Transition of agricultural income sources in rural economies of Mexico

Transición de las fuentes de ingresos agropecuarios en economías rurales de México

Transição de fontes de renda agrícola nas economias rurais do México

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Abstract

Traditionally, agriculture has been the main economic activity of rural communities, however, there are other sources of income that contribute to expenditures on family well-being. Nevertheless, the dynamics of these flows are unknown due to the absence of official statistics for small populations, which makes it difficult to analyze them in relation to poverty. Through an econometric model, the objective was to analyze the transition of income from agricultural production to sources in the service sector and remittances. It was taken as a study case, "Eleodoro Dávila" town from Filomeno Mata municipality, Veracruz, Mexico. Randomly, a questionnaire was applied to 33.33% of the population and an econometric model of expenditures on family well-being was built with data obtained. The dependent variable was expenditures on family well-being, while the independent variables were the diversity of sources of income. In addition, the elasticities of the independent variables were estimated from the econometric model. Primary and secondary activities, subsidies and household transfers were found to contribute to family well-being. In addition, it was found that a 1% increase in income from livestock production generates a 0.05% change in spending on family well-being, while agricultural production generates 0.16%. Trade, international and national remittances generate the greatest effects with 0.81%, 0.71% and 0.48% respectively. The situation that prevailed during 2019-2020 in the study community allows us to conclude that the agricultural sector has lost preponderance as the main source of income.

Resumen

Tradicionalmente, la agricultura ha sido la actividad económica principal de las comunidades rurales, sin embargo, existen otras fuentes de ingreso que aportan al gasto en bienestar familiar. Empero, se desconocen las dinámicas de estos flujos debido a la ausencia de estadísticas oficiales para poblaciones pequeñas, lo cual dificulta su análisis en relación con la pobreza. El objetivo fue analizar la transición de los ingresos provenientes de las unidades de producción agropecuarias hacia las fuentes del sector servicios y remesas, mediante un modelo econométrico. Se tomó como caso de estudio la localidad rural "Eleodoro Dávila", Filomeno Mata, Veracruz, México. En forma aleatoria, se aplicó un cuestionario al 33,33% de la población y con los datos obtenidos se construyó un modelo econométrico del gasto en bienestar familiar. La variable dependiente fue el gasto en bienestar familiar, mientras que las variables independientes fueron la diversidad de fuentes de ingresos. Se estimaron las elasticidades de las variables independientes. Se encontró que las actividades primarias y secundarias, los subsidios y las transferencias hogares contribuyen al bienestar familiar. Se halló que ante un incremento en 1% del ingreso proveniente de la producción pecuaria, se genera un cambio de 0,05% en el gasto en bienestar familiar, mientras que la producción agrícola genera 0,16%. El comercio, las remesas internacionales y nacionales generan los mayores efectos con 0,81%, 0,71% y 0,48% respectivamente. La situación que prevaleció durante el 2019-2020 en la comunidad de estudio permite concluir que el sector agropecuario ha perdido preponderancia como fuente principal de ingresos.

Palabras clave: Modelo econométrico, remesas, gasto en bienestar.

Resumo

Tradicionalmente, a agricultura tem sido a principal atividade econômica das comunidades rurais, no entanto, existem outras fontes de renda que contribuem para os gastos com o bem-estar familiar. No entanto, a dinâmica desses fluxos é desconhecida devido à ausência de estatísticas oficiais para pequenas populações, o que dificulta sua análise em relação à pobreza. O objetivo foi analisar a transição da renda das unidades de produção agropecuária para fontes no setor de serviços e remessas, por meio de um modelo econométrico. Tomando como estudo de caso a localidade rural "Eleodoro Dávila" município de Filomeno Mata, Veracruz, México. Aleatoriamente, foi aplicado um questionário a 33,33% da população e com os dados obtidos foi construído um modelo econométrico de gastos com bem-estar familiar. A variável dependente foi o gasto com o bem-estar familiar, enquanto as variáveis independentes foram a diversidade de fontes de renda. As elasticidades das variáveis independentes foram estimadas. As atividades primárias e secundárias, os subsídios e as transferências familiares contribuem para o bem-estar da família. Constatou-se que um aumento de 1% na renda da produção pecuária gera uma variação de 0,05% nos gastos com o bem-estar familiar, enquanto a produção agrícola gera 0,16%. Comércio, remessas internacionais e nacionais geram os maiores efeitos com 0,81%, 0,71% e 0,48% respectivamente. A situação que prevaleceu durante 2019-2020 na comunidade em estudo permite-nos concluir que o setor agrícola perdeu preponderância como principal fonte de rendimento.

