

Chapter 2

Determinants of the Recent Poverty Increase and Household Vulnerability in Rural Mexico

Abstract This chapter focuses on the poverty increase in Mexico that is clearly observed from 2006 to date after the country achieved a *sustainable* poverty decline during the 2000s for the first time since the lost decades of the 1980s and 1990s. In particular, it examines the impoverishment of the most marginalized rural localities, and conducts empirical analyses from the perspective of *household vulnerability* using household survey panel data for 2003 and 2007. In addition, this study applies a probit model to identify the characteristics and determinants of poverty, and the vulnerability of rural households in terms of both the *impoverishment of non-poor households* and *emergence from poverty of poor households*. The regression results indicate that the households susceptible to falling into poverty and vulnerability were those who were indigenous, with a migrant member, engaged in agriculture, without self-consumption for 2007, or access to credit. Meanwhile, households with highly educated household heads, and those with access to non-agricultural or wage income (especially in 2007) are likely to have resiliency to impoverishment. In addition, the study focuses on the relationship between household vulnerability (impoverishment) and the marked de-agriculturalization observed over the same period. The regression results imply that vulnerability may be mitigated in cases where wage income is secured after household members quit agricultural activities. However, the mitigating effects are not observed in cases where households relied on migration, remittances, or self-employment.

2.1 Introduction

From the year 2000 until the 2008 global economic crisis, Mexico demonstrated stable growth for the first time after the so-called lost decades of 1980s–90s as discussed in Chap. 1. During much of this period, the poverty ratio was in a continuous downward trend. However, it rose again from 2006. Several studies link this poverty increase with a rise in domestic food prices due to soaring global grain

prices at the beginning of 2006 (Attanasio et al. 2009, Wood et al. 2009, Valero-Gil and Valero 2008). This implies that from 2000 onwards, a considerable number of individuals who had emerged from poverty became impoverished once again as a result of certain shocks, suggesting the presence of a so-called *vulnerable* class.

According to the World Bank (2000), *poverty* refers to *pronounced deprivation in wellbeing*, with the simplest and most straightforward indicator being to compare individuals' consumption or income to the *poverty line*. The most widely used poverty lines are the World Bank's \$1.90 purchasing power parity (PPP) line and \$3.10 (PPP) line.¹ These international indicators are useful in cross-country comparison; however, they likely fail to accurately reflect the poverty conditions of a specific country. As a result, many countries have recently established their own poverty lines.

On the other hand, a new concept closely related to poverty is *vulnerability* (World Bank 2000). While the definition of vulnerability has not yet been sufficiently determined, and its use differs between researchers, in general, it is defined as the *probability of falling into poverty at some point in the future*. Thus, even non-poor individuals at present are considered *vulnerable* if the probability exists that they may fall into poverty in the future. Therefore, whereas *poverty* is a static concept representing a condition at a particular point in time, *vulnerability* is a dynamic concept encapsulating changes between different points in time.

Based on the foregoing, this chapter will elucidate the characteristics of the poverty increase mentioned above, in addition to its determinants from the perspective of *household vulnerability* using panel data from the most recent Mexican rural household surveys available. The remainder of the chapter is organized as follows. Section 2.2 provides an overview of the poverty trends in the sampled localities of the panel data. These localities consist of Mexico's most marginalized regions. Section 2.3 presents the empirical analyses using probit models, which examine the type of characteristics possessed by vulnerable households to reveal which households are more susceptible to impoverishment. Finally, Sect. 2.4 concludes the chapter.

2.2 Observations of Rural Poverty and Vulnerability in the Poorest Regions from the Sample Survey

2.2.1 Data

This study uses the two most recent years available (2003 and 2007) of the rural household panel data (*Encuestas de Evaluación de los Hogares: ENCEL*), which samples 657 villages from among the most marginalized localities in seven

¹See the discussions in Chap. 1 for the details of the World Bank's international poverty lines.

