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Analysis of Subsistence and Well-Being Strategies Through a Model of Household Economics in the Tlacolula Valley of Oaxaca State, Mexico

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Survival and well-being strategies of rural households are analyzed using the model of rural household economies (MRHE). There were selected three localities of the semiarid valley of Tlacolula located in the Central Valleys region of Oaxaca state, Mexico. Equations of MRHE were constructed by regression of ordinary least squares. The information on variables was obtained through a probabilistic household survey. Thus, it was possible to measure the impact of these variables on household well-being. The results show that households in this valley are looking to diversify their income sources through several local and regional economic activities. Thus, households intend to increase their well-being level, according to the availability of resources at household and the community. International migration and government transfers are the main sources of exogenous income that allow an increase in household well-being. In addition, some households invest in small family businesses whose net income contributes to the household income. Collection and hunting are part of the lifestyle of households that have survived in this valley since pre-Hispanic times and they are just subsistence activities.

Keywords: household economics, subsistence, activities, international migration

Introduction

Results of the analysis of household economics from three localities in the semi-dry Tlacolula valley in the central area of the state of Oaxaca, Mexico, where also occurs periods of intra-summer droughts, are presented. These conditions limit agricultural activities whose production is mainly oriented to self-consumption and small-scale commercial production is confined to scarce irrigated areas. The economy and society of this valley are traditional with strong indigenous features whose dynamic revolves around two regional markets, but also

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have permanent contact with global markets through migration and tourism (Cook & Binford, 1995). Many communities in this valley combine subsistence activities with artisanal production, which contain elements of the Zapotec culture (Hernández, Zafra, Ortiz, & Hernández, 2001). Currently these features constitute an attraction for domestic and foreign tourists. Both agriculture and backyard livestock make small contributions to the local gross production and even in communities with artisanal manufacture (Gijón-Cruz, Rees, & Reyes-Morales, 2000). Agriculture does not participate in the economic growth of this valley but rather could reflect marked social inequalities between households and towns (Murphy, Stepick, Morris, & Winter, 2002). However, agriculture has become a primary means to ensure survival since prehistoric times. Up to 73.6% of the population of the 18 municipalities of this valley is poor (CONEVAL, 2010). The average schooling is six years and 64.34% of the population had an income of up to two minimum wages in 2010 (INEGI, 2010).

The Second World War and its aftermath represented an opportunity for households of the Tlacolula Valley to participate legally in the US labor market through the *bracero program*. International remittances could significantly increase the consumption of beneficiary households and in some cases small investments in productive activities were performed (Gijon et al., 2000). At the end of the *bracero program*, international migration continued as a strategy to sustain or improve living conditions. Thus, between 2000 and 2010, half of the municipalities had great international migration flows measured by the migratory intensity index (Consejo Nacional de Población, 2010). Despite that, the flow of international remittances has not regained the levels it had since the crisis of the US economy in 2009 according to figures from the Bank of México (Gonzalez, 2013). Migration is considered vital for most households in this valley as a means of financing productive activities and generates a significant economic impact in the region and in the out-migration communities. Members of households that do not migrate due to the contraction of the global economy and the implementation of migration policies in the United States are employed in the labor markets of the region. Therefore, this paper analyzes in a context of scarce development opportunities through a multi-sector model of household economies how households improve their level of well-being by diversifying their sources of income.

Theoretical Framework

The theoretical background of rural household economies is relatively recent and refers to models of agricultural households based on the model of rural economies of Chayanov (1974), which focuses on family labor to meet basic household needs in the absence of wages. This author formally added to the classic model of the economy socio-demographic variables that explain the agricultural and artisanal production. In the seventies, it was necessary to review and update the work and thus emerged the models of agricultural households proposed by Barnum and Squire (1979) and Singh, Squire, and Strauss (1986). They considered agricultural production units able to produce not only for consumption but also for the market. Thus, agricultural activity represents a source of food and generates local employment and income from the sale of surplus. Migration was joined to these models as a factor of development and economic agents—land, labour, and financial resources—are allocated between subsistence production, commercial production and wage labor in accordance with certain rules accepted in the localities (Taylor & Adelman, 1996). In this vein, the unit of analysis for the study of rural household economy is centered on the household. Yúnez-Naude and Taylor (1999) conducted a model for México that links education, migration, and productivity. They show how the increase in the level of schooling negatively affects agricultural activity, inducing migration and employment addresses into non-agricultural activities. Hellin and Higman (2003) point out that globalization has had various

complex impacts for small farmers in the markets as they access new opportunities, but at the same time the risk of their assets increases. The most common problems that farmers face are transaction costs involving agricultural inputs, technical assistance, packaging, processing, and marketing activities.