Palavras-chave: Modelo econométrico, remessas, gastos com bem-estar.

Introduction

The concept of poverty is conceived as a condition in which the population is far from reaching a standard, social norm or state of optimal situation for its good development (ECLAC, 2018). Considering that the ability of a person to possess the elements of well-being does not only depend on whether they are free or have permission to acquire what they need, since a fundamental part is having the economic capacity to acquire them (Stezano, 2021).

As Sison (1995) indicates, economists associate well-being with per capita income, the level or quality of life of the inhabitants of a region.

In a general way, and despite the multidimensional and complex nature that it may have, it is said that poverty is a condition in which one or more people have a level of well-being below the minimum necessary for survival (Berneche, 2010, p. 31)

Considering the above, Camelo (2001) indicates that "household income and spending are central elements for the evaluation and study of the living conditions of families" (p. 5). In order to evaluated it, several methodologies are used, one of them is the Poverty Line (LP) proposed by the National Council for the Evaluation of Social Development Policy (CONEVAL). It is an approach that classifies a household as poor if its income or expenditure is less than the value of an LP. The latter represents the added value of all the goods and services considered essential to satisfy basic needs (a food basket and a non-food basket) (CONEVAL, 2019).

In this sense and taking into account that the food and non-food basket are considered essential for the good development of a person, it is concluded that this is nothing more than an expense in well-being and the poverty line is the possibility of be able to afford that expense.

In this way, Mora and Cerón (2015) point out that the expenditure made on the welfare of rural households comes from a total family income, and this in turn depends on various sources, either from productive units or from national remittances and international, trade, government programs, among others. So, knowing the diversity of sources of income for spending on welfare, it is possible to generate public policy proposals that can help improve the conditions of certain populations that require it.

In the same context, Gurusamy *et al*. (2018) indicate that "the importance of the study of the social well-being of households lies in the fact that the results can be used to propose specific intervention strategies, taking into account productive, socioeconomic and environmental characteristics" (p. 215).

However, the information on income and expenditure, which is exposed by the National Survey of Household Income and Expenses (ENIGH) of Mexico, is only displayed for populations greater than 2,500 inhabitants, leaving aside rural localities, which are characterized by being populations smaller than that. In this way, the lack of information at the local level of rural economies results in the difficulty of recognizing the sources of income destined for spending on family welfare, which represents a problem for the analysis of these economies.

In this context, Mora and Cerón (2015) analyzed factors that influence the diversification of activities, using data from the National Survey of Rural Households of Mexico (ENHRUM) of 2008, and in turn, determine the impact of this on the income of rural households in Mexico. They reveal that diversification of activities is the key for increasing income in rural households, which leads to the conclusion that public policies must be better focused, taking as a priority families with lower incomes.

Likewise, Gijón *et al.* (2015), tested a general model of family economies for rural communities, evaluating the main sources of income that contribute to family well-being, they verified that "government transfers constitute one more source of income, and can even reach represent, along with transfers from other households, restrictions on family welfare" (p. 1).

In Oaxaca, Mexico, Méndez and Reyes (2016) analyzed family well-being, proposed a theoretical model of well-being with 27 independent variables, and identified the variables that favor or restrict well-being. They conclude that income, occupation, housing quality and government support are variables that explain well-being.

Similarly, Reyes *et al*. (2015), propose a model for the rural households economies in Mexico, where family well-being and household income are related. They also indicate that international remittances are part of total income, in addition to government transfers and self-consumption production. They mention that international remittances (although in other cases regional wages) could be the catalyst to raise family well-being in relation to the level that the local labor market allows.

Therefore, this research aimed to develop a model of "Family Welfare Expenditure" to analyze the transition from agricultural sources of income to non-agricultural sources (services and remittances). It is important to highlight that the case study is a locality with an approximate population of 1440 inhabitants. It belongs to the municipality of Filomeno Mata, Veracruz. A rural population that occupied the third position of state poverty by 2015, with 91.6% of its population in that condition.