Mexican states (Guerrero, Hidalgo, Michoacán, Puebla, Querétaro, and San Luis Potosí). The series of surveys are designed and conducted periodically by the Social Development Secretary (*Secretaría de Desarrollo Social: SEDESOL*) with the assistance of the International Food Policy Research Institute (IFPRI) for the purpose of the external evaluation of the PROGRESA-Oportunidades program. The surveys have rich information on not only CCT-related topics but also multi-dimensional household characteristics ranging from disaggregated surveys on income and consumption, assets, employment, education, and health to surveys on migration, credit access, and social capital. This is why the ENCEL dataset is also very useful not only for the evaluation of the CCT program but also for multi-level analyses of rural households in general, as will be shown in this chapter. Taking this as a comprehensive rural household survey of the most marginal areas in Mexico, I focus on the general characteristics of rural household vulnerability in this chapter. The effects of the CCT program on poverty and vulnerability will be discussed mainly in the following chapters. ENCEL (2003) consists of 33,887 households and 205,206 individuals, of which 25,899 households and 176,809 individuals remained for ENCEL (2007). I use 17,603 households for the estimation after dropping samples whose consumption data were nil or incomplete.²

2.2.2 Observations of Rural Poverty

In this section, I use the Foster-Greer-Thorbecke (FGT) indices (Foster et al. 1984) to calculate the poverty ratio, poverty gap, and squared poverty gap based on per capita real household consumption,³ which is calculated as the sum of weekly food consumption and daily commodities. The FGT indices are defined as

$$P_{\alpha} = \frac{1}{n} \sum_{i=1}^q \left(1 - \frac{c_{it}}{z} \right)^{\alpha}, \quad (2.1)$$

where q represents the total number of individuals, each identified by i , and whose consumption, c_{it} , at time t is below the poverty line, z . n represents the total population. When $\alpha = 0, 1$, and 2 , P_0, P_1 , and P_2 represent the poverty headcount, poverty gap, and squared poverty gap ratios, respectively. In addition, this study

²A unique characteristic of the ENCEL is that the randomized experiment was implemented at the beginning of the program to evaluate the effects of the program accurately. The details of this randomization and utilization of the data are discussed in Chap. 1.

³The information how the consumption variable are calculated is available upon request. Consumption for each year is deflated by the annual CPI.

Table 2.1 FGT indices, 2003 and 2007

Indices	2003	2007
Poverty headcount ratio	0.87	0.91
Poverty gap ratio	0.46	0.52
Squared poverty gap ratio	0.28	0.35
Sample size	16,678	16,678

Source Author's calculation based on ENCEL (2003, 2007)

uses the rural food basket (*canasta básica alimentaria rural*)⁴ as the poverty line, which represents the lowest threshold in Mexico.⁵

According to Table 2.1, not only does the poverty ratio increase from 87 to 91% from 2003 to 2007, but we also see that both the poverty gap (from 0.46 to 0.52), which represents the “depth” of poverty, and squared poverty gap (from 0.28 to 0.35), which represents the “severity” of poverty, have worsened. The ratio of poor households is significantly higher here than in the statistics shown in Chap. 1, such as Table 1.4 and Figs. 1.7, 1.8 and 1.9, because only the most marginalized regions in Mexico were sampled in the household survey panel data.

Furthermore, in order to confirm that the poverty increase has worsened in the rural villages in the survey, I depict the cumulative distribution graph in Fig. 2.1, with the log of per capita real consumption in ascending order on the horizontal axis, and the cumulative % on the vertical axis. As shown, the three vertical lines represent the rural food basket (poverty line 1), the 75% line of the rural food basket (poverty line 2), and the 50% line of the rural food basket (poverty line 3). Since the real consumption for 2007 is higher than that of 2003 at any point on the graph, stochastic dominance is exhibited. In other words, we can confirm that for any level, the real consumption for 2007 falls below that of 2003 (that poverty unquestionably worsened).

