

**THE DETERMINANTS OF HOMEOWNERSHIP IN PRESENCE OF SHOCKS
EXPERIENCED BY MEXICAN HOUSEHOLDS**

A Thesis

by

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ABSTRACT

Homeownership is both an individual and society objective, because of the positive neighborhood effects associated with areas of higher homeownership. To help realize these positive effects, the Mexican government has several programs directed to increasing homeownership. Many factors, however, may influence homeownership including shocks experienced by households. Shocks such as death in family, illness or accidents, unemployment, and business, crop, or livestock loss affect homeownership if households are unable to cushion the impact of the shock. Government income support programs, however, may help cushion the effect of a shock. The main objective is to determine how shocks that households' experience and government income support programs influence homeownership in Mexico. A secondary objective is to determine how socio-demographic variables influence homeownership in Mexico.

Based on the Random Utility Model, logit models of homeownership are estimated using data are from the 2002 Mexican National Survey on Living Levels of Households. Two models are estimated; with and without income. Income is excluded because of a large number of households that did not report income. Generally, inferences from the two models are similar.

Homeownership appears to not be affected by shocks experienced by households. It appears households are able to cushion the impact of shocks. The two income support programs, the Program of Direct Rural Support of Mexico (PROGRESA) and the Program of Direct Rural Support of Mexico (PROCAMPO), appear to be increasing

homeownership. These social welfare programs provide cash transfers to households. For whatever reason, PROGRESA has a larger effect on homeownership than PROCAMPO.

Households with older heads have a larger probability of being a homeowner than households with younger heads. No statistically significance relationship exists between education and homeownership. Regional differences are seen in homeownership, with households located in the northwest region having a higher probability of homeownership than other regions. Differences in the significance of variable representing the household head's gender, marital status, and occupation on homeownership exist between logit models that include and do not include current income. The most likely reason for these differences is interactions between the variables and a wealth effect.

DEDICATION

To my Lord, for showing me patience and love.

To my wife, Miriam Juarez Torres, because your amazing love enlighten my road. Thank you for each prayer and words you gave me.

To my kids, Emilio Lopez Juarez and Lilian Helena Lopez Juarez, because you made my world so awesome.

To my Mom, Marbella Cabrera Aquino, because you taught me that each day is an opportunity to achieve my goals.

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ACRONYMS

CONAVI	The Mexican National Housing Commission
FONHAPO	The Mexican National Trust Fund for Popular Housing
FOVISSTE	The Housing Fund of the Institute of Security and Social Services for State Workers of Mexico
INFONAVIT	The Institute of National Housing Fund for Workers of Mexico
MxFLS	The Mexican Family Life Survey
PROCAMPO	The Program of Direct Rural Support of Mexico
PROGRESA	The Education, Health, and Nutrition Program of Mexico
RUM	Random Utility Model
SHF	The Mexican Federal Mortgage Society
SMSA	Standard Metropolitan Statistical Area
SME FUND	Support Fund for Small and Medium Enterprise

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CHAPTER I

INTRODUCTION

Areas with an increased percentage of homeownership¹ enjoy household and societal benefits that other neighborhoods do not enjoy. These benefits are discussed extensively in the literature (Rohe and Stegman 1994; Rohe and Stewart 1996; Rossi and Weber 1996; Green and White 1997; Glaeser and Sacerdote 1999; Dietz and Haurin 2003; Harkness and Newman 2005). Higher educational achievements and civic participation, increased health benefits, decreased crime rates, improved public assistance, higher levels of property maintenance, and enhanced neighborhood improvements are associated with areas of higher percentages of homeownership (National Association of Realtors 2012). Homeownership has been an essential element of individual life goals for decades and continues to be so even today (National Association of Realtors 2012).

Homeownership is the result of individual decisions based on housing supply and demand conditions. Supply side issues include the number of new and previously owned houses for sale availability, sale prices for houses, the supply of houses for rent, and rental prices. Property maintenance costs, subsidies and taxes, mortgage, equity, insurance, cost of renting, and household socioeconomic characteristics are among the determinants of homeownership demand.

Studies and theory also suggest a household's permanent income is among the determinants of homeownership demand. Households tend to purchase homes based

¹ Homeownership means households that live in and own their house.

more on their permanent income than their current income (Struyk 1976). The permanent income hypothesis implies that homeownership will not be entirely subject to current income and its year-to-year variations. The effects of income variations depends on if the variations are expected or unexpected and transitory or permanent (Aguilar and Hurst 2005). When a household faces a negative and unexpected event (such as family member death, illness, or accident, unemployment or business shut down, natural disaster, or farm production loss), the household will attempt to cushion the economic impact of the event. This is what is called smoothing consumption (Carter et al. 2005). If the household is successful in its coping strategies, then homeownership consumption decision may not change because of the event. Thus, a household will be homeowner even if unexpected events occur if they are successful in cushioning the impact.

The objective is determine how economic, natural, and social events that households' experience (henceforth referred to as shocks) and federal government income support programs influence homeownership in Mexico. This study attempts to determine whether Mexican households are successfully in absorbing shocks, such that the shocks experienced by households do not affect homeownership.

Further, this research tests how income subsidies impact homeownership. PROGRESA (The Education, Health, and Nutrition Program of Mexico), PROCAMPO (The Program of Direct Rural Support of Mexico), SME FUND (the Support Fund for Small and Medium Enterprise) are the programs included in the analysis. The first two programs are the major subsidies program administered by the Mexican government. SME FUND is an instrument that seeks to support small companies and entrepreneurs.

A second objective is to determine how socio-demographic variables influence homeownership in Mexico. Many studies highlight how household characteristics influence homeownership (Kain and Quigley 1972; Carliner 1974; Struyk and Marshall 1974; Hood 1999; Yates 2000; Fisher and Jaffe 2003; Cadena Minotta, Ramos Chalen, and Pazmiño Medina 2010). Socio-demographic characteristics available in the survey data set used, such as marital status, location, occupation, education, and age, provide the opportunity to test if these variables are influencing homeownership.

To analyze the relationship between homeownership and the determinants two logit models are estimated. The difference in the two models is the exclusion and inclusion of household income. The main reason for estimating the two models is that in the data set (discussed later), income is a variable many households did not report.

Why Study Homeownership in Mexico?

Because of the potential household and social benefits, the Mexican government has promoted homeownership through a number of channels. Five federal government institutions for increasing homeownership in Mexico are: INFONAVIT, FOVISSTE, SHF, FONHAPO and CONAVI.

INFONAVIT stands for The Institute of National Housing Fund for Workers of Mexico. It is the largest mortgage bank responsible for lending to middle-income applicants. Applicants to INFONAVIT must work for private companies and have contributed to the fund (Torres Baños and Eibenschutz Hartman 2005; Lopez Silva et al. 2011). The second granting institution is FOVISSTE which is the acronym for The

Housing Fund of the Institute of Security and Social Services for State Workers of Mexico in Spanish. FOVISSTE is a federal government fund for bureaucrats.

Applicants must be middle income and have contributed to the fund (Torres Baños and Eibenschutz Hartman 2005). These two mortgage banks, "... hold about 82 percent of the primary mortgage market" (Lopez Silva et al. 2011, p. 5).

The third financial institution is SHF, the Mexican Federal Mortgage Society. SHF is a second tier development bank. SHF grants credits through financial intermediaries such as commercial banks, insurance companies, and Financial Societies of Limited Object. SHF primarily promotes housing construction and homeownership for low income population. To obtain a home loan, applicants must complete the application of the institution to which they are applying for credit (Lopez Silva et al. 2011). FONHAPO is the National Institute for the Development of Communities and Housing. Its main objective is the construction of low cost housing developments for low income self-employed workers through non-governmental organizations (NGO). As before, each applicant needs meet each NGOs requirement to obtain credit (Torres Baños and Eibenschutz Hartman 2005; Lopez Silva et al. 2011). The Federal Commission coordinating all these institutions is called CONAVI. CONAVI is the Mexican National Housing Commission that design, coordinates, and promotes policies and housing institutions in Mexico (Lopez Silva et al. 2011).