In the economic welfare approach, well-being is defined in general terms as the amount of material goods and utility services produced by a nation-state, which are rationed among its inhabitants. According to Duarte and Jimenez (2007), economic well-being covers the economic needs of individuals and must perpetuate comfort through inheritance. To qualify the level of well-being from household, Chakravarty (2010) states that public institutions have used a method of multivariate statistical analysis that combines deprivation in the different dimensions that are related variables: education, social security, equipment and quality of housing, social assistance programs. This author identifies six sources of which household well-being depends on: (1) current monetary and non-monetary income; (2) set of assets and durable goods that provide basic services to households; (3) savings and assets different housing estate, own business and household borrowing capacity; (4) access to free goods and services; (5) the time available for rest, domestic work, education and recreation; and (6) the knowledge of people conceived as direct satisfactions of the human need for intellect.

In its complementary counterpart and time, subjective well-being is approached from the individual, who manages to do or be what he or she has in terms of his or her skills and functions he or she can perform. In this perspective, Sen (1996) establishes the notion of performances as part of the state of a person to do or be achieved; he also establishes the definition of ability of a person who focuses on alternative performances that the person can achieve; this, in turn, implies freedom of choice. Operations such as: food, health, education, among others can be critical and more complex ones are: achieve self-dignity, social integration, however, this depends on individuals valuing these performances.

The economy of welfare provides the hypothetical elements to understand the limitations and advances in economic processes at local, regional, and national levels, in which households and the community are involved. Proposals for alternatives on the state of well-being provide knowledge on non-monetary benefits and welfare changes due to loss in real income; and it must be added what Arrow and Scitovsky (1974) say: The failure of market prices to reflect adequately the social costs and benefits. Consequently, the free market economy is imperfect and having a sector of the poor, it is necessary to apply public policies to compensate it. For our viewpoint, household well-being is addressed from the household economy and not only it is measured but also explained through their sources of income and socio-demographic resources.

Theoretical and Empirical Models of Rural Household Economies

The Sample of Households

The information was obtained by a probabilistic survey in three locations during 2014 and early 2015. The questionnaire used is that of matrix of social accounting (Yúnez-Naude & Taylor, 1999) which was adapted and expanded to cover more accurately income activities, self-consumption, socio-demographic characteristics, and social capital. Instead of multiplier models, a multi-sectoral econometric model was constructed and includes comprehensively the components of household income, socio-demographic characteristics, and environmental adverse factors (Reyes-Morales & Gijon, 2011; 2012); these factors are not used in this paper.

As for the selection of households to interview, random number tables were used and the urban plan for their spatial representation was used in three stages. The average duration of each interview ranged from 50 to 80 minutes per household. The sample size was calculated based on the population of households in the three

study sites. According to the last census of population and housing (INEGI, 2010), San Juan Teitipac had 708 households; Villa Díaz Ordaz, 740; and Rojas de Cuauhtémoc, 314. The universe was 1,762 and the total sample of households from the three locations was 131 households; this amount approaches to standard normal distribution according to the central limit theorem, when the sample is greater than 100 (Babbie, 2004).

Theoretical Model

The model of the economy of rural households (MEHR) in some way is similar to the causal model developed by Morris and Winter authors (1996) which is related to housing conditions. This model suggests that the quality of housing is a synonymous with well-being and uses sociological concepts such as: discrimination and adaptation. However, it coincides with the MEHR in income and socio-demographic variables, which are considered as resources.

Thus, it was built a theoretical function of household well-being based on Reyes-Morales and Gijon-Cruz (2011; 2012) and Reyes-Morales (2014), which was applied to the study communities; emphasis was made on the allocation of socio-demographic and economic resources to labor markets, family business, and subsistence production. The unit of analysis of rural economies is the household, which is defined through its socioeconomic, environmental, and economic characteristics. Households function as units of production and consumption. They establish trade relations with other households and localities through the local and foreign markets. The peasant production is orientated to the satisfaction of food needs and surplus production, together with wages and other cash income sources, allowed to purchase goods and services. House income, *IF*—which is the family budget—is allocated to consumption, *C*, investment, *Inv*, and savings, *Ah*. Therefore, the household economy can be modeled by this household income equality:

$$IF = C + Ah + Inv \tag{1}$$

From equation (1), it obtains another important equation of the rural household economies that is the consumption (2), because daily survival and the current level of household well-being depend on it. If consumption increases, savings and investment decrease, and also the inverse relation is valid.

$$C = IF - (Ah + Inv) \tag{2}$$

The household well-being, *BF*, is determined by a fraction of household income that can be allocated to consumption, i.e., exchanging money for goods and services. In fact, consumption integrates spending on education, health, clothing and footwear, holidays, furniture and appliances, gifts in cash and in kind to friends and the community, transportation, housing and housing services, food. Then consumption as synonymous with household well-being is established as follows:

$$BF \cong C \tag{3}$$

Household income, *IF*, is the sum of all kinds of income received by all household members for their involvement in the market economy, by subsistence activities and transfers (Reyes-Morales, Gijón-Cruz, & Cruz-Hernández, 2015). From the above, the *IF* equation can be stated as follows:

$$IF = \sum_{k_1}^{4} I_k + \sum_{l_5}^{14} I_l + \sum_{m_{15}}^{17} I_m + \sum_{p_{18}}^{19} I_p \tag{4}$$

