The determinants of poverty in the Mexican states of the US-Mexico border[1]

Los determinantes de la pobreza en los estados mexicanos de la frontera con Estados Unidos

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Abstract

This study examines the determinants or correlates of poverty in the Mexican states bordering with the United States. The data used in the paper come from the 2008 National Survey of Income and Expenditures of Households. A logistic regression model was estimated to determine which variables might be important in explaining poverty in this region. It was found that the variables which are positively correlated with the probability of being poor are: living in Coahuila, Tamaulipas or Chihuahua, size of the household, being an ambulatory worker or working in an agricultural occupation, and being a manufacturing, transportation, sales, domestic service or support worker. Variables that are negatively correlated with the probability of being poor are living in Baja California, the education level of the household head and his/her age. Gender of the household head and household location were not statistically significant in the logistic regression analysis.

Keywords: poverty determinants, poverty profiles, logistic regression, Mexico-US border, multivariate analysis.

Resumen

Este estudio examina los determinantes o correlaciones de la pobreza en los estados de la frontera norte de México. Con base en la Encuesta Nacional de Ingresos y Gastos de los Hogares 2008, se estimó un modelo de regresión logística para determinar qué variables podrían ser importantes para explicar la pobreza en esta región. Se encontró que las variables correlacionadas positivamente con la probabilidad de ser pobre son: vivir en Coahuila, Tamaulipas o Chihuahua, el tamaño del hogar, que el jefe del hogar sea trabajador ambulante o que trabaje en el sector agrícola, manufacturero, de transporte, ventas, o como ayudante o trabajador doméstico. Las variables correlacionadas inversamente con la probabilidad de ser pobre son: vivir en Baja California, nivel de educación y edad del jefe del hogar. El género del jefe de hogar y la ubicación (rural o urbana) de los hogares no fueron estadísticamente significativas.

Palabras clave: determinantes de la pobreza, perfiles de pobreza, regresión logística, frontera México-Estados Unidos, análisis multivariante.

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Introduction

Poverty is widespread in Mexico, affecting more than 50 million people, almost half of the country´s population. Even though poverty is lower in the states bordering the United States than in the rest of the country, it can reach up to 45% of the population in some border states. It is therefore important to analyze the factors that are correlated with poverty in this region, in order to identify and propose appropriate public policies which could contribute to lower poverty levels in the area.

Until very recently, the lack of household income surveys statistically representative at the state level had made it impossible to analyze poverty at the state level in Mexico (except for a very few states for which there was a large enough sample). However, in 2008, the National Institute of Statistics and Geography (INEGI) and the National Council for the Evaluation of Social Development Policy (CONEVAL) conducted a new survey (National Househld Survey of Income and Expenditures-Socioeconomic Conditions Module, ENIGH-MCS by its acronym in Spanish), designed to be statistically representative at the state level and made the results available to the public at the end of 2009. In this paper we will take advantage of the new survey in order to analyze the determinants of poverty in the Mexican states which have a border with the United States. As far as the author knows, there is no research to date that has identified and estimated the determinants of poverty through a regression analysis in this region.

Thus, in this paper we intend to test the following hypotheses about poverty in the Mexican northern border states:

a) Poverty in rural areas is higher than in urban areas.
b) The state of residence of the household is a variable that explains poverty.
c) Household size, the education level of the household head, his/her age, gender and the occupation in which he/she works, are variables that explain poverty.

To test these hypothesis about the determinants or correlates of poverty, we use logistic regression analysis with the dependent variable being the dichotomous variable of whether the household is poor (1) or is not

poor (0). The explanatory variables considered in the analysis were: gender, age, education, occupation of the household head, and size, location (urban or rural) and state of residence of the household.

The rest of the paper is organized as follows: the next section briefly discusses the main approaches in the definition of the concept of poverty. After that section, offers a review of the literature about poverty in the Mexican border states. In the next section explains the data and poverty lines used in the study. Then, presents a poverty profile for the border states. Later, discusses the methodology used to analyze the determinants of poverty in the region and presents the results obtained from the multivariate regression analysis. Finally, the last section proposes some conclusions and policy implications that can be drawn from the study.

The concept of poverty

The World Bank (1990, p. 26) defines poverty as "the inability to attain a minimum standard of living". Lipton and Ravallion (1995, p. 2553) state that "poverty exists when one or more persons fall short of a level of economic welfare deemed to constitute a reasonable minimum, either in some absolute sense or by the standards of a specific society". Any definition of poverty includes a given level of welfare below which a person will be considered poor. Then, it is necessary to determine how to assess welfare. In this respect, there are mainly three approaches in the literature: the welfarist approach, the basic needs approach and the capabilities approach.