Although the Mexican government has put substantial efforts toward promoting homeownership, there are few studies devoted to analyzing homeownership in Mexico (Diaz Pedroza and Martinez Atilano 2005). There, however, are many studies that focus

on homeownership in various different countries (Eilbott and Binkowsky 1985; Forrest and Murie 1994; Arimah 1997; Tipple, Korboe and Garrod 1997; Yates 2000; Green and Hendershott 2001; Fisher and Jaffe 2003; Cadena Minotta, Ramos Chalen, and Pazmiño Medina 2010). An ECONLIT query for homeownership on June 12, 2012, resulted in 681 studies; none of these studies focused on Mexico. An additional query for “determinantes de la adquisicion de vivienda en Mexico” (determinants of property purchase in Mexico) on June 12, 2012 in Google Scholar shows only one study focused on the characteristics of homeownership in Mexico (Diaz Pedroza and Martinez Atilano 2005). This study neither included shocks nor governmental programs as variables in their model. Hence, this research helps fill the gap in the literature concerning Mexico homeownership determinants including households shocks and government programs.

CHAPTER II

LITERATURE REVIEW AND FRAMEWORK

Literature Review

There is a vast literature on homeownership determinants since the 1970's. Three early pieces are Kain and Quigley (1972), Carliner (1974), and Struyk and Marshall (1974). Kain and Quigley (1972) examine the effect of income, race, age, marital status, and family size on the probability that a household owns its home in St. Louis, Missouri. In their study, owning is associated with savings and renting with consuming. They stress the importance of the household's permanent income in the house tenure decision. Kain and Quigley (1972) conclude that black households are less likely to be homeowners than white households of similar socio-demographic characteristics.

Carliner (1974) examines the underlying factors of homeownership. He proposes four factors affecting homeownership: household's income, relative price of rental versus homeownership, the stability of household demand for housing, and the type of house desired. This last factor includes the location of the house as an expression of desirability. Other variables included are age, size of family, type of family (single men, single women, married, divorced men, and divorced women), location (urban versus rural), race, and income. Carliner (1974) did not distinguish between permanent and current income. Using data from the 1967 Survey of Economic Opportunity (SEO) in the United States, he found that: as the age of the individual increases the likelihood of homeownership increases; larger families increase the probability of homeownership;

married status increases the probability of ownership; rural locations increases the probability of homeownership; white households are more likely to be homeowners; and income positively increases homeownership probability.

Struyk and Marshall (1974) show in their pioneering work how permanent income impacts the decision to be a homeowner. They estimate a logit model of homeownership using data from the Pittsburgh area. Variables included are current and permanent income, subsidy rates, household characteristics, and tenure choice per group. First, permanent income is estimated using household characteristics and current income. Then the coefficients obtained from this regression are used to get an expected permanent income by household. This expected income is used as a proxy for permanent income in the homeownership model. The models for home tenure choice are divided into four husband-wife household types, by household head age, plus two categories that are not divided by age - other family type and primary individual. Results show that permanent income is a significant determinant of the probability of homeownership for all but one household type, other family.

Since the above papers, there has been numerous studies on the determinants of the demand for housing from various social and theoretical viewpoints (Artle and Varaiya 1978; Newman and Struyk 1983; Henretta 1984; Eilbott and Binkowsky 1985; Forrest and Murie 1994; Rohe and Stewart 1996; Arimah 1997; Tipple, Korboe and Garrod 1997; Hood 1999; Yates 2000; Green and Hendershott 2001; Fisher and Jaffe 2003; Quigley and Raphael 2004; Diaz Pedroza and Martinez Atilano 2005; Olsen 2007; Cadena Minotta, Ramos Chalen, and Pazmiño Medina 2010; Lopez Silva et al. 2011).

Studies range from a theoretical perspective (Artle and Varaiya 1978) to an applied perspective (Newman and Struyk 1983; Henretta 1984; Eilbott and Binkowsky 1985; Forrest and Murie 1994; Rohe and Stewart 1996; Arimah 1997; Tipple, Korboe and Garrod 1997; Hood 1999; Yates 2000; Green and Hendershott 2001; Fisher and Jaffe 2003; Quigley and Raphael 2004; Diaz Pedroza and Martinez Atilano 2005; Olsen 2007; Cadena Minotta, Ramos Chalen, and Pazmiño Medina 2010; Lopez Silva et al. 2011).

From the applied perspective, studies examine the benefits of homeownership to the household or area such as increasing property values, lower crime rates, increasing housing satisfaction, and increasing social participation. Henretta (1984) discusses how parental homeownership may result in an increased probability of the owners' sons owning a house, hence life stability. Data used are from is the 1980 Panel Study of Income Dynamic (PSID) conducted in the US. Rohe and Stewart (1996) relate homeownership and neighborhood stability. Desirable outcomes such as increased property values, lower crime rates, and housing satisfaction are associated with homeownership. Data from the 1980 and 1990 Census of Population and Housing provide the basis for their study.

Another thread of research examines low income households and homeownership. Newman and Struyk (1983) relate housing and poverty in a national US study. They find that people living in poverty are also more likely to live in serious deficient units and in overcrowded conditions with excessive expenditures. Low income households that rent and live in serious deficient units are double the percentage of low

income households that own their home. Their work is based on the Annual Housing Survey (AHS) conducted in the US.

Quigley and Raphael (2004), Olsen (2007), and Lopez Silva et al. (2011) attempt to establish relationships between homeownership and financing in the USA and Mexico. Their work follows the lines of financial assistance programs. The reason the study of Lopez Silva et al. (2011) did not show up in the previous mentioned Google Scholar search is the study is categorized by Google as housing finance in Mexico, not homeownership. Quigley and Raphael (2004) find that the local governments' rules in the USA increase housing prices, therefore, making homeownership less affordable. This situation impacts younger households more than older households; they propose financial assistance to younger home buyers. Olsen (2007) found that there is an anti-homeownership bias in the current American system of low-income assistance. He encourages uses the Housing Voucher Program as a vehicle to financially support homeownership. Lopez Silva et al. (2011) found that the homeownership subsidy programs by Mexican government do not have negative financial implications for mortgage institutions. They suggest the subsidies improve access to homeownership for low income families and do not weaken financial institutions.

Other studies are dedicated to studying the determinants of homeownership from the demand and supply side under different economic conditions. Homeownership in presence of economic recessions in UK and USA is examined by Forrest and Murie (1994) and Green and Hendershott (2001). Forrest and Murie (1994) show homeownership was delayed during the 1980's Britain economic recession. Their data

comes from the 1991 Inland Revenue Statistics. They show that in Britain, perceptions concerning homeownership during the recession changed. Their results suggest a declining preference for homeownership during the recession. Common thinking among respondents was to decrease their financial burden during the recession. Green and Hendershott (2001) examine the relationship between homeownership and unemployment. They find no relationship between younger and older households' heads being unemployed and homeownership, but a positive relationship for middle age households' head. Their data come from the Statistical Abstract of the US.

Trends in homeownership rates are another categorization of studies (Eilbott and Binkowsky 1985; Yates 2000; Fisher and Jaffe 2003). The principal characteristic of these studies is to show patterns across different locations on homeownership. Eilbott and Binkowsky (1985), using aggregate Standard Metropolitan Statistical Area data to explain homeownership rates, find that tenure decisions are influenced by size and age composition of households, household incomes, and house values.

Yates (2000) results reveals homeowners do not move in Australia if a household member non-head of the family is unemployed; but, homeowners are more likely to change their location if the household head losses his or her job. Her data come from the 1975-1976 and 1993-1994 Household Expenditure Surveys by the Australian Bureau of Statistics. Fisher and Jaffe (2003) using 1994 United Nations Center for Human Settlements Statistical Database explore 106 countries for which homeownership data is available. They find citizenship, urban population, government consumption, age, and mandatory financing of homeownership associated with higher rates of homeownership

in some countries and lower rates of homeownership in other countries. Because of these conflicting results, they did not successfully determine a single model with good explanatory power.

Another group of studies use the same variables as the previous studies, but applies them in a different context either in time or place. Hood (1999) using the 1996 National Longitudinal Survey of Youth in USA found that current income is statistically significant at the 0.01 level in explaining homeownership, although the magnitude of the effect is small. She also takes into account socioeconomic characteristics such as family income, race, gender, education, parental homeownership, age, marital status, and family size.