However, *Ah* and *Inv* are not available forms of income. Therefore, the equation (4) must be completed by subtracting the part that is not available:

$$BF = \sum_{k_1}^{4} I_k + \sum_{l_5}^{14} I_l + \sum_{m_{15}}^{17} I_m + \sum_{p_{18}}^{19} I_p - (c_1 Ah + e_1 Inv) \tag{5}$$

where:

$\sum_{k_1}^{4} I_k$ = Income from labour market (*RN*, *RI*, *SL*, *SR*)

$\sum_{l_5}^{14} I_l$ = Production income (*INS*, *INC*, *INM*, *INA*, *POA*, *INRL*,…)

$\sum_{m_{15}}^{17} I_m$ = Financial market income (*Ah*, *Pr*, *Int*)

$\sum_{p_{18}}^{19} I_p$ =Transfers (*TG*, *TOH*)

$(c_1 Ah + e_1 Inv)$ = it is part of household income that remains as savings and investment at the end of the year.

According to to Chayanov (1974), sociodemographic characteristics are added to the household economy; these variables are explanatory ones. In the model of household economics they will indicate whether they function as resources or restrictions to sustain the current level of household well-being:

$$CSD_q = f_1 EdPr + f_2 TH + f_3 EsPr + \cdots \quad (6)$$

where: *EdPr* = Average Age of household members, *TH* = Household Size, and *EsPr* = Average Schooling of the household members. Then complete general model is as follows:

$$BF = \sum_{k_1}^{4} I_k + \sum_{l_5}^{14} I_l + \sum_{m_{15}}^{17} I_m + \sum_{p_{18}}^{19} I_p + \sum_{q_{20}}^{28} CSD_q - (c_1 Ah + e_1 Inv) \quad (7)$$

General Regression Model

The technique to build the model equations is regression analysis of ordinary least squares. This procedure allows us to find the relationship between research variables. The analysis was performed using a survey database conducted in three localities aided by SPSS program version 21. Regression equations must meet the following criteria (Norusis, 1993):

(1) R^2 corrected more must be more than 0.5%.

(2) The equations must surpass the analysis of variance test (ANOVA), that is, the statistic F should be significant ($p < 0.05$).

(3) Regression coefficients, including the constant term, must be significant for the *t* test ($p < 0.05$).

The general linear regression model according to Kutner, Nachtsheim, and Neter (2004) and Johnson and Wichern (2007) to measure the proportionality between the dependent and independent variables is:

$$BF_i = a_{i0} + \sum_{K=1}^{4}(a_k I_{ik}) + \sum_{l=5}^{14}(a_l I_{il}) + \sum_{m=15}^{17}(a_m I_{im}) + \sum_{p=18}^{19}(a_p I_{ip}) + \sum_{q=20}^{28}(a_q CSD_{iq}) - (a_{38} Ah_i + a_{39} Inv_i) + \varepsilon_i \quad (8)$$

where ε_i is the random error term. The last term with negative sign refers to the non available portion for savings (*Ah*) and investment (*Inv*); i.e., during a year, *Ah* is not available for consumption and investment, while *Inv* cannot be used for consumption and saving. Nonlinear independent variables may exist; therefore, equation (8) can be converted into a nonlinear model (Norusis, 1993).

Results and Discussion

Socioeconomic Characterization

Agriculture and backyard livestock remain as the main sources for subsistence of households in Rojas de Cuauhtémoc, San Juan Teitipac, and Villa Díaz Ordaz. Because households do not obtain sufficient income from these activities to meet other basic needs, they are involved in other activities, such as: making bread, tortillas, or

crafts. Other households invest in family business or their labor force is employed as agricultural laborers or employees in commercial businesses. The structure of budget of households shows differences in income sources by locality (Figure 1). In the households of Rojas de Cuauhtémoc and Villa Diaz Ordaz, the largest contribution to household income comes from regional wages, *SR*. In Villa Díaz Ordaz, a high proportion of its labor force is employed in the region in various occupations, i.e., agricultural laborer, employee of commercial business, wage domestic worker and bricklayer. The labor force of households Rojas de Cuauhtémoc accesses to well-paid jobs such as: government official, office clerk, and independent professionals. Sumarizing, regional wages represent the largest source income.

