Investigation note

Determination of the behavior of the agricultural producer in relation to PROCAMPO case: Villaflores, Chiapas

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Abstract

Because Mexico is immersed in a world economy that is constantly changing, it is vitally important to measure the effects of agricultural policy through the use, of the resources available to the public treasury. Within this context, part of the resources that the producer receives as subsidies are through PROCAMPO. The general objective was to determine whether production and consumption (among other variables) have a relationship of interdependence of PROCAMPO at the moment in which the producer decides to participate or not in the program; that is, are these variables conditioning the producer's decisions regarding PROCAMPO? and to what extent? In this sense, the methodology to be followed was through the use of the logit model, where the results obtained; through this qualitative dependent variable test, it showed that the probability that a producer from the municipality of Villaflores, Chiapas, joins PROCAMPO, increases 55%; however, the probability that a producer joins the same program increases 91% when he grows corn. It is concluded that the independent variables of production and consumption condition the decisions of the agricultural producer with respect to PROCAMPO, in the study area.

Keywords: consumption, logit model, production, government program.

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The reforms in the agricultural policy of Mexico practiced since the mid-1980s have sought an impact on agricultural production and on the incomes of producers (Ramírez, 1994). Within the agricultural reforms implemented in the country highlights the Program Direct Support (PROCAMPO) effective since 1994, which transformed the orientation of agricultural subsidies in Mexico (ASERCA, 2009).

According to SAGARPA (2013), PROAGRO Productivo is a policy implemented by the Mexican government to supplement the economic income of producers in the Mexican countryside, whether for self-consumption or supply, to contribute to individual and country economic growth as a whole, as well as encouraging the production of licit crops through the granting of monetary support per area registered in the program, in accordance with current regulations, thus contributing to the attention to the needs regarding the right to food, raised in the pact for Mexico.

Thus, PROCAMPO is a direct support that the federal government grants through the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) to the income of rural producers. Likewise, this program began in late 1993 and responded to the opening of the national economy and the need to modernize the Mexican countryside (SAGARPA, 2007). At the beginning the government announced that the validity of the Program would be 15 years; however, it is still valid (Government of the Republic, 2013).

Therefore, the true role of PROCAMPO will be distinguished; through, of the question: Is this program neutral with relation in the decision-making of the producer, as to what to produce and how much to produce? that is, is PROCAMPO linked to production? Hence, considering the importance of PROCAMPO as the main instrument of support in the agricultural sector, the present investigation aims to analyze the relationship of PROCAMPO with certain key socioeconomic variables, such as production, income and consumption; and from there, identify their interdependencies and determine if they are present at the moment in which the producer decides to participate or not in the program. Are these variables conditioning the producer's decisions regarding PROCAMPO? and to what extent?

The methodology was deductive analytics, which is characterized by performing the analysis of the object of study from the general to the particular. The method used in the research is qualitative, applying information gathering techniques, which consisted of two phases. In the first phase, the bibliographic and statistical review related to PROCAMPO was carried out; as well as web pages related to the National Municipal Information System, to characterize the political, socio-demographic and economic situation of the municipality of Villaflores, Chiapas.

On the other hand, in the second phase, the field work was carried out, raising first-hand information through surveys with corn producers in the municipality of Villaflores, Chiapas, who are beneficiaries of PROCAMPO's government support. The information was obtained by means of a survey, which obtains specific information from a sample through the use of a structured questionnaire of 32 questions, which divides the producer income section, since it is the primary variable to be considered for the analysis of the research, given that it is related to the object of study. As well as the consumption expenses section of the producer, since it is the second variable to be taken into account for the analysis of the research work, in order to determine the expenses that the producer makes with the income obtained from agricultural, non-agricultural activities and PROCAMPO.

For the design of the survey, the National Household Income and Expenditure Survey of the National Institute of Statistics and Geography was taken into account as a guide. Also, for the elaboration, closed questions were mostly considered, in order to make the processing of the information in a simple way. In addition, for the analysis of the information gathered in the field, a Logit model is proposed at the individual level; that is, with non-grouped data, for whose estimation, the program used EViews 8, applies the method of maximum likelihood.

Regarding the type of sampling used for the investigation, it was simple random probabilistic sampling, since, in this type of sampling, the selection of the sample is done in such a way that all elements of the population are equally likely to be part of the sample. she (Alvarado and Obagi, 2008). The sample size was calculated based on the PROCAMPO beneficiary registry in the municipality of Villaflores, Chiapas, for the year 2013, with 485 beneficiaries. Hence, the sample was calculated using the formula to determine the sample size for a finite population. The choice of the sample size by the simple finite population random sampling method is due to the fact that the size of the population or universe is known; in such a situation, the precision of the estimate is higher, since the population as a whole is better represented (Triola, 2009).

The confidence percentage for this research is 95%, and an estimation error of 5%.

$$n = \frac{N * Z_{\alpha}^{2} * p * q}{d^{2} * (N \quad 1) + Z_{\alpha}^{2} * p * q}$$

Where: N= population size is 485 beneficiaries; n= size of the sample; p= expected proportion of 5%; q= 1-p (1-0.05=0.95); Z_{α}^{2} = 95% confidence level, therefore $Z_{\alpha}^{2} = 1.96^{2}$. Then, the sample size n obtained for the municipality of Villaflores was 64 beneficiaries to be surveyed.