Arimah (1997) and Tipple, Korboe, and Garrod (1997) provide a perspective of African homeownership by examining homeownership in Nigeria and Ghana. Both studies consider the cultural differences between Africa and western cultures. The African culture is reflected in the housing market through different types of housing tenure. They point out that there are people living in houses as if they are homeowners, but they are not homeowners. These people do not pay rent and they cannot sell the property. They live under the patriarch of the family. Their sons and grandsons may also live in the same house as an inheritance. Further, the lack of adequate institutions is detrimental to the process of purchasing houses.

Diaz Pedroza and Martinez Atilano (2005) and Cadena Minotta, Ramos Chalen, and Pazmiño Medina (2010) examine homeownership in Latin-American countries, which are considered middle income countries. Diaz Pedroza and Martinez Atilano's

(2005) is one of the first studies of homeownership in Mexico. Data used are from the 2002 National Survey of Income and Expenditure of Households (ENIGH) in Mexico. Their principal results are households' purchases of homes are positively related to household's income and the size of the family.

Cadena Minotta, Ramos Chalen, and Pazmiño Medina (2010) estimate a multinomial logit demand model for housing rental and purchase as a simultaneous decision process. Their data are from the 2006 Survey of Living Conditions (ECV) in Ecuador. The decision process is divided in two sections: home rental and homeownership. In the home rental, their results suggest there is a positive relationship between rental price and location, floor conditions, house rooms, and services available, such as internet. In the case of housing prices, there is a positive relationship between price and the types of roof, condition of the walls, attached areas for business and services available. Derived from the home rental results, they find that rental demand is associated with younger households in urban areas with above average incomes. In the homeownership case, the demand for purchasing a home is increased for households in the Sierra region of Ecuador and with a male household head.

In the applied homeownership literature, there are very few references to the house being an asset. Because of this lack of reference, literature on poverty analysis sheds some light on how a household might use their house asset when faced with a shock. Four works are discussed to illustrate how poverty analyses can be used. It should be noted that poverty analysis is usually applied to developing countries.

Carter et al. (2005) demonstrate that different strategies are adopted by households depending on the magnitude of the event and the expected household capacity to recovery from the shock. They state that economic effects can be traced through three stages: the period of shock, the coping period, and the recovery period. During the coping period, families use different strategies to mitigate the impact of a loss. Use of savings, borrowing funds, and selling assets are the most common mitigation strategies. Also, they provide two interesting case studies: the drought which affected Ethiopia in the late 1990's and Hurricane Mitch effect's on Honduras in 1998. In the Ethiopia case, the effects are traced from 1996 to 1999 with seven rounds of household surveys. For Honduras, the study is based on data just after the hurricane passed through in 1998 and data collected in 2000 and 2001. In both cases, families adopted coping strategies in the short and long run. Borrowing against future earnings, increases in work time, and drawing down on their assets are short term strategies. Reducing consumption is a long run strategy. In the Ethiopia case, labor markets and financial markets are restricted, so decreasing assets and consumption are the main strategies because Honduras has financial and labor markets more developed than Ethiopia, household strategies fall more into borrowing and increase labor time.

The magnitude of an event is positively related to the depth, duration, and extent of the shock. The effect of a natural disaster can last for a long time, such as in a drought, or be short in duration, such as a hurricane. A hurricane, for example, can destroy in a moment many resources. In contrast, a drought is usually more extensive, but slowly and steadily destroys resources. For natural disasters, the effect is usually

experienced by many households in a region. A contrasting shock is the effect of a death of household head. Death changes the economic and social face of a family, but the effect is usually less widespread than natural disasters.

Juarez Torres (2010) examines the household capacity to recovery from shocks based on household characteristics. She shows that the abilities of the family members plays an important role in the recovery stage. When Mexican households experience a household shock, they decrease their total assets by 0.78% on average. Comparing female and male household heads, she found that after a household shock, a household with a female head decreases their asset stock by 5.4% more than household with a male head. Her data are from the 2002 Mexican Family Life Survey (MxFLS).

Winters, Davis, and Corral (2001) point out the household capacity for recovery is related to market financial access (formal or informal), government programs access, and economic environment, such as infrastructure or flexible labor market. Data are from a nationally representative sample of Mexican ejido (common property land tenure).

Hoddinott (2006) using survey data from 1982 to 1984 of 400 resettled households shows different coping strategies followed by low income households in rural Zimbabwe. Households prioritize which family members are going to feel the bigger impact of the household shock. Men who constitute the labor force for the family, therefore a household asset, bear less of the effect than other household members. Women and children bear the negative impact primarily through nutrition and health.

Random Utility Model

Many considerations go into the purchase of a home. One of the major set of considerations is the environment of the house. Households consider the number of rooms, the condition of the house, non-built areas, type of services available (water, sewer, telephone lines, cable, and internet), and neighborhood (rates of crime, number and type of schools, hospitals, governmental offices in the area, malls in the area, etc.). Institutional factors are also reflected in the homeownership decision. Because purchasing a house is usually a major financial undertaking, financial institutions usually play a role. The availability of a loan and purchase price of the house, along with institutional requirements imposed to obtain a loan, influence the purchase decision. Because a house is not only a commodity but is itself a source of value, owner equity is another issue to consider. Moreover, transaction costs are incurred when purchasing a house.

These considerations, along with the underlying characteristics of the household, partially comprise the household utility gained from owning or renting a home. An individual household chooses to buy a home if the utility from homeownership is greater than the utility of non-homeownership given constraints faced by the household such as the household's budget. Random Utility Model (RUM) provides a theoretical framework to analysis the discrete homeownership decision.

The RUM was introduced by J. Marschak in the 1960s (Ibáñez and Batley 2005). In his work, the RUM translates the idea of an individual deterministic choice to a probabilistic one (Marschak 1960; Block and Marschak 1974). Subsequent papers

proposed alternative presentations of RUM (McFadden 1976, 1978; Williams 1977; Daly and Zachary 1978).

Following Greene (1997), assume that there are two choices. Let y_0 represents household non-homeownership and y_1 represent household homeownership. Let V_{i1} and V_{i0} represent the household i 's indirect utility functions associated with the two choices: homeownership and non-homeownership. The observed choice reveals the option which provides the largest utility for the household given the constraints faced by the household and household characteristics. Assuming a linear functional form, household i 's indirect utility function for choice j is

$$V_{ij} = \beta_j'x_i + \epsilon_{ij}$$

where β_j is a matrix of coefficients associated with the explanatory variables, x_i 's is a matrix of explanatory variables for the homeownership household characteristics, and ϵ_{ij} is the error term.

If $V_{i1} > V_{i0}$ then $y = y_1$ and if $V_{i1} \leq V_{i0}$ then $y = y_0$. The probability (Prob) that individual household i will be homeowner is:

$$\begin{aligned} & \text{Prob}[y = y_1 | x_i] \\ &= \text{Prob} [V_{i1} > V_{i0}] \\ &= \text{Prob} [\beta_1'x_i + \epsilon_{i1} > \beta_0'x_i + \epsilon_{i0} | x_i] \\ &= \text{Prob} [\beta_1'x_i - \beta_0'x_i > \epsilon_{i0} - \epsilon_{i1} | x_i] \\ &= \text{Prob} [(\beta_1 - \beta_0)'x_i > \epsilon_{i0} - \epsilon_{i1} | x_i] \\ &= \text{Prob} [\beta'x_i > \epsilon_i | x_i]. \end{aligned}$$

If the random errors are assumed to be identically and independently distributed with an extreme value (McFadden 1978), the probability can be expressed as the logit model:

$$\begin{aligned} & \text{Prob} [\beta'x_i - \epsilon_i > 0 | x_i] \\ &= F[\beta'x_i > 0 | x_i] \\ &= 1/(1 + \exp(-\beta' x_i)). \end{aligned}$$

The logit model will be estimated using maximum likelihood estimation in STATA 10.

Marginal Effects

The marginal effects measure the effect of an explanatory variable on the conditional mean of the explained variable (Cameron and Trivedi 2010). Mathematically, the marginal effect for variable x_i is

$$ME_i = dE(y = y_j|x_i)/dx_i$$

for the continuous case, and

$$ME_i = E(y = y_j|x_i, d = 1) - E(y = y_j|x_i, d = 0)$$

for the discrete case.