In addition, small-scale manufacturing businesses generated jobs that absorb some of the local labor force in occupations related to production of cheese and bread, commercial and service business. Households of Rojas de Cuauhtémoc, as the other two localities, have diversified its sources of income. They obtain wages within and outside the community but also from the following activities: commercial businesses, agriculture, backyard livestock, international remittances, *RI*, domestic remittances, *RN*, loans, *Pr*, government transfers, *TG*, and transfers from other households, *TOH*. They can even save, *Ah* and obtain, although rather low income, from collecting firewood, *INRL*, and hunting, *INCz*.

The main income sources of households of San Juan Teitipac are: net income of commercial business, *INC* and government transfers, *TG*. Villa Díaz Ordaz and San Juan Teitipac depend strongly on government programs, because of their high degree of marginalization, high degree of migration intensity, and high percentage of population in poverty (CONAPO, 2010).

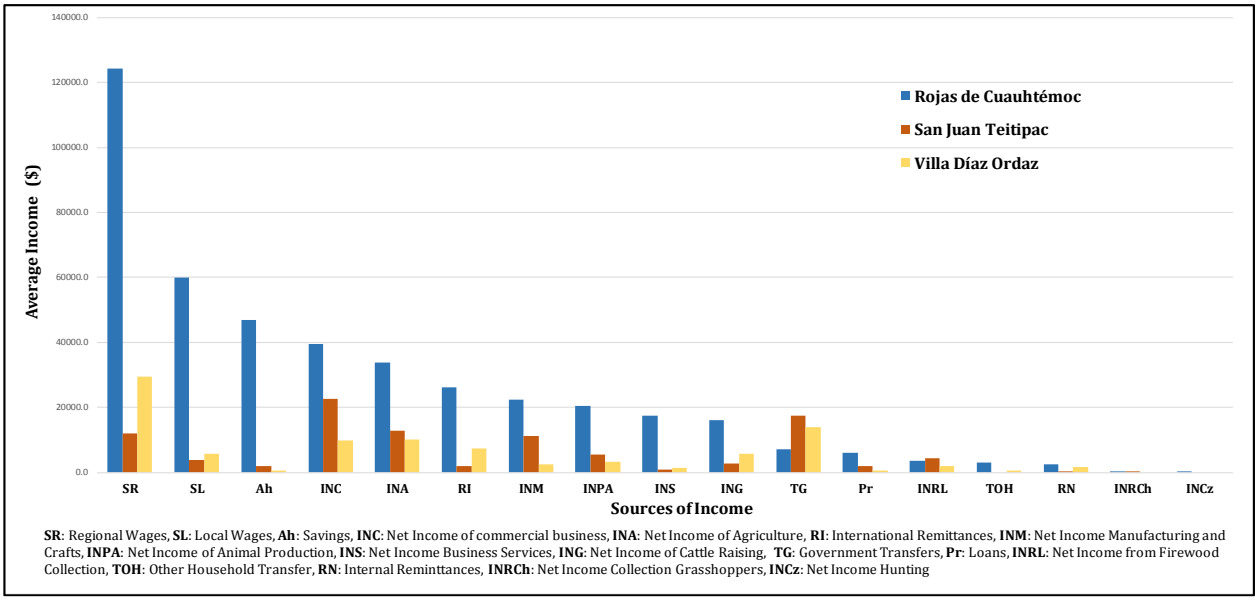

Figure 1. Average net income by source in Rojas de Cuauhtémoc, San Juan Teitipac, and Villa Díaz Ordaz (2014-2015). Source: Database of economic well-being survey in Rojas de Cuauhtémoc, San Juan Teitipac, and Villa Díaz Ordaz (2014-2015).

Businesses of animal production as butcheries and poultry markets are profitable in San Juan Teitipac. The following income sources are common in the three study localities: net income from commercial business, *INC*, manufacturing, *INM*, animal production businesses, *INPA*, and services, *INS*. Due to its significant contribution to the local economy, which represents an outlay of significant money into the region, local commerce involves

buying and reselling; thus, there is permanent flow of money entering and coming out the community.

In turn, the role of international remittances, *RI*, is to supplement the family budget. In fact, they have a significant impact on the household consumption. Incomes from local activities cover most household income. Besides, subsistence production represents a significant contribution in kind to households from agriculture, livestock, and firewood collection; the latter can be a source of fuel for local businesses.

Household Economies

The model of the rural household economies was established by locality and allows examining with more precision the economy of households in the three localities studied. The empirical model for each locality includes socio-demographic and economic variables. Thus, particular economic features of the Tlacolula Valley, Oaxaca can be identified.