The welfarist approach bases comparisons of well-being solely on individual utilities, which are based on social preferences, including poverty comparisons (Ravallion,1993). Some problems related with this approach are the need to make inter-personal utility comparisons to obtain social welfare functions, the degree of validity of full information and unbounded rationality assumptions on the part of the consumers, as well as the possible conflicts between individual maximization and valuable socialobjectives (Ravallion, 1993).

The basic needs approach concentrates on the degree of fulfillment of basic "…human needs in terms of health, food, education, water, shelter, transport" (Streeten et al., 1981, p. 7). The main argument behind the

basic needs approach is the possibly low correlation between income and the degree to which these needs are satisfied.

The capabilities approach, due to Sen (1985, 1987) considers commodities not as ends, but as means to desired activities. Sen (1987, p. 25) writes that the "value of the living standard lies in the living, and not in the possessing of commodities…" In this approach, poverty is interpreted as lack of capability. The operationalization of this approach is difficult, but an attempt has been made in the United Nations Development Programme (UNDP) Human Development Reports. The capabilities approach has been criticized on the ground that it does not clearly recognize the role individual preferences play in welfare, thus taking the opposite extreme to the welfarist approach.

For the Mexican and Latin American cases, Boltvinik (2001) has proposed the Integrated Method of Poverty Measurement, which is based on the Poverty Lines Method and the Unmet Basic Needs Method. This author notes that the Poverty Lines Method is based on private consumption of the household while the Unmet Basic Needs Method places more emphasis in public consumption as well as in public and private investment.

Literature review

Incomes and inequality in the border states

The large economic differences prevailing between Mexico and the United States are reflected also in the border area. According to the World Bank (2011), in the year 2009 current per capita income in the United States was US$45 989, which was 5.6 times greater than the corresponding figure for Mexico (US$8 143). Adjusted by purchasing power, the difference decreases but it is still large, since US income is 3.2 times larger than Mexican income. According to Anderson and Gerber (2009), the difference is not as large between the border counties (US) and the border municipios (Mexico) since in 1999 per capita PPP GDP was only 2.1 greater in the border counties.

Other important feature noted by several authors (Anderson and Gerber, 2009; Peach and Adkisson, 2000; Pick, Viswanathan and Hettrick,

2002) is that incomes and living standards decrease along the border as we move from west to east, both in the US side as in the Mexican side. Thus, according to Anderson and Gerber (2009), Gross Regional Product per Person in 1999 was US$29 618 in the California border counties and only US$15 333 in the Texas border counties. In the Mexican side, the same authors estimate that Gross Regional Product per Person in 1999 was US$11 575 in the border municipios of Baja California and only US$9 357 in the Tamaulipas border municipios.

According to Peach and Molina (2002), median household income in the Mexican border states for the year 2000 was 75% higher than in the non-border states (excluding the Federal District) and about 13% higher than median household income in the Federal District. Furthermore, while median household income for the whole country decreased by one percent between 1992 and 2000, it increased by 10% for the border states during the same period. The border state with the highest median household income is Baja California, followed by Nuevo León and Chihuahua, while the border state with the lowest median household income is Coahuila.

Peach and Molina (2002) note that income inequality is lower in the Mexican border states than in the country as a whole. Using the ENIGH for the year 2000, they estimated a Gini coefficient of 0.45 in the border states (taken as a whole region), compared to 0.53 nationally. The authors estimate that income inequality in the Mexican border states decreased during the decade of the nineties, since the Gini coefficient decreased from 0.53 in 1992 to 0.45 in 2000, while in the non-border states (excluding Mexico City) it remained the same, with a Gini coefficient of 0.54 in both years.

Poverty in the border region

Anderson (2003) estimates that poverty in the Mexican border states decreased from 1970 to 2000 in all states except Sonora. The states that experienced the highest decreases in their poverty rates were Coahuila (from 66.3% in 1970 to 51.8% in 2000); Baja California (from 55.3% in 1970 to 41.7% in 2000) and Chihuahua (from 62.1% in 1970 to 50.9% in 2000).

Camberos and Bracamontes (1995) estimate that in 1990 poverty affected 51% of the population in the country while the corresponding figure for the border states was much lower, 40%. Extreme poverty affected 26.8% of households in the country and 12.7% of households in the border states. Tamaulipas, Chihuahua and Coahuila had the highest moderate poverty rates with 22.6%, 20.1% and 19% of households, respectively; while Baja California and Nuevo León registered the lowest figures (12.1% and 15.4%, respectively).

Using census data and a poverty line equal to two minimum wages, Fuentes and Martínez (2006) estimate that the poverty rate for 1990 in all border states was lower than the national poverty rate. Thus, while the national poverty rate was 0.64, it was much lower in Baja California (0.41) and Sonora (0.53) and slightly lower in Coahuila (0.62), Nuevo León (0.59) and Tamaulipas (0.62).