Materials and methods

Study area

The study was carried out in the locality "Eleodoro Dávila", one of the eleven localities that make up the municipality of Filomeno Mata in the state of Veracruz de Ignacio de la Llave; Mexico is located between parallels 20° 10' and 20° 16' north latitude; the meridians 97° 38' and 97° 45' of west longitude; altitude between 194 and 800 meters above sea level (SEFIPLAN, 2018).

Population

In order to know the exact number of family nuclei, the director of the municipality's health center was consulted, who indicated that the municipality has 2,322 family nuclei and the town "Eleodoro Dávila" has 240.

Interviews and sample size

To obtain the data, a semi-structured questionnaire was prepared with 78 questions distributed in 6 sections; "The household", "Services", "Economic activities", "Other income and savings", "Household expenses", "Subsidies" and "Migration". To calculate the sample size, the formula proposed in Spiegel and Stephens (2009) was considered:

$$n = \frac{N * Z_a^2 * p * q}{d^2 * (N-1) + Z_a^2 * p * q}$$

where:

N: Population = 240, Z: Confidence level = 1.96, P: Expected proportion = 0.5, Q: Probability of failure = 0.5, and D: Precision = 0.09

Substituting the values gives 79.58 as a result, so a total of 80 interviews were carried out in the locality.

Model definition

It was used the methodology proposed by Reyes *et al*., (2015), which is based on the family income equation:

$$IF = C + Inv + Ah$$

where:

IF = Family income, C = Consumption, Inv = Investment and Ah = Savings

In addition, C contains the current expenses: Food, health, clothing and footwear, education, housing. Therefore, C approximates Family Welfare Expenditure: $C \cong GBF$

On the other hand, family income derives from various sources of the labor market, it were considered: local income (IngLoc), national remittances (RemNa), international remittances (RemInt), income from subsidies (ProG), income by livestock production (IngPP), income in agricultural production (IngPA), income from trade (IngC) and other income (IngOtr)

Substituting the above, the following equation is obtained:

$$GBF = \beta_1 IngLoc + \beta_2 RemNa + \beta_3 RemInt + \beta_4 ProG$$
$$+ \beta_5 IngPP + \beta_6 IngPA + \beta_7 IngC + \beta_8 IngOtr$$
$$- \beta_9 Inv\beta_1 - \beta_{10} Ah$$

For the investment variable, the following accounts were considered: Expenses in livestock production, agriculture and trade (transport and purchase of merchandise or supplies). Savings were calculated by subtracting total current spending from total income.

Interviews results were processed in an Excel spreadsheet and for the model generation was used the software Gnu Regression, Econometrics and Time-series Library (Gretl).

Welfare Spending Elasticities

Elasticity is defined, according to Varian (2010), as the measure of the "sensitivity" of demand to price or income variables. That is, elasticity is used to measure the sensitivity of the dependent variable to a change in the value of one of the independent variables, when the value taken by the rest of the independent variables is kept constant.

In this case, the sensitivity of the variable "Expenditure on Well-being" was measured in the face of changes in the variables of income, savings and investment.

Such elasticity was calculated as follows:

$$\varepsilon = \frac{dy}{dx} * \frac{\widetilde{Ing}}{\widetilde{GB}}$$

where:

ε = Elasticity

dy/dx = Coefficient of the model (of each variable)

$\widetilde{(Ing)}$ = Average of each income variable

$\widetilde{(GB)}$ = Average of the variable "Expenditure on Wellbeing"

Results and discussion

Socioeconomic characteristics

Family nuclei are made up of an average of 5 members, where 88.7% of family heads are men, 70% of all family heads only have a basic level of education (primary and secondary).

During the study period, 56.2% of the heads of families lived outside the locality; of this migrant population, 70% worked and lived in Mexico City and 20% in the United States of America.

According to the field data collected, the most used job with 39.5% of the economically active population, is the masonry trade and the second most popular job is related to the work of agricultural production with 18, 6%.

28.7% of the total family units own farmland, with an average extension of 1.8 hectares. 86.9% of the total agricultural producers declared that their main product is corn and only 8.6% use the land for coffee harvesting. Despite the fact that one of the little recognized production activities in the region is livestock, in the locality 53.7% of the interviewed families own backyard cattle, while 22.5% of households own a local business.