Marginal effects can be evaluated at various levels of the x 's. Here, average marginal effect is presented. The average marginal effect is calculated at the average of the sample independent variables.

Goodness of Fit: Predicted and Actual Outcomes

Finally, one measure of goodness of fit of the logit model is the predictive power of the binary regression model (Cameron and Trivedi 2010). This measure compares the binary observed outcome, $y = y_1$ or $y = y_0$, the household owns a house or do not own,

with the prediction outcome of whether $\hat{y} = y_1$, or $\hat{y} = y_0$. The prediction rule is $\text{Prob}(\hat{y}|x_i) = y_1$, when $F[(\beta'x_i > c)| x_i]$ and $\text{Prob}(\hat{y}|x_i) = y_0$, when $F[(\beta'x_i \leq c)| x_i]$ for a specified value. Usually, a value of 0.5 is assumed for c which will be assumed here.

Data

Data used in this study are from The Mexican Family Life Survey (MxFLS), conducted nationwide in Mexico during 2002 (Rubalcava and Teruel 2002). Fieldwork for the baseline of the MxFLS was completed in August 2002 with a sample of 8,440 households. This baseline provides a reference point for a second survey which was conducted during 2005 and 2006. The first survey is used because availability of the data; subsequent survey data is not readily available to the public. The data include information on the household and individuals in the household.

The variables used in the model are described in Appendix A, table 1. Five thousand three hundred and six households reported the complete set of variables. Variable one is the dependent variable. The second to the 11th variables pertain to shocks and income subsidies. The 12th to 35th variables are socio-demographic characteristics. The 35th variable is the gender of the household head. Research on economic shocks mention this variable as a characteristic of the household that can cushion the impact of a shock (Juarez Torres 2010).

Summary statistics for the variables used in the analysis are presented in Appendix A, table 2. The dependent variable (homeownership), and shocks,

governmental programs, marital status, regional location, occupation, and education variables are 0-1 qualitative variables. Age is sectioned in four categories: household head age less than 30 years old; between 30 years old and 45; between 46 years old and 60 years old; and beyond. The last category is the base. This partition is based on previous homeownership analysis that suggests different homeownership rates among younger, middle age, and retired people (Kain and Quigley 1972, Carliner 1974, Struyk and Marshall 1974).

The variable numbered as 36 is the household annual income reported in the MxFLS. Income is the only continuous variable in the model. This variable accounts for all principal sources of income earned by household members during the year previous to the survey. The range in of household incomes is from approximately 3 thousands Mexican pesos to 889,974 thousand Mexican pesos. Household annual income is reported for only 39.32% of total households interviewed; as such, two models are estimated with and without income.

The MxFLS records household homeownership. Over 75% of households in the data are homeowners (see Appendix A, Table 3). The observed percentage of household homeownership is above average international rates, but the Mexican homeownership rate is not large enough to place Mexico among the top five countries with the highest rates of homeownership (Fisher and Jaffe 2003). An indicator variable of homeownership is used as the dependent variable in the model.

MxFLS also records six different shocks, if the household experienced:

1. member death in the last 5 years;
2. member sickness or accident that requires hospitalization in the last 5 years;
3. member unemployment or business failure in the last 5 years;
4. house or business loss for natural disaster the in last 5 years;
5. total agricultural production loss in the last 5 years; and
6. loss, theft, or death of animals for agriculture production in the last 5 years.

Each of these shocks are included in the analysis as qualitative variables indicating if a household experienced a shock. Household characteristics recorded in the MxFLS include: level of education of household members; if the household receives governmental aid or subsidies including its type; household income; marital status; occupation; gender; and age of the household head.

The MxFLS also provides the location of the respondent in terms of the Mexican state division. So, all Mexican states are classified in regions according to the National Program of Development. In Mexico, the Mexican government must release a National Program of Development every six years. The 2000-2006 administration, headed by Vicente Fox, determined that Mexico was divided by five regions for administrative purposes. The regions were divided in 5 categories: south southeast, centerwest, center, northwest, and northeast. In Appendix A, table 4, the regions with their state members are provided and in Appendix B, figure 1, the regions are displayed on a map of Mexico.

Household shocks by categories are presented in Appendix A, table 5. From the complete set of observations used in the model (5,306), 8.05% of total households were affected by a family member death during last five years previous to the year surveyed. More than 12% of the households faced a sickness or accident of a member family.

The next two shock categories in Appendix A, table 5, represent more economic oriented shocks. Only 7.33% of household experienced unemployment or business failure of a household member and 1.45% experienced a loss of home or business due to an earthquake, flood or other natural disaster. The last two categories are related to rural households. Of the total respondents, 6.01% experienced a total crop loss and 2.15% face a loss, theft or death of animals for agriculture production.

The breakdown between household's homeownership and household shocks experienced by households is also given in Appendix A, table 5. More than 6% of the households experienced the death of a household member compared to 1.6% of households who are non-homeowners. Also, 9.37%, 5.16%, 1.23%, 5.54% and 1.88% of households who owned homes experienced the unemployment or business failure of a household member; loss of home or business due to an earthquake, flood or other natural disaster; total crop loss; and loss, theft or death of animals for agriculture production. Household non-homeowners experienced less shocks than homeowners percentage wise.

CHAPTER III

RESULTS

As previously noted, many households in the data set did not provide income. As such two logit models with and without income are estimated. The model without income includes 5,306 observations, whereas the model with income only 3,319 observations are used. Similarities and differences between the models are discussed throughout this chapter.

Model without Income

Estimated coefficients, standard errors, and p-values are displayed in Appendix A, table 6. Because the shocks negatively impact a household, it is expected all coefficients associated with shocks would be negative. Of the shock variables, only unemployment or business failure of a household member (*Unemployed*) and loss of home or business due to an earthquake, flood or other natural disaster (*Home loss*) have the expected negative sign. Only household total crop loss (*Crop loss*), however, is statistically significant at the 10% level or less. Total crop loss (*Crop loss*) variable has an unexpected positive sign. If a household had experienced a total loss of crop, the log odds of homeownership versus non-homeownership increases by 0.492.

Among the governmental programs, the Education, Health, and Nutrition Program of Mexico variable (*PROGRESA*) and The Program of Direct Rural Support variable (*PROCAMPO*) are statistically significant at the 10% level. Being enrolled in either the *PROGRESA* or *PROCAMPO* program increases the log odds of

homeownership versus non-homeownership by 0.337 or 1.033. These log odds indicate the PROCAMPO program has a greater impact on homeownership than PROGRESA. PROCAMPO is related to rural sector production, whereas, PROGRESA is a government social assistance program.

In the case of the marital status, neither household head divorced (*Divorced*), nor married (*Married*) are statistically significant at the 10% level. Household head living in a free union (*Free union*), living in a legal separation (*Legally separated*), and single (*Single*) are statistically significant at the 10% level. All coefficients in this group are negative. The base for marital status is widow or widower household head. The negative coefficients indicate the probability of owning a house decreases compared to a widow or widower household head.

All location variables (*Southsoutheast, Centerwest, Center, Northeast*) coefficients are negative and statistically significant at 10% level. The base for the location variables is the northwest Mexico. For households located in the south southeast, the centerwest, center, and northeast of Mexico, the probability of owning a house decreases compared to a household located in the northwest.

The last variables pertain to occupation, education, age, and gender. A household head whose principal job is industrial activities or government or in commercial activities but is not the owner (*Laborer*) is the only occupation coefficient statistically significant at 10% level. The base for this group of variables is unpaid workers. For household heads in this group, the probability of owning a house decreases compared to a household heads whose principal job is unpaid. None of the education

variables are statistically significant at the 10% level. Coefficients associated with household heads that are less than 30 years old (*Age less than 30*) or between 31 to 45 years old categories (*Between 31 and 45*) are statistically significant at 10% level. For household heads that are less than 30 years old or between 31 to 45 years the probability of homeownership versus non-homeownership decreases compared to a household head older than 60 years old. Finally, household head's gender is not statistically significant at the 10% level.