Based on data from the 1990 census, Pick et al. (2002) find that poverty in both sides of the border is much higher in the east than in the west. For the Mexican border states, they estimate high poverty levels in southern parts of Chihuahua, Coahuila, and Nuevo León, and in most of Tamaulipas. They also found that poverty is lower in the major metropolitan areas in both sides of the border than in the non-metropolitan areas.

Through the use of a poverty maps methodology, CONEVAL estimated an average poverty rate of 33% in the year 2000 for the border states and practically the same figure for 2005, 32.9%. Poverty decreased substantially in Baja California (from 23.7% in 2000 to 9.2% in 2005), remained about the same in Nuevo León and Sonora and increased in Coahuila, Chihuahua, Sonora and Tamaulipas.

Using the most recent income and expenditure survey ENIGH-MCS 2008 (INEGI, 2009), CONEVAL (2010) estimated that the average poverty rate for the six border states (Tamaulipas, Nuevo León, Coahuila, Chihuahua, Sonora and Baja California) was 36.1%, about 13 percentage points less than the poverty rate for the whole country. The border states with the lowest poverty rates are Nuevo León, Sonora and Baja California, with poverty rates equal to 0.29, 0.31 and 0.31, respectively, while the border states where poverty is higher are Coahuila, Tamaulipas and Chihuahua, with a poverty rate of 0.45, 0.42 and 0.39, respectively.

Studies about the determinants of poverty in Mexico

There are relatively few studies about the determinants of poverty in Mexico. Cortés (1997) and Garza-Rodríguez (2000) estimated a logistic regression of the probability of being poor as a function of several economic, demographic and location variables. With data from 1992, Cortés (1997) found a direct relationship between poverty and the burden of dependency and between poverty and living in a rural area. He also found an inverse relationship between poverty and the number of years of education.

Garza-Rodríguez (2000), based on 1996 data, found that the variables which were positively correlated with the probability of being poor were: size of the household, living in a rural area, working in a rural occupation and being a domestic worker. On the other hand, variables negatively correlated with the probability of being poor were: the education level of the household head, his/her age and whether he or she works in a professional or middle level occupation.

Székely (1998), through a different approach, and based on data for 1984, 1989 and 1992, found that a low level of education is a very important factor to explain the high poverty levels prevalent in the country. Other factors that he found were important in explaining poverty were a large household size, living in a rural area, and occupational disparities.

Data and poverty lines

Data

The Socioeconomic Conditions Module of the National Household Income and Expenditure Survey 2008 (INEGI, 2009), includes data on income, food, health, education, social security, quality of housing, utilities and social cohesion. It was collected from August to November of 2008 and provides results at the national, urban and rural level as well as at the state level. The total sample consists of 70 106 households.

The MCS 2008 was collected under a probabilistic and stratified two-stage cluster sampling design. The units of analysis in the survey are the household, the dwelling unit and the members of the household. Current

income is broken down into five categories: labor income, rents, transfer payments, imputed rent of owner-occupied housing and other current incomes.

The variables considered in the poverty profile and in the multivariate regression model are gender, age, education and occupation of the household head, and size and location (rural or urban) of the household. Also included in both the poverty profile as well as in the regression model is the state of residence of the household.

Poverty lines

The poverty lines used in this study are the official poverty lines for urban and rural areas estimated by CONEVAL (2010). The poverty line we used was the "welfare line", described as CONEVAL (2010, p. 19) as "the monetary value of a food and non-food basket of basic consumption". This poverty line was equal to $1 921.74 pesos per capita per month for urban areas and $1 202.8 pesos per capita per month for rural areas.

A poverty profile for the border states

Poverty profiles

One of the first steps in poverty analysis is to construct a poverty profile, defined as a

> … special case of a poverty comparison, showing how poverty varies across sub-groups of society, such as region of residence or sector of employment. A poverty profile can be extremely useful in assessing how the sectoral or regional pattern of economic change is likely to affect aggregate poverty (Ravallion, 1993, pp. 59-60).

Typical classifications included in a poverty profile include region of residence, rural or urban location, family size and characteristics of the household head, such as age, education, sector of occupation, etc.

A poverty profile can be used to identify who are the poor, the degree of poverty of each group as well as how far from the poverty line each poor group is. All these issues are very important for policy purposes, in order to design proper policies to attack poverty. Table 1 shows the poverty profile estimated for the region conformed by the six Mexican border states: Tamaulipas, Nuevo León, Coahuila, Chihuahua, Sonora and Baja California.

