1 after the cut (see Table 1); B_1=beta value of time; T=time; B_2=differential slope; x_1=Trimester Index of State Economic Activity (*Índice Trimestral de Actividad Económica Estatal*, ITAEE); B_3=Beta value of the ITAEE control variable; x_2=Yield of one of the eight states (UDM/HA); B_4=Beta value of the control variable, yield; μ_1=stochastic error.

Table 1. Information about structural analysis tests that will be conducted.

Independent variables	Independent variable	Years that were examined	Cut
Time Trimester Index of State Economic Activity (*Índice Trimestral de Actividad Económica Estatal*, ITAEE). Yield (UDM/HA)	Corn and bean production from Puebla, Durango, Veracruz, Tabasco, Chiapas, Campeche, Quintana Roo and Yucatán.	2019 2020 2021 2022	0 before the year examined and 1 after the year examined.

Source: Prepared by the authors.

The 64 structural analysis tests that have the form of Equation 1 will be made according to what was described by Gujarati and Porter (2009) and Wooldridge (2010), and the Excel software will be used. Likewise, Equation 1 indicates that two control variables were added with the aim of obtaining more robust results.

This is how, in the 64 tests that will be made, the intercept (α_2) and the differential slope (B_2) will be reviewed, with the aim of establishing the presence of a structural change in corn and bean production in the eight states examined during the years 2019, 2020, 2021 and 2022.

In this sense, when only the p value of the differential intercept (α_2) is lower than 0.05, then there is a structural change in the intercept; on the other hand, in the case where only the p value of the differential slope (B_2) is lower than 0.05, then there is a structural change in the slope; lastly, in the case that both values are lower than 0.05, then there is a structural change in the slope and in the intercept. If both values are higher than 0.05, there is no structural change.

RESULTS AND DISCUSSION

Based on the methodology, the results from the 32 structural analysis tests with dichotomous variables of corn in the eight states examined in the years 2019, 2020, 2021 and 2022, are presented in Table 2.

The results from the structural analysis tests for corn production presented in Table 2 show that a structural change was not present in seven of the eight states examined in the periods 2019, 2020, 2021 and 2022, since in these tests the p values of the intercept (α_2) and of the differential slope (B_2) are higher than 0.05 in every case. This means that there was not a structural change in corn production in the years 2019, 2020, 2021 and 2022, in the states of Puebla, Durango, Veracruz, Tabasco, Chiapas, Campeche and Yucatán. The only exception is the state of Quintana Roo, where it was found that corn production suffered a structural change in the differential intercept (α_2) in the year 2022, since its p is lower than 0.05.

Now, the results from the 32 structural analysis tests with dichotomous variables of bean from the eight states examined in the years 2019, 2020, 2021 and 2022 are presented in Table 3.

The structural analysis tests of bean production presented in Table 3 show that there was no structural change in six of the eight states examined in the periods 2019, 2020, 2021 and 2022, since in these tests, the p values of the intercept (α_2) and of the differential slope (B_2) are higher than 0.05 in every case. This means that there was no structural change in bean production in the years 2019, 2020, 2021 and 2022, in the states of Puebla, Veracruz, Tabasco, Chiapas, Campeche and Yucatán.

The exceptions are the state of Quintana Roo, where it was found that in the years 2019 and 2022, bean production suffered a structural change in the differential slope (α_2), since the p value is lower than 0.05 in both years; and Durango, where it was found that in the year 2019 there was a structural change in the slope (B_2) and in the differential intercept (α_2), because the p value is lower than 0.05 in both cases, and in the

Table 2. Structural analysis tests with dichotomous variables of corn.

Year	Corn	Puebla	Durango	Veracruz	Tabasco	Chiapas	Campeche	Quintana Roo	Yucatán
		p-value							
2019	Interception	0.99	0.25	0.24	0.04	0.11	0.01	0.00	0.88
	Differential intercept	0.75	0.38	0.26	0.40	0.70	0.51	0.27	0.59
	X	0.95	0.66	0.69	0.02	0.07	0.00	0.95	0.19
	Differential slope	0.75	0.34	0.25	0.40	0.72	0.47	0.32	0.59
	Economic activity (ITAEE)	0.85	0.95	0.20	0.77	0.04	0.13	0.79	0.20
	Yield	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.04
2020	Interception	1.00	0.26	0.16	0.06	0.12	0.01	0.00	0.83
	Differential intercept	0.89	0.29	0.50	0.77	0.83	0.41	0.17	0.89
	X	0.96	0.67	0.49	0.03	0.08	0.00	0.95	0.20
	Differential slope	0.89	0.51	0.11	0.60	0.90	0.81	0.96	0.94
	Economic activity (ITAEE)	0.86	0.99	0.11	0.96	0.04	0.15	0.85	0.20
	Yield	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.04
2021	Interception	1.00	0.31	0.27	0.04	0.11	0.01	0.00	0.90
	Differential intercept	0.86	0.09	0.94	0.62	0.55	0.52	0.17	0.58
	X	1.00	0.76	0.75	0.02	0.07	0.00	0.95	0.21
	Differential slope	0.86	0.66	0.48	0.37	0.70	0.24	0.96	0.46
	Economic activity (ITAEE)	0.82	0.91	0.23	0.79	0.04	0.12	0.85	0.22
	Yield	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.03
2022	Interception	0.95	0.28	0.28	0.06	0.10	0.01	0.00	0.91
	Differential intercept	0.77	0.07	0.87	0.85	0.47	0.21	0.01	0.72
	X	0.97	0.69	0.77	0.03	0.06	0.00	0.81	0.21
	Differential slope	0.77	0.17	0.44	0.54	0.53	0.69	0.37	0.58
	Economic activity (ITAEE)	0.85	0.93	0.25	0.89	0.03	0.14	0.96	0.22
	Yield	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.04

Source: Prepared by the authors.

years 2021 and 2022 where only the differential slope changed (B_2) because the value is lower than 0.05 in both cases.