Marginal Effects - Significant Variables

Average marginal effects for the regression model without income are given in Appendix A, table 7. Households experiencing a total crop loss (*Crop loss*) have on average a 6.8% increase in the probability of owning a house compared to those who have not-experience a crop loss, after controlling for governmental programs, marital status, regional location, occupation, education, age, and gender.

For governmental programs, households enrolled in PROGRESA (*PROGRESA*) or PROCAMPO (*PROCAMPO*) have on average 4.9% or 12.9% increase probability of being a homeowner compared to households not enrolled in these programs when controlling for the other variables. Marginal effects suggest the PROCAMPO program has an approximately three times larger effect on homeownership than the PROGRESA program. Household heads living in a free union (*Free union*), legal separation (*Legally separated*), or a single household head (*Single*) have a 13.4%, 13.0%, and 10.3% decrease in probability of being a homeowner compared to a widower household head. Households living in the south southeast (*Southsoutheast*), centerwest (*Centerwest*),

center (*Center*), and northeast (*Northeast*) states of Mexico have a 3.2%, 16.4%, 15.3% and 6.5% decrease probability of being a homeowner compared to households in the northwest states. Household heads whose principal jobs are in industrial activities or government or in commercial activities but are not an owner (*Laborer*), have a 6.5% decrease probability of being a homeowner compared to unpaid workers. Household heads less than 30 years old (*Age less than 30*) and household heads between 31 to 45 years old (*Between 31 and 45*) have 36.8% and 10.6% decrease in probability of being a homeowner compared to household heads who are more than 60 years old.

Model with Income

Income variables are commonly used in the homeownership analysis. Unfortunately, as previously noted the data base lacks of information on households income for many observations. Only 3,319 out of 5,306 households reported income, 62.5% observations. The estimated logit model with income is given in the Appendix A, table 8.

In the shocks group, none of the variables are statistically significant at the 10% level. The main difference in the shock category between the models is household total crop loss (*Crop loss*) is not statistically significant in the model with income.

Inferences from the governmental programs are similar to the previous model. The Education, Health, and Nutrition Program of Mexico variable (*PROGRESA*) and The Program of Direct Rural Support variable (*PROCAMPO*) are significant in both models. The PROCAMPO program generates more of an impact on homeownership than PROGRESA, similar to the model without income.

No marital status variables are statistically significant at the 10% level in contrast to the model without income in which several marital variables are significant. Similar to the model without income, all location variables are statistically significant at the 10% level and have negative coefficients. All occupation variables' coefficients are statistically significant at 10% level and are negative. Relative to a household head whose principle job is unpaid, all other occupation categories have a decreased probability of owning a house.

Similar to the previous model, no education variables are statistically significant at 10% level. Further similarities between the two models are shown in the age variables. Coefficients associated with household heads that are less than 30 years old (*Age less than 30*) and between 31 to 45 years old (*Between 31 and 45*) categories are statistically significant at 10% level. Household heads in these two categories have a decrease probability of homeownership compared to a household whose head is older than 60. Household head's gender becomes statistically significant at 10% level when income is included. The probability of owning a home increases if the household head is male.

Finally, the income variable (*Income*) is statistically significance at 10% level. For each additional 1,000 Mexican pesos added to the annual salary, the log odds ratio to own a house increases by 0.00000175. The odds ratio for this coefficient is close to 1². An odds ratio coefficient of 1 suggests homeownership is independent from current income.

² If the log odds is equal to 0.00000175, then the odds ratio (exponent of log odds) is 1.00000175, which is close to 1.

Marginal Effects – Significant Variables

Average marginal effects of the model with income are given in Appendix A, Table 9.

Household members enrolled in PROGRESA (*PROGRESA*) or PROCAMPO (*PROCAMPO*) have 7.0% and 15.5% increase probability of being a homeowner compared to households not enrolled in these programs after controlling for the other variables. Households living in the south southeast (*Southsoutheast*), centerwest (*Centerwest*), center (*Center*), and northeast (*Northeast*) states of Mexico have 4.4%, 18.2%, 16.7% and 8.2% decrease probability of being a homeowner compared to households in the northwest states. Household heads that either work in rural activities (*Farmer*), in industrial activities or government, or in commercial activities but are not an owner (*Laborer*), and in commercial activities or industrial owners (*Business*), have 17.9%, 23.5% and 18.8% decrease probability of being a homeowner compared to unpaid workers. Household heads that are less than 30 years old (*Age less than 30*) and household heads between the ages of 31 to 45 (*Between 31 and 45*) have on average 30.2% and 9.4% decrease in probability of being a homeowner compared to household heads who are older than 60 years old. A one thousand Mexican peso change in the total household annual income (*Income*) has on average 0.0000281% increased probability of being a homeowner. Household heads who are male (*Gender*) have on average 6.2% increase in probability of being a homeowner compared to household heads who are female.

Goodness of Fit: Predicted and Actual Outcomes

Correctly and incorrectly classified predictions for both models are given in Appendix A, table 10. For the model without income, 4,158 out of 5,306 observations are correctly classified or 78.4%. Of the 5,306 observations, 898 observations are misclassified as homeownership when the observed classification is non-ownership and 250 are misclassified as non-ownership when the respondent owned a house.

The percentage of correctly specified is slightly less for the model with than without income at 76.83%. Five hundred eighty-one out of 3,319 observations, observations are misclassified as homeownership when the observed classification is non-ownership and 188 of 3,319 observations are misclassified as non-ownership when the observed case is ownership.

A measure of goodness of fit for logit models is the McFadden pseudo R-squared (Wooldridge 2002). For the model without income, the McFadden pseudo R-squared is 0.160, whereas, for the model with income the R-squared is 0.158. The model with income explains slightly less of the total variability in homeownership than the model with income. One must be careful, however, in comparing the two R-squared values because of difference in the number of observations. Wooldridge notes, however, "...goodness of fit is not as important as statistical and economic significance of the explanatory variables" (Wooldridge 2002, p. 465).

Discussion

Similarities and differences exist between the models with and without income. The first similarity between the two models is the non-significant of household shocks. Five

of the six shocks in both models are not statistically significant at the 10% level. Not being significant may indicate the households are effectively cushioning the impact of the shocks. As noted in the literature review, households can use several different strategies to help mitigate the effect of shocks on assets. It appears that the use of strategies such as using savings, borrowing funds, and selling assets are employed to mitigate these shocks on homeownership. Another similarity between the two models are the income subsidies programs, PROCAMPO and PROGRESA. Both PROCAMPO and PROGRESA participation have a significant positive influence on the probability of homeownership. PROCAMPO has the larger effect on homeownership in both models. A third similarity between the models is location; all household locations are negative in both models (*Southsoutheast, Centerwest, Center, Northeast*). The base for household location is northwest region which is near the California and Arizona borders. It is possible that economic activities near California and Arizona are strong enough that households located in the northwest are more willing or able to buy a house.

Education (*Education*) does not show statistically significance relationship with homeownership in either model. Some previous studies indicate education is an important variable. Individuals with higher levels of educational usually attain better jobs with higher incomes. Higher incomes provide individuals funds for down payment and mortgage payments. Unfortunately, the dependent variable recorded in the data set only records whether the household owns their house and not the value of the house. It is possible that homeownership is not linked to education, but the value of house owned is a function of education.

The last similarity between the two models is age. Previous studies suggest younger individuals have a decreased probability of homeownership. Both estimated models confirm this effect. For most people as they grow older wealth increases providing an increased ability to purchase and maintain a house. Finally, another possible cause of why household head age less than 30 years old (*Age less than 30*) and household head age between 31 to 45 years old (*Between 31 and 45*) is mobility. Younger household heads may be more mobile than their older counterparts, therefore, less willing to be homeowners.

As noted, there are several differences between the two models. One difference is the significant of total crop loss (*Crop loss*). Household crop loss is significant and positive in the model without income variable, but is insignificant in the model with income. It is possible that an effect not accounted, such as a subsidy after experiencing a crop loss, is impacting homeownership. This effect may be linked to PROCAMPO (*PROCAMPO*), because the program supports rural production activities.

Marital status variables also differ between the two models. When income is included, marital status variables becomes insignificant. A relationship between marital status and homeownership is not present when income is included. It is possible that a wealth effect associated with marital status is affecting homeownership when income is not included.