Table 1. Poverty profile for the Mexican border states

Variable	Poverty Incidence
Total population	0.319
Household size	
1-2 persons	0.233
3-4 persons	0.303
5-more persons	0.414
Location	
Urban	0.296
Rural	0.453
Gender of Head	
Male	0.319
Female	0.319
Age of Head	
Less than 25	0.324
26-45	0.337
46-65	0.271
65 and more	0.385
Education of Head	
No Instruction	0.565
Preschool	0.170
Elementary School	0.414
Junior High School	0.365
High School	0.235
Normal School	0.087
Technical School	0.224
College	0.092
Master	0.012
Doctoral	0.072

Variable	Poverty Incidence
Occupation of Head	
Professionals	0.045
Technical workers	0.167
Educators	0.055
Occupations in the arts, performances and sports	0.263
Administrators and directors in both public and private sector	0.039
Agriculture, husbandry, forestry/fisheries workers	0.530
Manufacturing /repair supervisors	0.134
Manufacturing /repair skilled workers	0.349
Manufacturing/repair heavy equipment operators	0.304
Manufacturing/repair unskilled workers	0.459
Transportation workers	0.300
Service and administration supervisors	0.073
Administrative and support workers	0.220
Sales workers	0.286
Ambulatory workers	0.527
Personal services workers in establishments	0.335
Domestic services workers	0.318
Protection services workers	0.276
Worker out of the country	0.138
State	
Baja California	0.270
Coahuila	0.408
Chihuahua	0.345
Nuevo León	0.261
Sonora	0.272
Tamaulipas	0.377

Source: Own estimates based on ENIGH-MCS 2008 (INEGI, 2009).

Poverty and household size

As noted by Merrick (2003, p. 202), "there is little debate about whether poverty and household size are correlated". Large households tend to be associated with higher poverty (Birdsall and Griffin, 1988; Eastwood and Lipton, 1999; Lanjouw and Ravallion, 1995).

The absence of well developed social security systems and low savings in developing countries will tend to increase fertility rates, especially among the poor, in order for the parents to have some economic support

from the children when parents reach old age. It might be rational for them to increase the number of children in order to increase the probability that they will get support when they get old. High infant mortality rates among the poor will tend to provoke excess replacement births or births to insure against high infant and child mortality, which will increase household size (Schultz, 1981).

Also, as noted by Birdsall and Griffin (1988), a large family size limits the amount of resources available to the family to invest in the human capital of their children, which leads to lower productivity and thus, lower income and higher poverty. However, it remains very difficult to determine the direction of causality between poverty and family size, given that many variables are correlated both with poverty and with family size. In this respect, Llovet (1989), points out that it is not possible to conclude that there is a universally positive or negative relationship between fertility and income (and thus indirectly poverty) but that the relationship depends on the level of aggregation, the units of analysis, the period of observation, geographic location and other factors.

In this paper, we found a direct relationship between household size and poverty in the border states. Table 1 indicates that the higher the household size, the higher the poverty rate. Thus, a family with five or more members has almost twice the poverty rate of a family formed by one or two members. However, it has to be noted that since we did not use equivalent scales to account for possible differences between the consumption of children and the consumption of adults, the estimated poverty rates could be overestimating poverty. The same could be true if, as it is to be expected, there are economies of scale in consumption.

Rural and urban poverty

Although the incidence of poverty in rural areas is higher than for urban areas, we found that the rural to urban poverty incidence ratio (RUPIR) is much lower in the border states than the RUPIR estimated for the whole country by Garza-Rodríguez (2000), Levy (1994), Székely (1998) and McKinley and Alarcón (1995). For example, Garza-Rodríguez (2000) estimated a RUPIR of 2.8 for the nation while the RUPIR for the border region is 1.5.

Poverty and gender

Many studies have documented the existence of the phenomenon of the "feminization of poverty", which is said to exist if poverty affects women more than men. In particular, it has been shown in many countries that poverty is higher for female headed households than for households headed by men. Recent examples of these findings are Gang, Sen and Yun (2008) for the case of India; Anyanwu (2005) for Nigeria and Serumaga-Zake and Naudé (2002) for South Africa. All of these authors found that poverty is higher for female headed households.

However, we found no evidence of the feminization of poverty in the border region. The estimate for the incidence of poverty in households headed by men was found to be equal than the poverty rate for household headed by women.

Poverty and age

We can see in Table 1 that poverty incidence is higher for households headed by older persons. Thus, while 39% of the families headed by a person 65 years and older is poor, the poverty rate for households whose head is between 45 and 65 years old is twelve percentage points lower (0.27). This result contrasts with the results of the poverty profile obtained by Garza-Rodríguez (2000) for Mexico with 1996 data, who found that the poverty rate is about the same for households headed by persons of all ages except households whose head is younger than 25 years old, who suffer a higher poverty rate.

Poverty and education

Looking at the results of the poverty profile for the border region shown in Table 1, it can be seen that there is a strong inverse relationship between the level of education and poverty incidence. Thus, while the poverty rate for households where the head has no instruction is 56%, the

corresponding figure for households headed by someone with a master's degree is just one percent.