Empirical Model of Rojas de Cuauhtémoc

The model of Rojas de Cuauhtémoc contains equation (9), which does not contain constant term. All independent variables of this equation obtained by multiple regression analysis have linear forms. Its R^2 corrected is 0.913, i.e., the degree of explanation of the equation is 91.3%; the statistic F of ANOVA is 39.013 (p < 0.000); and all independent variables are significant according t test, as you can see figures within parenthesis below each term of equation (9).

$$\begin{aligned} BF = {} & \underset{(0.017)}{4{,}613.143\, EsPr} + \underset{(0.033)}{6{,}584.272\, TH} + \underset{(0.005)}{0.063\, SR} + \underset{(0.003)}{44.025\, INCz} + \underset{(0.013)}{0.409\, RI} + \underset{(0.010)}{00.281\, INA} \\ & + \underset{(0.038)}{0.286\, INS} - \underset{(0.005)}{35.763\, INRCh} \end{aligned} \tag{9}$$

Socio-demographic variables are: average schooling, *EsPr* and household size, *TH*; income variables present are: regional salaries, *SR*, net income from hunting, *INCz*, international remittances, *RI*, net farming income, *INA*, net income from services business, *INS*, and net income of grasshoppers collection, *INRCh*. Out of the eight independent variables, seven have positive sign, i.e., they are directly correlated to the household well-being, *BF*. Therefore, by increasing the value of the positive independent variables, the value of *BF* proportionally increases in the same direction. Conversely, the net income of grasshoppers collection has a regression coefficient with negative sign; this means that there is an inverse relationship with *BF*. So an increase in *INRCh* will reduces, in turn, *BF* level.

Regarding the contribution of socio-demographic variables, the greatest is average schooling, *EsPr*. This is because the level of education contributes significantly to improve the remuneration of the household members. Household spends on education in the short term, but in the long term cumulative expense represents an investment, which will increase the opportunities of the labor force in the labor market. Another important socio-demographic variable is household, size, *TH*, which includes labor force. Households also benefit from gifts received through family networks and friends, *TOH*, and from government transfers, *TG*, as a compensation for the lack of economic benefits received from the nation's development model.

Of income variables, the greatest weight (Beta value) corresponds to regional wages, *SR*. The labor force is employed in the markets of the region as a first option due to restrictions to migrate abroad in the short term. Meanwhile, the second variable weight is hunting, *INCz*, which normally represents an income in kind. This source of income corresponds only to Rojas de Cuauhtémoc and indicates that households benefit form a extra

resource associated to alfalfa crop which allows hunting rabbits. Complementarily international remittances, *RI*, contribute to the household budget, which meets spending on health and facilitate business investment. Income from agriculture and service businesses has little weight in household well-being. Irrigated agriculture on a small scale in Rojas de Cuauhtémoc holds dairy production. However, from the economic point of view, the allocation of time and resources to the collection of grasshoppers does not contribute to the *BF*. Therefore, it corresponds little to the material approach of well-being and the subjective approach should be explored.

Table 1

Statistical Tests of Model of Rural Household Economies of Rojas de Cuauhtémoc, Oaxaca, Mexico, 2014

Variables and statistics	Coefficients			
	No standardized B	Standardized Beta	Statistic *t*	Sig.
Average schooling, *EsPr*	4,613.143	0.386	2.592	0.017
Household size, *TH*	6,584.272	0.255	2.277	0.033
Regional wages, *SR*	0.063	0.212	3.144	0.005
Net income from hunting, *INCz*	44.025	0.206	3.403	0.003
International remittances, *RI*	0.409	0.195	2.724	0.013
Net income from agriculture, *INA*	0.281	0.195	2.829	0.010
Net income from business services, *INS*	0.286	0.157	2.208	0.038
Net Income from grasshoppers collection, *INRCh*	-35.763	-0.195	-3.125	0.005
R^2	0.937			
R^2 corrected	0.913			
Statistic F	39.013 ($p < 0.000$)			
Degrees of freedom (regression and total)	8 y 29			

Source: Database economic well-being survey and applied in Rojas de Cuauhtémoc, San Juan Teitipac, and Villa Díaz Ordaz (2014-2015).

Empirical Model of San Juan Teitipac

The model is represented by the regression equation (10) and all its independent variables have linear shapes with positive signs; the corrected R^2 is acceptable (0.856); ANOVA and *t* tests are overcome.

$$\underset{}{BF} = \underset{(0.000)}{12{,}442.792\,TH} + \underset{(0.000)}{360.437\,RN} + \underset{(0.030)}{369.224\,EdPr} + \underset{(0.009)}{0.256\,INC} \quad (10)$$

Socio-demographic variables *TH* and *EdPr* have positive sign. Both work as a resource for households and are relate to the labor force, however, not the entire labor force is employed in labor markets because it is involved in the household agriculture. Households of San Juan Teitipac with dry and barren agricultural land rent irrigated land in neighboring localities; thus, these households cultivate basic crops and green vegetables; man are farmers and women sell the production in the marketplaces of the city of Oaxaca (Santos, Martina, personal communication, April 27, 2016). Therefore, *TH* and *EdPr* implicitly reflect the agricultural income obtained by households.