Another difference is the occupation variables. Household head whose principal job is in industrial activities or government or in commercial activities but is not an owner (*Laborer*) is the only statistically significant variable and negative when income

is not included. When income is included, all occupation variables are significant and negative. Occupation results are the most unintuitive result because unpaid workers are the base for this group. It is possible that unpaid workers are not receiving a salary according to the law; but they are receiving benefits in kind, such as homeownership. It is possible also that they are acting as homeowners. Arimah (1997), in discussing homeownership in Nigeria, states culture has an influence as they view homeownership. In Nigeria, there are people living in units where they don't own the property but they live and act as homeowners. A second possible explanation is the unpaid workers group also includes retired household heads. The simple correlation between unpaid workers and household head above 60 years old is 0.04. Although small, this correlation between age and unpaid workers is the largest positive correlation between age and the various occupation categories.

Finally, the effect of gender on homeownership differs when income is included. Household head gender (*Gender*) is not significant in the model without income, but it is significant in the model with income. Struyk and Marshall (1974), Arimah (1997), Hood (1999) and Cadena Minotta, Ramos Chalen, and Pazmiño Medina (2010) include gender as a variable, but only Arimah (1997) and Hood (1999) find gender to be statistically significant. It is not clear why gender between the two models differs in significance.

CHAPTER IV

CONCLUSIONS

In our modern society, homeownership is both an individual and society objective, because of the positive neighborhood effects associated with areas of higher homeownership (National Association of Realtors 2012). Because of these positive effects, governments have emphasized homeownership by developing policies to achieve higher rates of homeownership. The Mexican government is no exception with many institutions whose goals are to increase homeownership. Although the Mexican government efforts to increase homeownership in Mexico are enormous, research devoted to analyze the determinants of homeownership in Mexico is sparse. This thesis helps close this gap. At the same time, it is of interest to assess whether there is any effect on homeownership resulting from economic, natural, and social shocks that households' experience. Research into the effects on such shocks on homeownership in Mexico is even sparser.

To analyze the determinants of homeownership in presence of household shocks in Mexico, this research uses data from a national survey of households in Mexico (MxFLS 2002). Based on the random unity model, logit models are estimated which analyze homeownership and non-ownership. Previous studies (Kain and Quigley 1972; Carliner 1974; Struyk and Marshall 1974; Hood 1999; Yates 2000; Fisher and Jaffe 2003; Cadena Minotta, Ramos Chalen, and Pazmiño Medina 2010) suggest socio-demographic characteristics such as marital status, home location, occupation, education,

income, and age help explain homeownership. Besides socio-demographic variables, variables representing shocks and government programs are included in the analyses. Two models are estimated; one without income and the other with income. Income is excluded because of the large number of households that did not report income. Generally, inferences from the two models are similar.

Results show household shocks are generally not statistically significant. According to Carter et al. (2005), households adopt different strategies to mitigate the effect of a shock on a household. Use of savings, borrowing funds, and selling assets are the most common mitigation strategies. It appears Mexican households are not selling their homes as a strategy to cope with shocks. It is possible that borrowing against future earnings, increasing work hours, selling of non-home assets, and reducing consumption are strategies used by Mexican households to cope with shocks. Mexico has well developed financial and labor markets and several income support programs which may help households to cope with such shocks short of selling their homes.

Two income support programs, PROGRESA and PROCAMPO, are statistically significant with participation in these programs increasing the probability of homeownership. These programs may be cushioning the impacts of household shocks helping to prevent a situation where households must sell their homes. In a previous study, Winters, Davis, and Corral (2001) suggest the Mexican household recovery capacity is not only related to financial markets access (formal or informal), but also government program access. It appears by supporting households income, PROGRESA and PROCAMPO are also providing support for homeownership. If the Mexican

government wishes to increase rates of homeownership, a good instrument may be income supports programs such as PROGRESA and PROCAMPO. For whatever reason, PROGRESA seems to have a larger effect on homeownership. The government may look into differences between the programs and structure new programs for increased homeownership based on the PROGRESA program.

Struyk and Marshall (1974) demonstrate in their pioneering work the nature of the relationship between income and homeownership. They find current income does not support homeownership as much as permanent income. Hood (1999) findings on income are similar to Struyk and Marshall (1974). For Mexican homeownership, results of the current study indirectly support the permanent income hypothesis. Current income is statistically significant and positive, but the marginal effects on homeownership are relatively small. This indirectly suggests that households are relying on other income. Unfortunately, the data set does not include any information that could be used as a proxy for permanent income.

Finally, an inference drawn the socioeconomic characteristics pertains to age. Younger household heads have a smaller probability of being a homeowner. It is likely that income, wealth, and mobility are variables interacting with age. As individuals become older, income and wealth generally increase with mobility decreasing. It is postulated that these reasons explain why households with younger heads are less likely to be homeowners than households with older heads. This discussion and results are similar to those results found in Hood (1999).

Limitations and Future Research

The principal limitation in the present research is data limitations. Household income is reported only by 62.5% of the households in the data set. By dropping observations that do not report income, the usable sample may be biased making the estimated coefficients biased and inconsistent. Moreover, Mexican households' data comes from a 2002 survey. Availability of more recent data may make the results more useful for policy implications. Further, no information was contained in the dataset that would allow for a permanent income variable or proxy. Another issue is the potential endogeneity between income and the various government programs. Future studies should consider endogeneity in their model development and estimation. Along these lines, testing for the appropriate model (with or without) income should be considered. In the current study, all possible observations were used for each model. Testing model specification would most likely require the same number of observations for each model.

Another limitation in dataset is that the dataset only records if the household owns a house or not, but does not record the value of the house, and when and how the house was bought. Some of the socio-demographic variables may not be significant in explaining homeownership, but may help explain the value of homes households buy. For example, higher the household head's education level, generally, the larger the household's income. Households with higher incomes may purchase more valuable houses. Similar effects may be seen with some of the other insignificant variables. Examining determinants of value of house purchased may be a fruitful future avenue of research for the Mexican housing market.

When and how the house was bought may help explain why households are more or less likely to be homeowners or not. For example, if the household faces a shock and wants to sell its house, but the household home is purchased through INFONAVIT or FOVISSTE, then the household faces a greater transaction cost than a house purchase through a bank. Higher transaction cost would influence homeownership because household are less likely to sell its home when faces a shock.

MxFLS also does not record if the household has sold or bought houses. A household may have sold its house in response to a shock in the five years previous to the 2002 MxFLS, but quickly recovered from the shock such that the household was able to purchase a house. In the data, such a household is recorded as a homeowner. The house was used as an asset to cope with the shock. However, this situation would be less common than borrowing or take another job.

Location is often cited as a determinant of homeownership. Many previous studies show location is important when comparing urban versus rural homeownership (Carliner 1974; Fisher and Jaffe 2003; Cadena, Ramos Chalen and Pazmino 2010). Location can also indicate the neighborhood a house is located which may impact homeownership rates and values (Rohe and Stewart 1996). In the present research, location is based on regional location of the household responding to the survey. Compared to the northwest region, all other regions in Mexico have a lower probability of owning a house. Research into why there is such a regional division may provide insights for policy purposes. Future research should include an urban versus rural

perspective, in addition to, the regional division. Unfortunately, the available data did not include if the households are urban or rural.

Younger single household heads are less likely to be homeowners. Mobility is a factor not traceable in the data and limits homeownership results. Mobility is related to age, marital status, and unemployment. Yates (2000) reveals homeowners are more likely to change their location if the household head loses his or her job.

Private transfers within Mexican households are not included here, but are important to consider in future studies. Private transfers may increase homeownership rates and cushion the impact of shocks. Mexico has a large tradition of private transfers. Not only because there are transfers or remittances from U.S., but intergenerational transfers exist within Mexican households. It is common in Mexico for parents to help their sons and daughters when they want to purchase a house or when they face economic shocks.

Availability of updated data from the subsequent surveys provides an opportunity to exploit more sophisticated models. Future studies could be based on econometric models such as pooled cross sectional models or panel data models. Further, comparing homeownership at the different points in time may provide information on structural changes in the Mexican housing market. The recent global recession may have an effect on homeownership which needs to be examined. More recent data may also be more relevant for policy recommendations.