Poverty and occupation

The poverty profile in Table 1, shows that poverty is higher for households whose head is an agricultural worker, an ambulatory worker or an unskilled manufacturing worker, while it is lower for households whose head works as a director in the public or private sector, or who is a professional or educator.

Poverty and state of residence

Table 1 shows that the incidence of poverty is higher for the states of Coahuila, Tamaulipas and Chihuahua and it is lower for the states of Nuevo León, Baja California and Sonora. These results coincide with the estimates obtained by coneval (2010).

Determinants of poverty

The logistic regression model

We will use a logistic regression model to analyze the determinants or correlates of poverty in the Mexican border states. The dependent variable of this model is a dichotomous variable that takes the value 1 if the family is poor and zero if it is not. The explanatory variables are a set of economic and demographic variables relating to the household or to the household head: household size, place of residence (rural or urban), state of residence, and household head's gender, level of education and occupation.

Following the logistic regression model, the probability of a family being poor is a function of a set of variables X so that:

$$\text{Prob}(Y = 1) = F(\beta'x) \qquad (1)$$
$$\text{Prob}(Y = 0) = 1 - F(\beta'x) \qquad (2)$$

Using the logistic distribution we have:

$$\text{Prob}(Y = 1) = \frac{e^{\beta'x}}{1 + e^{\beta'x}} \qquad (3)$$

$$= \Lambda\,(\beta'x),$$

Where Λ represents the logistic cumulative distribution function. Then the probability model is the regression:

$$E[y \mid x] = 0[1 - F\,(\beta'x)] + 1\,[F\,(\beta'x)]$$

$$= F\,(\beta'x) \qquad (4)$$

Empirical Results

The estimated logistic regression is shown in Table 2. Among the most important results we can highlight the existence of an inverse relationship between the level of education and the probability of being poor. Besides education, the only other variable negatively correlated with poverty was the age of the household head. Table 3 shows the probability of being poor at the mean values of the continuous variables.

Among the variables positively correlated with poverty stand out: household size, the household head being an agricultural or an ambulatory worker, a manufacturing or repair worker, sales worker, personal services worker or a domestic service worker. Living in Coahuila, Tamaulipas or Coahuila increased the probability of being poor. Among the most important variables that did not have a statistically significant relationship with poverty are the location (rural or urban) of the household and the gender of the household head.

Odd ratios

Another way to interpret the results of the logistic model is through the use of the odds ratio, which in this case is defined as the ratio of the probability of being poor divided by the probability of not being poor. Table 4 shows the estimates of the odd ratios for each independent variable in the logistic regression model as well as their standard errors and corresponding confidence intervals.

Those variables whose odds ratios are greater than one are positively correlated with the probability of being poor, while those variables which have odd ratios lower than one are inversely correlated with the probability of being poor. If the confidence interval for the estimate of an odd ratio includes the number one then that variable has no statistically significant effect on the probability of a household being poor.

Poverty and household size

In line with the results obtained in the poverty profile, the positive sign of the logistic regression parameter for household size indicates the existence of a direct relationship between poverty and household size. Also, we can observe in Table 4 above that an increase of one member in the size of the household increases the odds of being poor by 31%.

This positive effect of household size upon poverty coincides with the findings obtained for the case of Mexico by Cortés (1997), Székely (1998) and Garza-Rodríguez (2000). Other authors found that the same type of relation holds for the cases of China (Gustafsson and Sai, 2009), India (Gang et al., 2008); Pakistan (Sabir, Hussain, and Saboor, 2006), Nigeria (Anyanwu, 2005) and South Africa (Serumaga-Zake and Naudé, 2002).

Rural and urban poverty

Many studies have shown that poverty in developing countries is more prevalent in rural areas than in urban areas. For the case of Mexico, Garza-Rodríguez (2000), found a direct relationship between poverty

Table 2. Logistic estimates of poverty determinants

Number of strata = 4
Number of PSUs = 1 993
Number of obs = 8 385
Population size = 3 854 405
Design df = 1 989
F(37, 1953) = 20.11
Prob > F = 0

Explanatory Variable	Coef.	Linearized Std. Err.	z	P>z	[95% Conf.	Interval]
Age of head	-0.097	0.014	-6.71	0	-0.125	-0.069
Age of head squared	0.001	0.000	5.15	0	0.001	0.001
Household size	0.282	0.021	13.18	0	0.240	0.324
Female head	0.050	0.094	0.54	0.592	-0.133	0.234
Technical workers	0.478	0.364	1.31	0.189	-0.236	1.192
Educators	-0.238	0.510	-0.47	0.641	-1.237	0.762
Occupations in the arts, performances and sports	1.199	0.451	2.66	0.008	0.314	2.084
Administrators and directors in both public and private sector	-0.748	0.465	-1.61	0.108	-1.661	0.165
Agriculture, husbandry, forestry/fisheries workers	1.550	0.368	4.22	0	0.829	2.271
Manufacturing /repair supervisors	0.017	0.392	0.04	0.964	-0.751	0.786
Manufacturing /repair skilled workers	0.993	0.347	2.86	0.004	0.312	1.674
Manufacturing/repair heavy equipment operators	0.655	0.357	1.84	0.066	-0.044	1.355
Manufacturing/repair unskilled workers	1.275	0.360	3.54	0	0.569	1.982
Transportation workers	0.772	0.359	2.15	0.032	0.067	1.476
Service and administration supervisors	-0.375	0.428	-0.88	0.38	-1.214	0.463
Administrative and support workers	0.778	0.361	2.15	0.032	0.069	1.486