Econometric model to determine spending on family welfare

The family welfare spending model was estimated using ordinary least squares. All parameters were significant; that is, all variables influenced the model. The coefficients are presented in table 1.

Table 1. Model of family economies.

	Coeficient	Standard deviation	t statistic	p value	
Constant	419.373	1016.08	0.4127	0,6811	
IngLoc	0.848070	0.173586	4.886	<0.0001	***
RemNa	0.836116	0.129117	6.476	<0.0001	***
RemInt	0.773989	0.0546399	14.17	<0.0001	***
ProG	0.996636	0.403600	2.469	0.0160	**
IngPP	0.952900	0.361818	2.634	0.0104	**
IngPA	0.871758	0.162730	5.357	<0.0001	***
IngC	0.880391	0.107711	8.174	<0.0001	***
IngOtr	0.885057	0.221726	3.992	0.0002	***
Saving	−0.852593	0.0546405	−15.60	<0.0001	***
Investment	−0.878308	0.108567	−8.090	<0.0001	***
Dependent variable mean	6144.072	Dependent variable SD		7730.358	
Sum of squares residual	9.01e+08	Regression SD		3613.933	
R-squared	0.809110	R-squared corrected		0.781445	
F(10, 69)	29.24649	P value (F)		5.28e-21	
Log-likelihood	−763.0024	Akaike Criterion		1548.005	
Schwarz Criterion	1574.207	Hannan-Quinn Criterion		1558.510	

IngLoc: local income; RemNa: national remittances; RemInt: international remittances; ProG: income from subsidies; IngPP: income by livestock production; IngPA: income in agricultural production; IngC: income from trade; IngOtr: other income.

According to the r squared, the model has a goodness of fit of 80% and all the variables turn out to be significant. The estimated equation is effective to the econometric tests; that is, the t statistic is significant at a level of 0.01 in 8 of the variables, except for ProG and IngPP, which are significant at a level of 0.05. Therefore, this model predicts that each of the independent variables establish linear relationships with spending on family welfare.

In relation to the evaluation of assumptions with the formal tests, the following was obtained:

The model has an automatic heteroskedasticity correction, so the estimation of the parameters guarantees constant variance and therefore the confidence intervals for the estimated coefficients are correctly calculated.

Due to the nature of the data (cross section), the assumption of no autocorrelation is not considered, the errors are independent since each observation is a family nucleus.

According to the variance inflation factors (VIF), 8 of the variables have values less than 4, and since the collinearity problem could occur in values greater than 10, it means that these explanatory variables are independent and are not found strongly correlated, except for the variables IngC and INVERSION. In the first test, these last two variables would indicate the presence of a collinearity problem. However, according to the BKW table (by the initials of the test authors), none of the variables has a "strong" almost linear dependence. Then none of the parameter estimates are problematic.

Regarding the normality test, the null hypothesis is rejected, the residuals do not meet the assumption of following a normal distribution. However, despite the assumption not being fulfilled, the estimators are the Best Linearly Unbiased Estimators and the hypothesis tests on the parameters are correct.

All mentioned previously, indicates that the model is statistically reliable, expressed as follows:

$$GBF = 419.373 + 0.84807 IngLoc + 0.836116 RemNa + 0.773989 RemInt + 0.996636 ProG + 0.9529 IngPP + 0.871758 IngPA + 0.880391 IngC + 0.885057 IngOtr - 0.878308 Inv - 0.852593 Ah$$

This equation reveals that the welfare spending of families in this locality depends on a diverse portfolio of income sources. An increase in each of the income variables generates an increase in welfare spending, unlike the Savings and Investment variables that generate a negative effect. In the case of savings, for each peso allocated to this item, spending on welfare decreases by 0.8535 cents. The investment variable is found in the same case, for each peso invested, welfare spending decreases by 0.8783081 cents. The negative proportions correspond to the expected signs in the model definition.

In accordance with the above, it follows that the main sources of household liquidity are: subsidies, income from livestock production, trade, transfers between households, agricultural production, local income and remittances.