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APPENDIX A

Table 1. Description of Variables Used in the Models

Variable Name	Description
1	Homeowner The household place is owned by a household member. If it is, then house=1, otherwise=0.
<i>Household Shocks</i>	
2	Death in family The death of a household member. This is an event that have affected home causing economic damage over the past 5 years. Binary variable recorded as the event=1, otherwise=0.
3	Illness/accident A serious illness or accident of a household member that require hospitalization. This is an event that have affected home causing economic damage over the past 5 years. Binary variable, the event was recorded as 1, otherwise 0.
4	Unemployed Unemployment or business failure of a household member. This is an event that have affected home causing economic damage over the past 5 years. Binary variable, the event was recorded as 1, otherwise 0.
5	Home loss Loss of home or business due to an earthquake, flood or other natural disaster. This is an event that have affected home causing economic damage over the past 5 years. Binary variable, the event was recorded as 1, otherwise 0.
6	Crop loss Total crop loss. This is an event that have affected home causing economic damage over the past 5 years. Binary variable, the event was recorded as 1, otherwise 0.
7	Loss of livestock The loss, theft or death of animals' production (horses, oxen, etc.). This is an event that have affected home causing economic damage over the past 5 years. Binary variable, the event was recorded as 1, otherwise 0.
<i>Governmental Programs</i>	
8	PROGRESA PROGRESA (The Education, Health, and Nutrition Program of Mexico) is a government social assistance program in Mexico created in 1997. This is a different source of the

principal income that the household has received during the last 12 months. Binary variable recorded as received=1, not received=0.

- 9 PROCAMPO PROCAMPO (The Program of Direct Rural Support) is a government social assistance program to rural producers in Mexico created in 1993. This is a different source of the principal income that the household has received during the last 12 months. Binary variable recorded as received=1, not received=0.
- 10 SME FUND The Support Fund for Small and Medium Enterprise (SME FUND) is an instrument that seeks to support small companies and entrepreneurs. This is a different source of the principal income that the household has received during the last 12 months. Binary variable recorded as received=1, not received=0.
- 11 Other govt. This variable is built because there are subsidies received by the household which are different from the following government programs: VIVAH; Credit to the Word; Joint Social Investment; PET; Alliance for the Countryside; FONAES and the programs described above. This is a different source of the principal income that the household has received during the last 12 months. Binary variable recorded as received=1, not received=0.

Marital Status

- 12 Free union Household head couple living in a free union. Binary variable recorded as living=1, or not living=0.
- 13 Legally separated Household head couple living separated but not divorced. Binary variable recorded as living=1, or not living=0.
- 14 Divorced Household head divorced. Binary variable recorded as divorced=1, or non-divorced=0.
- 15 Married Household head married. Binary variable recorded as married=1, not married=0.
- 16 Single Household head single. Binary variable recorded as single=1, non-single=0.

17 Widow/widower Household head widow or widower. Category base.

Regional Location

18 Southsoutheast Household located in the south southeast region in Mexico. Binary variable recorded as located=1, not located=0.

19 Centerwest Household located in the centerwest region in Mexico. Binary variable recorded as located=1, not located=0.

21 Center Household located in the center region in Mexico. Binary variable recorded as located=1, not located=0.

22 Northeast Household located in the northeast region in Mexico. Binary variable recorded as located=1, not located=0.

23 Northwest Household located in the northwest region in Mexico. Category base.

Occupation

24 Farmer Household head principal job is in rural activities. Binary variable recorded as farmer=1, not farmer=0.

25 Laborer Household head principal job is in industrial activities or government, or in commercial activities but is not an owner. Binary variable recorded as laborer=1, not laborer=0.

26 Business Household head principal job is in commercial activities or industrial owners. Binary variable recorded as businessman=1, not businessman=0.

27 Unpaid Household head principal job does not receive a salary.

Education

28 Less than high school Household head education. If the household head has a formal education less than high school or high school, the variable is recorded as 1, otherwise is 0.

29 More than high school Household head education. If the household head has a formal education beyond high school, the variable is recorded as 1, otherwise is 0.

30 No formal education Household head does not have formal education. Category base.

Age

31 Age less than 30 Household head age. If the household head is less than 30 then the variable is recorded as 1, otherwise is 0.

32 Between 31 and 45 Household head age. If the household head is between 31 to 45 years old then the variable is recorded as 1, otherwise is 0.

33 Between 46 and 60 Household head age. If the household head is between 46 to 60 years old then the variable is recorded as 1, otherwise is 0.

34 Older than 60 Household head age beyond 60. Category base.

Other

35 Gender Household head gender. Binary variable recorded as male=1, female=0.

36 Income Total household main annual salary. This is a continuous variable recorded in thousands of Mexican pesos.

Table 2. Variables Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
<i>Household Shocks</i>				
Death in family	0.081	0.272	0	1
Illness/accident	0.121	0.326	0	1
Unemployed	0.073	0.261	0	1
Home loss	0.015	0.120	0	1
Crop loss	0.060	0.238	0	1
Loss of livestock	0.022	0.145	0	1
<i>Governmental Programs</i>				
PROGRESA	0.153	0.360	0	1
PROCAMPO	0.090	0.287	0	1
SME FUND	0.001	0.034	0	1
Other govt.	0.013	0.111	0	1
<i>Marital Status</i>				
Free union	0.129	0.335	0	1
Divorced	0.017	0.131	0	1
Legally separated	0.049	0.217	0	1
Married	0.705	0.456	0	1
Single	0.051	0.220	0	1
Widow/widower	0.048	0.213	0	1
<i>Regional Location</i>				
Southsoutheast	0.213	0.410	0	1
Centerwest	0.186	0.389	0	1
Center	0.202	0.402	0	1
Northeast	0.195	0.396	0	1
Northwest	0.204	0.403	0	1
<i>Occupation</i>				
Farmer	0.218	0.413	0	1
Laborer	0.500	0.500	0	1
Business	0.255	0.436	0	1
Unpaid	0.027	0.161	0	1
<i>Education</i>				
More than high school	0.103	0.304	0	1
Less than high school	0.786	0.410	0	1
No formal education	0.112	0.315	0	1
<i>Age</i>				
Age less than 30	0.163	0.369	0	1
Between 31 and 45	0.419	0.494	0	1
Between 46 and 60	0.292	0.455	0	1

Other

Gender	0.871	0.336	0	1
Income	44,985	58,647	3	889,974
Homeowner	0.756	0.429	0	1

Table 3. Homeownership in the Mexican Family Life Survey 2002

Variable Name	Number of Observations	Percent
Homeownership	4,013	75.63
Non- homeownership	1,293	24.37
Total	5,306	100.00

Table 4. Regions in Mexico by States According to the Mexican National Program of Development, 2000-2006.

Category	States
Southsoutheast	Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, Yucatán
Centerwest	Aguascalientes, Colima, Guanajuato, Jalisco, Michoacán, Nayarit, San Luis Potosí, Zacatecas
Center	Distrito Federal, Estado de México, Hidalgo, Morelos, Puebla, Querétaro, Tlaxcala
Northwest	Baja California, Baja California Sur, Sinaloa, Sonora
Northeast	Chihuahua, Coahuila, Durango, Nuevo León, Tamaulipas

Table 5. Shocks Experienced by Homeownership Mexican Households in the Mexican Family Life Survey 2002.