Sales workers	1.042	0.346	3.01	0.003	0.363	1.720
Ambulatory workers	1.804	0.390	4.62	0	1.038	2.569
Personal services workers in establishments	0.995	0.360	2.76	0.006	0.289	1.702
Domestic services workers	0.960	0.390	2.46	0.014	0.195	1.726
Protection services workers	0.673	0.368	1.83	0.067	-0.048	1.395
Worker out of the country	0.237	1.038	0.23	0.819	-1.798	2.272
Preschool	-1.773	0.868	-2.04	0.041	-3.475	-0.072
Elementary School	-0.535	0.167	-3.2	0.001	-0.863	-0.207
Junior High School	-0.728	0.178	-4.1	0	-1.077	-0.380
High School	-1.259	0.187	-6.74	0	-1.626	-0.893
Normal School	-1.044	0.557	-1.87	0.061	-2.136	0.048
Technical School	-1.245	0.212	-5.89	0	-1.660	-0.830
College	-1.979	0.220	-8.99	0	-2.411	-1.547
Master´s	-4.244	1.028	-4.13	0	-6.261	-2.228
Doctoral	-1.362	0.971	-1.4	0.161	-3.267	0.543
Rural	0.163	0.108	1.5	0.134	-0.050	0.375
Household residing in Baja California	-0.167	0.126	-1.33	0.185	-0.414	0.080
Household residing in Coahuila	0.715	0.119	5.99	0	0.481	0.950
Household residing in Chihuahua	0.267	0.122	2.19	0.029	0.028	0.506
Household residing in Sonora	-0.042	0.122	-0.35	0.73	-0.281	0.197
Household residing in Tamaulipas	0.576	0.122	4.71	0	0.336	0.815
Constant	0.294	0.485	0.61	0.545	-0.658	1.245

Source: Own estimates based on ENIGH-MCS 2008 (INEGI, 2009).

Table 3. Probability of being poor at mean values of continuous variables

Explanatory Variable	Margin	Delta Method Std. Err.	z	P>z	[95% Conf.	Interval]
Gender of Head						
Male	0.233	0.008	29.86	0	0.217	0.248
Female	0.242	0.016	14.85	0	0.210	0.274
Occupation of Head						
Professionals	0.124	0.036	3.43	0.001	0.053	0.195
Technical workers	0.186	0.023	8.02	0	0.140	0.231
Educators	0.100	0.037	2.71	0.007	0.028	0.173
Occupations in the arts, performances and sports	0.319	0.066	4.87	0	0.191	0.448
Administrators and directors in both public and private sector	0.063	0.020	3.11	0.002	0.023	0.102
Agriculture, husbandry, forestry/fisheries workers	0.400	0.031	12.96	0	0.339	0.460
Manufacturing /repair supervisors	0.126	0.022	5.66	0	0.082	0.169
Manufacturing /repair skilled workers	0.276	0.014	19.14	0	0.248	0.304
Manufacturing/repair heavy equipment operators	0.214	0.021	10.05	0	0.172	0.256
Manufacturing/repair unskilled workers	0.336	0.027	12.59	0	0.284	0.388
Transportation workers	0.234	0.019	12.36	0	0.197	0.271
Service and administration supervisors	0.089	0.022	3.94	0	0.045	0.133
Administrative and support workers	0.235	0.024	9.69	0	0.188	0.283
Sales workers	0.286	0.019	14.97	0	0.249	0.324
Ambulatory workers	0.462	0.046	10.02	0	0.372	0.552
Personal services workers in establishments	0.277	0.022	12.37	0	0.233	0.321
Domestic services workers	0.270	0.037	7.23	0	0.197	0.343
Protection services workers	0.217	0.027	8.14	0	0.165	0.269
Worker out of the country	0.152	0.125	1.21	0.225	-0.094	0.398