Internal remittances, *RN*, have the greatest weight on the *BF*. This outcome is a find and contradicts the migratory intensity index of CONAPO (2010) which reports a high degree of international migration flow in San Juan Teitipac; households in this town currently receive very little money from international remittances because many migrants are being deported from the United States. Instead, family members living in other states of Mexico (Mexico City, States of Mexico, Sinaloa and Baja California) have more stable jobs, therefore, they can save small amounts of cash to send to their home household.

Table 2

Statistical Tests of the Model of Rural Household Economies of San Juan Teitipac, Oaxaca, Mexico, 2014

Variables and statistics	Coefficients			
	No standardized B	Standardized Beta	Statistic *t*	Sig.
Household size, *TH*	12,442.792	0.532	7.017	0.000
Internal remittances, *RN*	360.437	0.484	8.749	0.000
Average Age, *EdPr*	369.224	0.169	2.242	0.030
Net income from commercial businesses, *INC*	0.256	0.155	2.717	0.009
R^2	0.868			
R^2 corrected	0.856			
Statistic F	73.745 ($p < 0.000$)			
Degrees of freedom (regression and total)	4 y 49			

Source: Database of economic well-being survey applied in Rojas de Cuauhtémoc, San Juan Teitipac, and Villa Díaz Ordaz (2014-2015).

At the local economy level, commercial businesses studied during fieldwork in this town are: corner shop, bakeries, clothing stores, hardware stores, drugstores, and funeral parlors. Income from these businesses is significant for the family budget, because it almost doubles the regional wages. On the contrary, *SR* are not allocated entirely for consumption because they are rather allocated to saving and investment.

Empirical Model of Villa Díaz Ordaz

The model of household economies of Villa Diaz Ordaz includes equation (11); the independent variables present linear forms and the constant term is absent. The statistical tests applied to multiple regression analysis are shown in Table 3; R^2 corrected is 0.861 and the statistic F of ANOVA is 64.17 ($p < 0.000$). Independent variables are significant except *RI*, which almost reaches 95% of confidence.

$$\underset{}{BF} = \underset{(0.000)}{9{,}900.631\,TH} + \underset{(0.001)}{15.168\,Pr} + \underset{(0.018)}{2{,}198.682\,EsPr} - \underset{(0.052)}{0.504\,RI} - \underset{(0.000)}{1.517\,INPA} \quad (11)$$

Socio-demographic variables, like in the other two communities, are *TH* and *EsPr*; income variables presented are: loans, *Pr*; international remittances, *RI*; and net income of animal production, *INPA*. The first variable has positive sign while the remaining two variables are negative.

TH has the greatest weight, so it is crucial to meet the household needs. Thus, household members are employed in the labor markets of the region and especially in the Tlacolula which is five minutes driving. Ttherefore, regional wages are the most frequent option within the income structure. The labor force also makes domestic activities and is allocated to household economic activities; household members who do not perform any economic activity receive either government transfers or economic assistance from relatives.

At the same time, *EsPr* of household members provides a favorable position in the regional labor market, since by raising the level of education, the opportunities expand and remuneration may increase. Annual spending in education of households is about Mex$5,236.58, which is the third major spending item just below housing and housing services. Education accounts for 10.73% of the average well-being of this town, which is at Mex$48,788.75. If we analyze the average schooling in the region which is 6.045 years, spending on education is not high, because this town has public primary education services, which do not involve a high cost for household. However, as children move to higher education, expenses increase. Thus, children who attend to secondary school have travel daily to other towns within the Valley of Tlaolula and beyond; and for

university education they have to travel to the city of Oaxaca.

Access to credit is related to wages which works as collateral in a bank or a savings bank. In this way, households can receive a loan, which directly goes to household consumption. In contrast, international remittances, and net income from animal production restrict *BF*, in equation (11). In other words, both incomes do not contribute to *BF* because these are not allocated to consumption. In addition, international remittances have decreased considerably in the new millennium; as a result, household income is contracting at the expense of less consumption. Finally, it must be underlined that *INPA* is entirely reinvested, so its contribution to *BF* is nil.

Table 3

Statistical Tests of Model of Rural Household Economies of Villa Díaz Ordaz, Oaxaca, Mexico, 2015

Variables and statistics	Coefficients			
	No standardized B	Standardized Beta	Statistic *t*	Sig.
Household size, *TH*	9,900.631	0.721	6.998	0.000
Loans, *Pr*	15.168	0.677	3.542	0.001
Average schooling, *EsPr*	2,198.682	0.248	2.449	0.018
International remittances, *RI*	-0.504	-0.237	-1.993	0.052
Net income from animal production, *INPA*	-1.517	-0.551	-4.013	0.000
R^2	0.875			
R^2 corrected	0.861			
Statistic F	64.17 ($p < 0.000$)			
Degrees of freedom (regression and total)	5 y 51			

Source: Database economic well-being survey applied in Rojas de Cuauhtémoc, San Juan Teitipac, and Villa Díaz Ordaz (2014-2015).