Categories	Household Non-Homeowners		Household Homeowners		All Households	
Death of a household member	85	1.60%	342	6.45%	427	8.05%
Serious illness or accident of a household member.	146	2.75%	497	9.37%	643	12.12%
Unemployment or business failure of a household member	115	2.17%	274	5.16%	389	7.33%
Loss of home or business due to an earthquake, flood or other natural disaster.	12	0.23%	65	1.23%	77	1.45%
Total crop loss	25	0.47%	294	5.54%	319	6.01%
Loss, theft or death of animals for agriculture production	14	0.26%	100	1.88%	114	2.15%

Table 6. Model without Income: Regression Results (Number of Observations = 5,306)

Variable Name	Coefficient	Standard Error	P value
<i>Household Shocks</i>			
Death in family	0.190	0.139	0.174
Illness/accident	0.118	0.113	0.298
Unemployed	-0.178	0.131	0.172
Home loss	-0.006	0.343	0.987
Crop loss	0.492*	0.235	0.037
Loss of livestock	0.191	0.316	0.546
<i>Governmental Programs</i>			
PROGRESA	0.337*	0.117	0.004
PROCAMPO	1.033*	0.244	0.000
SME FUND	0.163	1.158	0.888
Other govt.	-0.053	0.340	0.876
<i>Marital Status¹</i>			
Free union	-0.794*	0.242	0.001
Divorced	-0.332	0.322	0.302
Legally separated	-0.764*	0.242	0.002
Married	-0.030	0.230	0.895
Single	-0.618*	0.246	0.012
<i>Regional Location²</i>			
Southsoutheast	-0.204**	0.120	0.089
Centerwest	-0.981*	0.118	0.000
Center	-0.924*	0.114	0.000
Northeast	-0.412*	0.118	0.000
<i>Occupation³</i>			
Farmer	0.007	0.261	0.978
Laborer	-0.428**	0.246	0.082
Business	-0.128	0.252	0.612
<i>Education⁴</i>			
More than high school	-0.042	0.177	0.813
Less than high school	-0.062	0.141	0.658
<i>Age⁵</i>			
Age less than 30	-1.929*	0.160	0.000
Between 31 and 45	-0.717*	0.150	0.000
Between 46 and 60	0.121	0.158	0.443
Gender	0.186	0.143	0.193
Constant	2.286*	0.389	0.000

Notes: 1) The base for this group is household head widow or widower.
2) The base for this group is household located in the northwest region.
3) The base for this group is unpaid workers.
4) The base for this group is household head that no formal education.
5) The base for this group is the age group of older than 60.

Table 7. Model without Income: Average Marginal Effects

Variable Name	Coefficient	Standard Error	P value
<i>Household Shocks</i>			
Death in family	0.028	.0199	0.160
Illness/accident	0.018	.0166	0.290
Unemployed	-0.028	.021	0.184
Home loss	-8.8 exp -04	.052	0.987
Crop loss	0.068*	.029	0.020
Loss of livestock	0.028	.045	0.531
<i>Governmental Programs</i>			
PROGRESA	0.049*	.016	0.002
PROCAMPO	0.129*	.024	0.000
SME FUND	0.024	.165	0.885
Other govt.	-0.008	.053	0.877
<i>Marital Status¹</i>			
Free union	-0.134*	0.045	0.003
Divorced	-0.053	0.055	0.331
Legally separated	-0.130*	0.045	0.004
Married	-0.005	0.036	0.898
Single	-0.103*	0.045	0.023
<i>Regional Location²</i>			
Southsoutheast	-0.032**	.019	0.095
Centerwest	-0.164*	.021	0.000
Center	-0.153*	.020	0.000
Northeast	-0.065*	.019	0.001
<i>Occupation³</i>			
Farmer	0.001	.040	0.978
Laborer	-0.065**	.038	0.082
Business	-0.020	.039	0.616
<i>Education⁴</i>			
More than high school	-6.4 exp -04	.027	0.814
Less than high school	-0.009	.021	0.656
<i>Age⁵</i>			
Age less than 30	-0.368*	.031	0.000
Between 31 and 45	-0.106*	.022	0.000
Between 46 and 60	0.018	.024	0.439
Gender	0.029	.023	0.204

Notes: Marginal effects for factor levels are the discrete change from the base level.

1) The base for this group is household head widow or widower.

2) The base for this group is household located in the northwest region.

3) The base for this group is unpaid workers.

4) The base for this group is household head has no formal education.

5) The base for this group is the age group of older than 60.

Table 8. Model with Income: Regression Results (Number of Observations = 3,319)

Variable Name	Coefficient	Standard Error	P value
<i>Household Shocks</i>			
Death in family	0.057	0.166	0.730
Illness/accident	0.131	0.137	0.340
Unemployed	-0.224	0.155	0.148
Home loss	0.132	0.453	0.772
Crop loss	0.461	0.328	0.160
Loss of livestock	0.295	0.478	0.537
<i>Governmental Programs</i>			
PROGRESA	0.438*	0.159	0.006
PROCAMPO	0.963**	0.394	0.014
SME FUND	-0.509	2.061	0.805
Other govt.	-0.089	0.410	0.829
<i>Marital Status¹</i>			
Free union	-0.592	0.388	0.127
Divorced	-0.385	0.384	0.316
Legally separated	0.426	0.443	0.337
Married	0.154	0.378	0.684
Single	-0.398	0.383	0.299
<i>Regional Location²</i>			
Southsoutheast	-0.271**	0.147	0.066
Centerwest	-1.132*	0.147	0.000
Center	-1.041*	0.139	0.000
Northeast	-0.507*	0.141	0.000
<i>Occupation³</i>			
Farmer	-1.111**	0.643	0.084
Laborer	-1.466*	0.631	0.020
Business	-1.169**	0.643	0.069
<i>Education⁴</i>			
More than high school	-0.014	0.227	0.952
Less than high school	0.055	0.184	0.766
<i>Age⁵</i>			
Age less than 30	-1.881*	0.220	0.000
Between 31 and 45	-0.583*	0.209	0.005
Between 46 and 60	0.304	0.217	0.161
Income	1.75exp[-06]*	8.49exp[-07]	0.039
Gender	0.385*	0.186	0.038
Constant	3.068*	0.754	0.000

- Notes:
- 1) The base for this group is household head widow or widower.
 - 2) The base for this group is household located in the northwest region.
 - 3) The base for this group is unpaid workers.
 - 4) The base for this group is household head has no formal education.
 - 5) The base for this group is the age group of older than 60.

Table 9. Model with Income: Average Marginal Effects

Variable Name	Coefficient	Standard Error	P value
<i>Household Shocks</i>			
Death in family	0.009	0.027	0.730
Illness/accident	0.021	0.022	0.340
Unemployed	-0.036	0.025	0.148
Home loss	0.021	0.073	0.772
Crop loss	0.074	0.053	0.160
Loss of livestock	0.047	0.077	0.537
<i>Governmental Programs</i>			
PROGRESA	0.070*	0.025	0.006
PROCAMPO	0.155**	0.063	0.014
SME FUND	-0.082	0.331	0.805
Other govt.	-0.014	0.066	0.829
<i>Marital Status¹</i>			
Free union	-0.095	0.062	0.127
Divorced	-0.062	0.062	0.316
Legally separated	0.068	0.071	0.337
Married	0.025	0.061	0.684
Single	-0.064	0.061	0.299
<i>Regional Location²</i>			
Southsoutheast	-0.044**	0.024	0.066
Centerwest	-0.182*	0.023	0.000
Center	-0.167*	0.022	0.000
Northeast	-0.082*	0.023	0.000
<i>Occupation³</i>			
Farmer	-0.179**	0.103	0.084
Laborer	-0.235*	0.101	0.020
Business	-0.188**	0.103	0.069
<i>Education⁴</i>			
More than high school	-0.002	0.037	0.952
Less than high school	0.009	0.029	0.766
<i>Age⁵</i>			
Age less than 30	-0.302*	0.034	0.000
Between 31 and 45	-0.094*	0.034	0.005
Between 46 and 60	0.049	0.035	0.161
Income	2.81e-07*	1.36e-07	0.039
Gender	0.062*	.030	0.039

Notes: Marginal effects for factor levels are the discrete change from the base level.

1) The base for this group is household head widow or widower.

2) The base for this group is household located in the northwest region.

3) The base for this group is unpaid workers.

4) The base for this group is household head has no receive any kind of formal education.

5) The base for this group is the age group of older than 60.

Table 10. Goodness of Fit and Prediction

Classified	Actual Outcome				Total
	Homeownership		Non-homeownership		
Model without Income					
Homeownership	3,763	70.92%	898	16.92%	4,661
Non-homeownership	250	4.71%	395	7.44%	645
Total		4,013		1,293	5,306
Model with Income					
Homeownership	2,234	67.31%	581	17.51%	2,815
Non-homeownership	188	5.66%	316	9.52%	504
Total		2,422		897	3,319

APPENDIX B



Figure 1. Location of States in Mexico.