Education of Head						
No Instruction	0.460	0.042	11.01	0	0.378	0.542
Preschool	0.126	0.093	1.37	0.172	-0.055	0.308
Elementary School	0.333	0.015	22.79	0	0.304	0.362
Junior High School	0.291	0.012	23.91	0	0.268	0.315
High School	0.195	0.014	14.28	0	0.168	0.222
Normal School	0.231	0.091	2.53	0.012	0.052	0.410
Technical School	0.197	0.021	9.48	0	0.156	0.238
College	0.105	0.012	8.64	0	0.081	0.129
Master´s	0.012	0.012	1	0.317	-0.012	0.036
Doctoral	0.179	0.140	1.28	0.199	-0.094	0.453
Location						
Urban	0.230	0.007	30.68	0	0.215	0.244
Rural	0.260	0.020	12.82	0	0.220	0.300
State						
Baja California	0.174	0.013	13.75	0	0.149	0.199
Coahuila	0.337	0.018	18.86	0	0.302	0.372
Chihuahua	0.245	0.015	15.95	0	0.215	0.275
Nuevo León	0.199	0.015	13.26	0	0.170	0.229
Sonora	0.193	0.013	14.72	0	0.167	0.218
Tamaulipas	0.307	0.017	17.690	0.000	0.273	0.341

Table 4. Odds ratio estimates of poverty determinants

Number of strata = 4
Number of PSUs = 1 993
Number of obs = 8 385
Population size = 3 854 405
Design df = 1 989
F(37, 1953) = 20.11
Prob > F = 0

Explanatory Variable	Odds Ratio	Linearized Std. Err.	t	P>t	[95% Conf.	Interval]
Age of head	0.908	0.013	-6.71	0	0.882	0.934
Age of head squared	1.001	0.000	5.15	0	1.001	1.001
Household size	1.326	0.028	13.18	0	1.271	1.382
Female head	1.051	0.098	0.54	0.592	0.875	1.263
Technical workers	1.613	0.587	1.31	0.189	0.790	3.293
Educators	0.788	0.402	-0.47	0.641	0.290	2.143
Occupations in the arts, performances and sports	3.317	1.497	2.66	0.008	1.368	8.039
Administrators and directors in both public and private sector	0.473	0.220	-1.61	0.108	0.190	1.179
Agriculture, husbandry, forestry/fisheries workers	4.711	1.731	4.22	0	2.291	9.686
Manufacturing /repair supervisors	1.018	0.399	0.04	0.964	0.472	2.194
Manufacturing /repair skilled workers	2.698	0.937	2.86	0.004	1.366	5.332
Manufacturing/repair heavy equipment operators	1.926	0.687	1.84	0.066	0.957	3.878
Manufacturing/repair unskilled workers	3.580	1.289	3.54	0	1.767	7.254
Transportation workers	2.163	0.777	2.15	0.032	1.070	4.374
Service and administration supervisors	0.687	0.294	-0.88	0.38	0.297	1.589

Administrative and support workers	2.176	0.786	2.15	0.032	1.071	4.421
Sales workers	2.834	0.980	3.01	0.003	1.438	5.585
Ambulatory workers	6.073	2.371	4.62	0	2.824	13.058
Personal services workers in establishments	2.706	0.975	2.76	0.006	1.335	5.487
Domestic services workers	2.613	1.020	2.46	0.014	1.216	5.616
Protection services workers	1.961	0.722	1.83	0.067	0.953	4.035
Worker out of the country	1.268	1.315	0.23	0.819	0.166	9.702
Preschool	0.170	0.147	-2.04	0.041	0.031	0.931
Elementary School	0.586	0.098	-3.2	0.001	0.422	0.813
Junior High School	0.483	0.086	-4.1	0	0.341	0.684
High School	0.284	0.053	-6.74	0	0.197	0.410
Normal School	0.352	0.196	-1.87	0.061	0.118	1.049
Technical School	0.288	0.061	-5.89	0	0.190	0.436
College	0.138	0.030	-8.99	0	0.090	0.213
Master´s	0.014	0.015	-4.13	0	0.002	0.108
Doctoral	0.256	0.249	-1.4	0.161	0.038	1.721
rural	1.177	0.128	1.5	0.134	0.951	1.456
Household residing in Baja California	0.846	0.107	-1.33	0.185	0.661	1.083
Household residing in Coahuila	2.045	0.244	5.99	0	1.618	2.585
Household residing in Chihuahua	1.306	0.159	2.19	0.029	1.028	1.659
Household residing in Sonora	0.959	0.117	-0.35	0.73	0.755	1.218
Household residing in Tamaulipas	1.778	0.217	4.71	0	1.399	2.259
Constant	1.341	0.651	0.61	0.545	0.518	3.472

Source: Own estimates based on ENIGH-MCS 2008 (INEGI, 2009).

and living in a rural area. Other authors, such as Levy (1994), Székely (1998) and Cortés (1997) also found a positive effect of rurality upon poverty for Mexico. However, as can be seen in Table 2, we did not find evidence of this rurality effect in the logistic regression results, as the coefficient for this variable in the regression model was not statistically significant.