The results obtained are shown from the linear model of probability and logit model, where it is determined if the producers of Villaflores, Chiapas are incorporated into the PROCAMPO program. First, it is considered that the coefficients of the independent variables are statistically significant at 0.05 (significantly different from zero). Then, as shown in Table 1, the two coefficients are positive, which means that the dependent variable behaves in the same way as the independent variables. With respect to the effect of the production variable, it is said that, for each unit of increase in production, the probability that a producer will join PROCAMPO will increase 2%.

Table 1. Probability linear model (Dependent Variable: PROCAMPO; Method: Least Squares).

Variable	Coefficient	Std. Error	t-Statistic	Probability
Production	0.022591	0.008711	2.593456	0.0118
Consmens	0.000121	3.82E-05	3.157959	0.0025
R-squared	0.119711	Mean dependent var		0.6875
Adjusted R-squared	0.105513	S. D. dependent var		0.467177
S. E. of regression	0.441843	Akaike info criterion		1.235028
Sum squared resid	12.10398	Schwarz criterion		1.302493
Log likelihood	-37.52089	Hannan-Quinn criter		1.261606
Durbin-Watson stat	1.678873			

Source: elaboration with field data, 2017.

On the other hand, regarding monthly consumption, it is indicated that, for each unit of increase in monthly consumption expenses, the probability that a producer will join PROCAMPO will increase by 0.0001 or 0.01%.

With respect to the above, it is perceived that the linear probability model expresses values of the estimators of Y (in this case $\hat{Y}$) greater than 1. Hence, this model does not respect the restriction that the probabilities must be within the range 0 and 1, consequently, its main weakness of the MLP.

According to Gujarati and Porter (2010), the MLP has an infinity of problems, such as the normality of the $\mu_{i,}$ the heteroscedasticity of $\mu_{i,}$ the possibility that $\hat{Y}_i$ it is outside the 0-1 range and the generally low values of R^2. Thus, the fundamental problem with the MLP is that logically it is not an attractive model because $P_i = E(Y = 1/X)$ it increases linearly with *X*, that is, the marginal or incremental effect of *X* remains constant all the time. Therefore, what is required is a (probabilistic) model that has two characteristics: as X_i, $P_i = E(Y = 1/X)$ increases, it also increases but never goes beyond the 0-1 interval and the relationship between P_i and X_i is non-linear. Therefore, it is possible to use the cumulative distribution function (FDA) in regressions of models in which the response variable is dichotomous, to acquire 0-1 values (Gujarati and Porter, 2010).

For Medina (2003), the estimation and interpretation of linear probabilistic models raises a number of problems that have led to the search for alternative models that reliably estimate dichotomous variables. To avoid that the estimated endogenous variable is outside the range (0,1), the available alternatives are to use non-linear probability models, where the specification function used guarantees a result in the estimate comprised in the 0-1 range. Since the use of a distribution function guarantees that the result of the estimation is bounded between 0 and 1, in principle the possible alternatives are several, being the most common the logistic distribution function, which has given rise to the logit model (Medina, 2003).

Therefore, the logit model is proposed (since it encapsulates the probabilities within this range) since it is counted among the qualitative response regression models, in which the answer variable or dependent *Y* is binary or dichotomous, taking the values 1 or 0. In the present case, 1 if the producer has PROCAMPO or 0, if he does not have PROCAMPO.

In effect, the logit model is a probability model; its objective is to find the probability that an event will happen; in this case that, *Y* equals 1; that is, that the i-th producer has PROCAMPO. Where, from the statistical significance of the coefficients of the explanatory variables, it is observed that by virtue of the values of the probabilities (*p*- value), although they are greater than 0.05, they are less than 0.10; so, it is concluded that, although they do not pass the test 5%, will approve in 10%. In Table 2, the models obtained by eviews, Logit 1 and 2, are shown.

Cuadro 2. Logit model 1. Dependent variable: PROCAMPO; Method: ML-binary logit (quadratic hill climbing).

Variable	Coefficient	Standard error	z-Statistic	Probability
C	-2.816298	1.397883	-2.014688	0.0439
Production	0.114678	0.065785	1.743228	0.0813
Consmens	0.000713	0.000397	1.794352	0.0728
McFadden R-squared	0.112913	Mean dependent var		0.6875
S. D. dependent var	0.467177	S. E. of regression		0.438557
Akaike info criterion	1.195665	Sum squared resid		11.73229
Schwarz criterion	1.296862	Log likelihood		-35.26127
Hannan-Quinn criter.	1.235532	Deviance		70.52255
Restr. deviance	79.49906	Restr. log likelihood		-39.74953
LR statistic	8.976511	Avg. log likelihood		-0.550957
Prob(LR statistic)	0.01124			
Obs with Dep= 0	20	Total obs		64
Obs with Dep= 1	44			

Source: elaboration with field data, 2017.