Therefore, the results from the research are similar to the findings by Gómez and Tacuba (2017), who indicate that the programs *Fertilizantes para el Bienestar* and *Programa Nacional de Modernización del Campo*, did not have a significant impact, which they attribute to deficiencies in their design.

The latter is indicated by Ortiz and Sánchez (2024), Cortez *et al.* (2022) and Santiago (2023), authors who analyzed the impact of Sembrando Vida, signaling some deficiencies, such as: the resources granted are not enough to achieve the goals of the program and to cover their basic needs; it should go beyond rural zones, and give technical support and inputs; it is necessary to improve the registration requirements; and it should encompass beyond the rural level.

Table 3. Structural analysis tests with dichotomous variables of bean.

Año	Frijol	Puebla	Durango	Veracruz	Tabasco	Chiapas	Campeche	Quintana Roo	Yucatán
		p-value							
2019	Interception	0.05	0.19	0.92	0.50	0.20	0.01	0.57	0.01
	Differential intercept	0.44	0.04	0.76	0.94	0.67	0.94	0.06	0.80
	X	0.49	0.31	0.24	0.43	0.95	0.07	0.05	0.89
	Differential slope	0.38	0.04	0.70	0.89	0.63	0.91	0.04	0.80
	Economic activity (ITAEE)	0.89	0.13	0.52	0.63	0.18	0.03	0.07	0.37
	Yield	0.00	0.00	0.05	0.00	0.00	0.00	0.12	0.56
2020	Interception	0.07	0.24	0.99	0.50	0.23	0.01	0.79	0.01
	Differential intercept	0.67	0.94	0.46	0.38	0.55	0.58	0.86	0.93
	X	0.57	0.39	0.22	0.41	0.86	0.07	0.03	0.89
	Differential slope	0.62	0.40	0.59	0.95	0.92	0.95	0.15	0.95
	Economic activity (ITAEE)	0.99	0.18	0.46	0.63	0.21	0.03	0.04	0.38
	Yield	0.00	0.00	0.05	0.00	0.00	0.00	0.20	0.56
2021	Interception	0.04	0.25	0.90	0.51	0.20	0.01	0.53	0.01
	Differential intercept	0.92	0.69	0.27	0.28	0.64	0.49	0.64	0.91
	X	0.33	0.37	0.25	0.43	0.94	0.07	0.07	0.88
	Differential slope	0.94	0.04	0.78	0.93	0.65	0.90	0.14	0.80
	Economic activity (ITAEE)	0.77	0.15	0.54	0.65	0.18	0.03	0.09	0.36
	Yield	0.00	0.00	0.05	0.00	0.00	0.00	0.16	0.56
2022	Interception	0.04	0.24	0.88	0.49	0.18	0.01	0.42	0.01
	Differential intercept	0.13	0.92	0.20	0.23	0.67	0.42	0.70	0.93
	X	0.33	0.42	0.27	0.41	0.97	0.07	0.12	0.87
	Differential slope	0.94	0.03	0.83	0.85	0.51	0.93	0.02	0.75
	Economic activity (ITAEE)	0.77	0.18	0.56	0.61	0.16	0.03	0.22	0.36
	Yield	0.00	0.00	0.05	0.00	0.00	0.00	0.04	0.56

Source: Prepared by the authors.

The deficiencies pointed out by the authors can explain why, in general, no evidence was found in the study of a structural change caused by the Sembrando Vida program. Therefore, according to the results and the study, it is necessary to address these deficiencies of the program.

On the other hand, there are authors that have found evidence that the government programs have had a significant impact, as in the case of De Ita (2019), who indicates that Bienpesca and Production for Wellbeing, have had a significant impact because they increased agricultural productivity by 20% in the states where the program was applied like Guerrero, Veracruz and Chiapas.

About this, Montes and Sánchez (2024) and Santiago (2023) indicate that the Sembrando Vida program has some characteristics that make it stand out over previous programs. They are that: it seeks to cover several areas; it seeks to create jobs; give technical support; include women; place peasants at the center of the program; and offer monthly support.

This is why even when these programs do not achieve their aim, it is necessary to continue supporting the agricultural sector in Mexico. This is because the agricultural sector has multiple problems, such as the poverty of people in the agricultural sector and the lack of modernization of a large part of agricultural producers (Ríos, 2020; Baca and Cuevas, 2018; Ayala and Chapa, 2017; Guzmán *et al.*, 2012; Becerril *et al.*, 2011; De Grammont, 2010). Because of this, the study suggests continuing to support the agricultural sector in Mexico, although restructuring the program for it to have a more significant impact.

CONCLUSIONS

The results indicate that the Sembrando Vida program has not been successful in impacting corn production in seven of the states examined, and in the case of bean, it did not impact in six of the eight states analyzed. The exception in corn was the state of Quintana Roo in the year 2022; and in the case of bean, it was Quintana Roo in the years 2019 and 2022, and Durango in the years 2019, 2021 and 2022. This allows establishing that the Sembrando Vida program did not have a significant impact on the production of two crops. This can be attributed to deficiencies of the program. Some limitations of the study are that fruit trees were not examined.

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