Poverty and gender

In line with the results obtained by Garza-Rodríguez (2000) and Székely (1998), we found no evidence that female-headed households are more likely to be poor than male-headed households. Thus, even though the coefficient for the gender of the head variable is negative, it is not significantly different from zero.

Poverty and age

According with the life cycle theory of income, we would expect that poverty will be higher for households headed by young and by old people and it will be lower for households headed by middle age persons. This is because productivity (and therefore income) is low at a relatively young age, increases at middle age and then decreases again at old age. If, as it is the case in developing countries, savings are low, then poverty will increase at old age as the individual has few savings to compensate for low incomes.

In line with this reasoning and coinciding with the results obtained for Garza-Rodríguez (2000) for the whole country, for the border states case we found that there is a strong and statistically significant inverse relationship between poverty and age of the head. Thus, looking at Table 4, we can see that an increase of one year in the age of the head decreases the odds of being poor by almost nine percent.

Poverty and education

Given that the main asset of the poor is their labor, and since the returns to labor are highly correlated with education, we would expect to find an inverse relationship between education and poverty. The results obtained for this variable in the multivariate analysis confirm the findings encountered in the poverty profile of an inverse relationship between level of education and poverty. This result is in line with the general consensus in the literature about poverty and particularly with the results obtained for the case of Mexico by Cortés (1997), Székely (1998) and Garza-Rodríguez (2000). It can be seen in Table 4 that the odds of being poor for a household whose head has completed Junior High School education are 55% lower than those of a household whose head has no instruction.

Poverty and occupation

In line with human capital theory, we would expect that occupations that require a high amount of capital will have higher salaries than those which do not. Then, in turn, occupations which pay higher salaries will tend to be associated with lower poverty levels.

Confirming this line of reasoning, as well as the results obtained in the poverty profile, Table 2 shows that the probability of being poor is higher for households whose head works in occupations which require a low stock of human capital such as agricultural worker, ambulatory worker or unskilled manufacturing worker. Likewise, the odd ratio results shown in Table 4 indicate that the odds of being poor for a family whose head is an agricultural worker are five times the odds of a household headed by a person with a professional occupation (the base category for household head´s occupation in the logistic regression).

Poverty and state of residence

In line with the results obtained in the poverty profile, Table 2 shows that (using Nuevo León as the comparison category), the probability of being

poor is higher for families living in the states of Coahuila, Tamaulipas and Chihuahua. Even though we did not analyze any hypothesis about why these states have higher poverty rates, we can hypothesize for further research that this fact could be due to their lower level of industrialization and development, as compared to Nuevo León for example.

Conclusions

The purpose of this article was to identify the determinants of poverty in the Mexican states which have a border with the United States. Using a recently released survey ENIGH-MCS 2008 (INEGI, 2009), we constructed a poverty profile for the region in order to get a first approximation to the problem of finding which variables explain or are correlated with poverty. The poverty profile constructed for the region indicated that poverty is higher for households living in the states of Coahuila, Tamaulipas and Chihuahua, for rural households and for large households and for households whose head has low education, is an ambulatory worker or works in an agricultural occupation.

Concerning the hypotheses proposed at the beginning of this investigation, we concluded that, for the states of the northern border of Mexico, the hypothesis that poverty in rural areas is higher than poverty in urban areas was rejected (there is no statistically significant relationship); the hypothesis that the state of residence of the household is a variable that explains poverty was accepted; the hypotheses that household size, education level, age and occupation of the household head are variables that explain poverty were accepted also, while the hypothesis that the gender of the household head is a statistically significant variable to explain poverty variable was rejected.

Confirming the results obtained in the poverty profile, the multivariate analysis developed in this study showed that the main variables that are positively correlated with the probability of being poor are: living in the states of Coahuila, Tamaulipas or Chihuahua, size of the household, being an ambulatory worker or working in an agricultural occupation, and being a manufacturing, transportation, sales, domestic service or support worker, while the variables that are negatively correlated with the

probability of being poor are living in Baja California, the education level of the household head and his/her age. We did not find evidence in this study to support the hypothesis of the feminization of poverty, since the parameter estimate for this variable in the logistic regression was not statistically different from zero.

From the results obtained from the poverty profile at the state level, it is recommended that all states in the region should design and implement public policies to alleviate poverty, since poverty incidence is high even in the state with the lowest poverty rate (Nuevo León, where poverty affects 26% of households). The need for these policies is even greater in the cases of the states of Coahuila, Tamaulipas and Chihuahua since poverty rates in these states are higher than 35%.

All the education variables included in the multivariate analysis were highly significant, indicating the importance of education in the reduction of poverty. Family size was also identified as an important factor to explain poverty in the region. From these results, it should be clear that policies aimed at the reduction of poverty in the border region should concentrate on increasing the education level of the population, increasing the productivity of workers and designing appropriate economic and demographic policies to discourage large family size.

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