Regarding Table 2, it is stated that both cases, the coefficients of the explanatory variables are statistically significant 10%; that is, their values are different from zero. On the other hand, Table 3, reflects that the estimated model is statistically significant, by virtue of the fact that the values of the probability (*p*- value) are less than 0.05 (5% of the confidence level), both from the point of view of the statistical significance of the coefficients, as well as the overall goodness of fit of the model (expressed in the statistic prob LR statistic) and therefore, a change in any of them has a significant effect on the dependent variable, in this case , in the logit.

Cuadro 3. Logit model 2. Dependent variable: PROCAMPO; Method: ML-binary logit (quadratic hill climbing).

Variable	Coefficient	Standard error	z-Statistic	Probability
C	-3.949825	1.66433	-2.373222	0.0176
Production	0.212061	0.082655	2.56561	0.0103
Cultivos	2.400143	0.990037	2.424297	0.0153
McFadden R-squared	0.144457	Mean dependent var		0.6875
S. D. dependent var	0.467177	S. E. of regression		0.43161
Akaike info criterion	1.156482	Sum squared resid		11.36351
Schwarz criterion	1.257679	Log likelihood		-34.00741
Hannan-Quinn criter	1.196348	Deviance		68.01482
Restr. deviance	79.49906	Restr. log likelihood		-39.74953
LR statistic	11.48423	Avg. log likelihood		-0.531366
Prob (LR statistic)	0.003208			
Obs with Dep= 0	20	Total obs		64
Obs with Dep= 1	44			

Source: elaboration with field data, 2017.

According to the calculation of probabilities based on the logit values, it is important to note that the regression model estimated a logit probability model and not a linear probability model; since both are different, they are valued by different methods: the linear model by means of ordinary least squares (MCO) and the logit model by the maximum likelihood (MV) method, with non-clustered data. Then, according to Medina (2003) given a random variable, characterized by some parameters and given a population sample, maximum-likelihood estimators of the parameters of a given population are considered, those values of the parameters that would most likely generate the sample observed

Therefore, the maximum-likelihood estimators are those values for which the joint density function (or likelihood function) reaches a maximum. In the linear model the $\hat{Y}_i$ estimates are probabilities and in the logit model they are logits; that is, not directly probabilities. Then, the inverse transformation is performed on the $\hat{Y}_i$ estimates (which are logits), which consists of taking the antilogarithm (the exponential) of the logit to obtain the odds (possibilities) and then the probabilities. Once the probabilities are calculated based on the logit values, when the value of the dependent variable is 0 and 1, it is obtained that the sum of probabilities results from this being greater when the value of the dependent variable is 1, that when it is 0. That is, the probabilities tend to approach 1 when the value of the dependent variable is 1, whereas when it is 0, the probabilities have to approach zero. Therefore, the model tends to optimally replicate the observed variable.

In terms of probabilities, it is inferred that, for each unit of production increase in tons, the probability that a producer from the municipality of Villaflores, Chiapas will join PROCAMPO will increase 55%; however, the probability that a producer joins the same program will increase 91% when he grows corn. The verification of the relevance of the logit model, in comparison with the MLP, is determined through the sum of the squared residuals of both models.

Because of the above, it is shown that this sum is lower in the Logit model than in MLP, given that in the Logit model it is obtained by the maximum likelihood method; therefore, this model is relevant in the study of the incorporation of the agricultural producer to PROCAMPO. Thus, small agricultural areas represent an important limitation in agricultural production, where according to the results of this research, shows that PROCAMPO promotes an increase in the production of small extensions of production, considering the use of new technology. In this way, it is necessary to prioritize the promotion of research activities, technology transfer and technical assistance, which lead to increase agricultural productivity. Also, promote the development of rural infrastructure to capture the production of small producers. In this tenor, despite the problems of decapitalization, the peasant economy has not only managed to survive, but has also entered into new organizational practices.

On the other hand, productive heterogeneity prevents and distorts sectoral policies of a global nature, which must incorporate the specific problems of each producer, product and region; disaggregating pricing policies, support and subsidies, credit and insurance, investment and technical assistance, as well as organization and training. Finally, it is necessary to have a more active participation of rural society and the State, not as a recipient of a program, but in the decision-making process of it.

Conclusions

First, it is inferred that the greater the production, the greater the possibility that the producer will be annexed to PROCAMPO. In the same way that, when joining the federal program, it will help in the increase of the producer's production. So the role played by the government program is of radical importance because PROCAMPO is linked to production. Therefore, to include this determinant, it is conceived that the support received by the producer through PROCAMPO has a distorting effect on the market.

With respect to the consumption variable, the same behavior as the production variable can be seen, where increasing the monthly consumption expenditure will increase the possibility that the producer will be linked to PROCAMPO. The support received by this through PROCAMPO is part of their income and this in turn, is intended for consumption or savings. The latter is generally considered as a remnant of income over family consumption in products of first necessity.

The independent variables of production, consumption and crops are variables that explain the interdependence with the endogenous variable; that is, PROCAMPO, given that these conditions the decisions of the agricultural producer with respect to the program, in the study area.

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