Elasticity of spending on welfare with respect to income variables

When measuring the sensitivity of change in welfare spending, with respect to the income variables, all of them turn out to be inelastic, that is, the results are less than 1. The elasticities are of great relevance, since they help to confirm the sectors or sources of income that generates increases in welfare spending.

Table 2 shows the changes caused by each of the income sources in welfare spending. Thus, it can be seen that trade is the one that generates the greatest sensitivity, since, in the face of an increase in one percentage unit in this income, a change of 0.81% in spending is generated.

The economy of families in the locality has a strong link with the international economy, because in the face of a change in an increase of one percentage unit in income from international remittances, this leads to a change in spending of 0.71%.

According to the elasticities, the changes caused by agricultural and livestock production are relatively low, being 0.16% and 0.05%, respectively. In other words, the contribution of the agricultural sector in changes in welfare spending is lower than the contributions made by the services or remittances sector.

These results agree to a certain extent with those exposed by Reyes *et al.,* (2015) and Gijó (2015), who report that the main source of income is national and international remittances, in their study locations.

Table 2 Elasticities of welfare spending.

Variables	Parameters	Variables	Elasticities
Local income	0.84807	1765.75	0.24
National remittances	0.836116	3520	0.48
International remittances	0.773989	5675	0.71
Subsidy income	0.996636	1062.5	0.17
Income from livestock production	0.9529	351.6875	0.05
Income from agricultural production	0.871758	1095.92708	0.16
Trading income	0.880391	5619.6	0.81
Other income	0.885057	461.25	0.07
Savings	-0.852593	6751.90208	-0.94
Investment	-0.878308	5757.4125	-0.82

In addition, Blanco and Bardomás (2015), note that since year 2000, the heads of rural households in Mexico were employed in a greater proportion, outside the family agricultural production units. They mention that this trend continues and is even accentuated, as households with different sources of employment grow. As a reference to this, in this study, 56.2% of the heads of households worked and lived outside the locality at the time of collecting the information.

In the same way, Méndez-Barrón (2016) indicates that "in general there is a reduction in the role of agricultural activities, rather than a reduction, a recomposition of the rural productive structure is observed, where commercial and service activities are strengthened to the detriment of the primaries" (p. 431). Likewise, Salgado-Nieto (2019) points out that remittances, non-agricultural and agricultural wages have become the main sources of income for rural households.

In this regard, Martínez-Domínguez *et al.*, (2018) assert that "in the Mexican countryside, a transition of the workforce from the agricultural to the non-agricultural sector is taking place, since the former stopped generating sufficient income to support the families" (p. 22).

In short, in relation to the studies carried out in other locations in Mexico, mentioned above, and the conclusions reached by the researchers; the results of the locality studied do not show a discrepancy in the transition of income sources.

Also, one of the reasons for these results could be the low endowments of land for agricultural use, so alternatives are needed for this situation faced by households. As mentioned by Gurusamy *et al*. (2018), one of the options is "to encourage non-agricultural activities, mainly small businesses and trades" (p. 232).

Conclusions

With a 80% goodness of fit, the proposed model allows us to analyze the sources of income that contribute to family well-being. According to this model, it can be recognized that primary and secondary activities, as well as government subsidies and transfers between households, contribute to family income and therefore to family well-being.

It is necessary to mention that each of the sources of income generates changes in family well-being in different proportions. In this sense, the income derived from livestock production only produces a change of 0.05% in welfare spending; while agricultural production generates 0.16%. Therefore, these effects are lower in relation to the changes created by other income, such as trade that generates a change of 0.81%, international remittances 0.71% and national remittances 0.48%. In other words, changes in income, derived from agricultural and livestock production, generate relatively small changes in spending on family welfare.

The situation that prevailed in the locality studied during the 2019-2020 period, describes a rural community that is moving towards a recomposition of the rural productive structure, in which the service activity supported by remittances is being strengthened.

In this way, it is necessary to deliberate about the public policies that are implemented in rural localities. Proposals are needed to reactivate the agricultural sector, especially in small peasant production units that allow for an impact on food security, as well as on territorial development. In the same context, it is necessary to encourage the productive investment of international remittances, and where appropriate, reduce dependence on this source of income, which has been a palliative but has not meant an improvement in the poverty conditions of the rural locality.

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