Conclusion

The equations of household economy model of Rojas, Teitipac, and Diaz Ordaz contain common variables. Out of these, socio-demographic variables such as: household size and average schooling represent an economic resource for households; in this way, the family labor strongly influences the level of income either through remittances and wages or through household business and subsistence production. The income structure of Rojas de Cuauhtémoc shows that regional wages are the mainstay of its economy and its average household well-being is almost twice that of the other two localities. The population of this town has a higher average schooling than that of the other two locations; for this reason, its labor force can get better wages from the labor markets. A common characteristic in the three localities is the number of household members (household size) that is closely tied to household labor force size.

The household economy model of Rojas de Cuauhtémoc shows that small-scale commercial agriculture sustains a productive chain milk cattle and dairy products. As this activity alone does not cover the household budget, households have to diversify their income sources. However, when households allocate labor force to not always profitable activities such as collecting grasshoppers, household well-being contracts. This is because this activity is rather a community tradition than a source of income. Other activities of this type increase well-being and hunting rabbit is a good example which is carried out during irrigation of alfalfa, so there is no extra invest in time or materials.

San Juan Teitipac is characterized by seasonal agriculture and the main occupations are primary activities,

which are self-consumption orientated. Household members remain in the household to support family businesses and subsistence production or are employed as laborers in irrigated lands rented by their landsmen in the nearby localities generated outside Teitipac people. In this way, households can secure jobs outside their community for the labor force. Likewise, the regional wages contribute to the household well-being and, to less extent, both internal and international remittances. However, income from animal production exceeds remittances, i.e., migration is no longer a source of secure income that allows households to meet their economic goals. Therefore, this option has been displaced by local economic activities, which allows households obtaining income in the short term.

Finally, Villa Diaz Ordaz, like other towns of study, depends on agriculture and backyard livestock for food. Its labor force is employed mainly as agricultural laborers and for this occupation is not required a high schooling level. Instead, the age of the labor force is more important and the household size, because the latter one provides more members to work the field and to work in the markets of the region.

The households' poor economic situation in this town drives the household labor to seek jobs in commercial business, in paid domestic work, mason, bricklayer's assistant or worker. Because of insufficient regional wages, households resort to borrowing to cover the family budget and transfers from other households help to complete it. Another finding in household economies is the income from animal production with negative sign, that is not profitable, therefore, it does not contribute to household well-being.

Finally, socioeconomic household characteristics represent a resource available to have family well-being through the optimal size of the home and the level of education that integrates the workforce. While still considered within the home education as an expense rather than as long-term investment, we will continue with the vicious cycle of marginalization in the Tlacolula Valley communities.

Concluding, socioeconomic household characteristics represent available resources available that mantain household well-being given an optimal size of the household and a minimum level of labor force's schooling. However, education is still considered as an expense in the household budget rather than a long-term investment in the Tlacolula Valley communities. If this belief remains, the vicious cycle of marginalization will continue. Similarly, income from services businesses, international migration, backyard livestock and loans increase the household well-being. Of these, exogenous income composed of regional wages and international remittances together make a greater contribution than endogenous income formed by local businesses. However, separately for each locality, local businesses function as a strategy either for survival or to attain a certain level of well-being. Similarly, agriculture continues to dominate the region and, to a lesser extent, contributing to the household well-being.

Footnotes

(1) The migratory intensity index measures migration from México to the United States and the marginality index has a hierarchical ordinal scale with five ponts which are: very low, low, medium, high and very high.

(2) The family budget in households of Villa Díaz Ordaz follows this order from highest to lowest: foods $29,177.65; housing and basic housing services $6,522; education $5,289.12; clothes and shoes $1,933.53; health $1,696.76; transportation $1,064.31; cooperation and gifts $726.27; parties $622.06; furniture and appliances $182.74.

References

Arrow, K. J., & Scitovsky, T. (1974). *La Economía del Bienestar*. México: Fondo de Cultura Económica.

Babbie, E. (2004). *The practice of social research* (Thomson Wadsworth, 10th ed.). United States of America: Chapman University.

Barnum, H., & Squire, L. (1979). An econometric application of the theory of the farm-household. *Journal of Development Economics, 6*, 79-102.

Censo de Población y Vivienda. (2010). Disponible en: http://www.inegi.org.mx/est/contenidos/proyectos/ccpv/cpv2010/

Chakravarty, S. R. (2010). *Metodología de la Medición Multidimensional de la Pobreza para México* (Primera ed.). El Colegio de México. CONEVAL.

Chayanov, A. V. (1974). *La organización de la unidad económica campesina* (primera edición). Ediciones Nueva Visión SAIC. Argentina: Buenos Aires.

Consejo Nacional de Evaluación de la Política de Desarrollo Social. (2010). Disponible en: http://www.coneval.gob.mx/Medicion/MP/Paginas/Medicion-de-la-pobreza-municipal-2010.aspx

Consejo Nacional de Población (CONAPO). (2010). Disponible en: http://www.conapo.gob.mx/en/CONAPO/Indice_de_Marginacion_por_Localidad_2010

Cook, S., & Binford, L. (1995). *La Necesidad Obliga. La pequeña industria rural en el capitalismo mexicano* (Primera edición en regiones). México, D. F.: Consejo Nacional para la Cultura y las Artes.

Duarte, T., & Jiménez, R. E. (2007). Aproximación a la teoría del bienestar. *Scientia et Technica, XIII*(37), 1-6. Universidad Tecnológica de Pereira.

Gijón-Cruz, A. S., Rees, M. W., & Reyes-Morales, R. G. (2000). Impacto de las Remesas Internacionales. *Ciudades*, 47, 34-42. RNIU, Puebla, México.

Gonzalez, A. R. (2013). Disminuyo en 2012 el flujo de remesas de migrantes mexicanos. Disponible en: http://www.jornada.unam.mx/2013/02/02/economia/026n2eco

Hernández, D. J., Zafra, G., Ortíz, B. T., & Hernández, G. A. (2001). *Artesanías y artesanos en Oaxaca.* Oaxaca: CONACULTUA-FONCA, IEEPO.

Hellen, J., & Higman, S. (2003). *Feeding the market*. United States of America: Kumirian Press.

Instituto Nacional de Estadística y Geografía (INEGI). (2011). Principales resultados del Censo de Población y Vivienda 2010, México. Disponible en: http://www.inegi.gob.mx

Johnson, R. A., & Wichern, D. W. (2007). *Applied Multivariate Statistical Analysis.* New Jersey, EU: Pearson Prentice Hall.

Kutner, M. H., Nachtsheim, C. J., & Neter, J. (2004). *Applied linear regression models.* New York, NY, EU: McGraw-Hill Irwin.

Morris, E. W., & Winter, M. (1996). *Housing family and society.* Ames, Iowa: Earl W. Morris and Mary Winter.

Murphy, A. D., Stepick, A., Morris, E. W., & Winter, M. (2002). *La Cabeza de Jano. La desigualdad social en Oaxaca*. Oaxaca: Fondo Editorial IEEPO.

Norusis, M. J. (1993). *SPSS for Windows. Base System User´s Guide Release 6.0.* United States of America: SPSS Inc.

Reyes-Morales, R. G. (2014). Modelo general de bienestar familiar: un instrumento versátil para analizar la economía familiar, internalizar costos ambientales e interacción social. *Memorias del 4th Congreso Nacional de Ciencias Sociales*. San Cristóbal de las Casas, Chiapas, COMECSO.

Reyes-Morales, R. G., & Gijón-Cruz, A S. (2011). Bienestar y remesas internacionales de los hogares rurales de México. *Memorias del IV Congreso de la Red Internacional de Migración y Desarrollo: Crisis global y estrategias migratorias, Ecuador*. 18-20 de mayo de 2011, FLACSO—Quito, Ecuador.

Reyes-Morales, R. G., & Gijón-Cruz, A. S. (2012). El modelo de bienestar familiar un instrumento efectivo para el análisis del desarrollo de las localidades rurales de México. *Memorias del 1er Congreso Iberoamericano sobre Desarrollo Regional.* Ciudad de México, septiembre 2012. AMECIDER.

Reyes-Morales, R. G., Gijón-Cruz, A. S. & Cruz-Hernández, I. (2015). Migración internacional, economías familiares, mercados y medio ambiente en México. *Migración y Desarrollo, 13*(25), 117-150.

Sen, A. (1996). Capacidad y Bienestar. In M. C. Nussbaum (Ed.), *La calidad de vida* (Primera ed., p. 575). Ciudad de México: Fondo de Cultura Económico.

Singh, I., Squire, L., & Strauss, J. (1986). *Agricultural household models.* Baltimore: Johns Hopkins University Press.

Taylor, E., & Adelman, I. (1996). *Villages economies. The design, estimation, and use of villagewide economic models* (1st ed.). United States of America: Cambridge University Press.

Taylor, E., & Yúnez-Naude, A. (1999). *Education, migration and productivity. An analytic approach and evidence from rural Mexico.* Paris-France: The organisation for economic co-operation and development (OECD).

Yúnez-Naude, A., & Taylor, J. E. (1999). Manual para la elaboración de matrices de contabilidad social con base en encuestas socioeconómicas aplicadas a pequeñas poblaciones rurales (Documento de trabajo, XIV, CEE, El Colegio de México).