2.2.3 Vulnerability of Rural Households

One method of measuring household vulnerability is with a transition matrix (see Table 2.2). Here, I used three types of poverty lines, taking into account the high ratio of extremely poor households displayed in Table 2.1. They are the same as poverty lines 1, 2, and 3 (rural food basket, rural food basket $\times 0.75$, and rural food

⁴The food basket corresponds to 23.27 pesos per capita per day (as of June 2011), which is equivalent to US\$2 according to the exchange rate of the same period. See CONEVAL (2011) for details.

⁵There are three national poverty lines: the food poverty line (*Pobreza alimentaria*, the level that covers the minimum food basket); the human capital poverty line (*Pobreza de capacidades*, the level that covers the minimum necessary expenditures for food basket, education, and healthcare); and the asset poverty line (*Pobreza de patrimonio*, the human poverty line plus the minimum expenditures pertaining to clothing, housing, and transportation) (CONEVAL 2011).

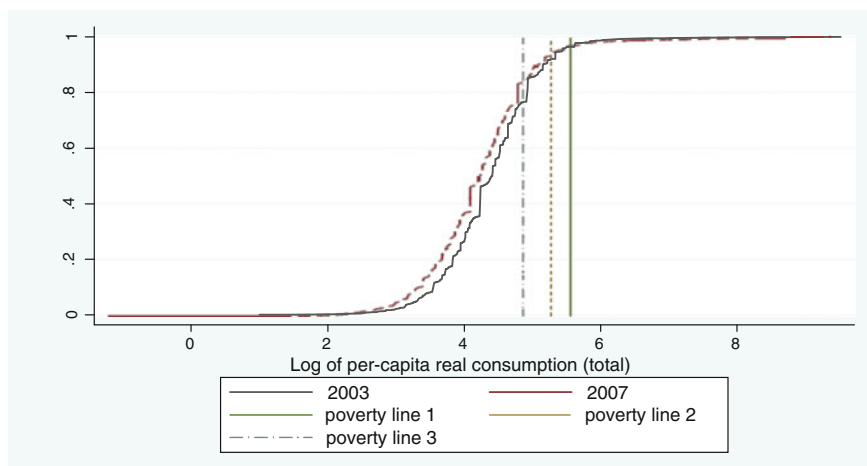


Fig. 2.1 Stochastic dominance (Cumulative distribution of per-capita consumption). *Source* Author's calculation based on ENCEL (2003, 2007)

basket $\times 0.5$), respectively, from Fig. 2.1. Based on the per capita real total consumption of each household, for each survey period, households are classified as being *non-poor* if they exceed the poverty line, and as *poor* when falling below it. Using the panel data enables us to follow the same households over multiple periods, allowing for the following classifications (Kurosaki 2009).

- *Always poor*: households that are poor for all the sample periods.
- *Always non-poor*: households that are non-poor for all the sample periods.
- *Temporarily poor*: households that have fallen into poverty at least once during the sample period.

Table 2.2A shows that, using the *rural food basket* as the poverty line, 81% are classified as *always poor*, 3.4% *always non-poor*, and 15.5% ($9.5 + 6.0\%$) *temporarily poor*. Taking into consideration that temporarily poor households are non-poor at times, but may potentially fall into poverty during other times, those households will be defined as *vulnerable* to poverty hereafter in this paper. When lowering the poverty line in Table 2.2B ($\times 0.75$ line), the breakdown of households becomes 67.5% *always poor*, 8.3% *always non-poor*, and 24% *temporarily poor*. In Table 2.2C ($\times 0.5$ line), the results are 38, 28, and 34%, respectively. We can see that under each threshold, there is a significant % of vulnerable households oscillating around the poverty line. This tendency becomes more notable as the poverty line is lowered. This suggests that the presence of *vulnerable* households, which cannot be identified through static analyses, should not be ignored when discussing poverty issues.

Table 2.2 Transition matrix

A. Poverty line: Rural food basket ×1				
		2007		
		Non-poor	Poor	Total
2003	Non-poor	562	1579	2141
		3.4%	9.5%	12.8%
	Poor	1004	13,533	14,537
		6.0%	81.1%	87.2%
	Total	1566	15,112	16,678
		9.4%	90.6%	100.0%
B. Poverty line: Rural food basket ×0.75				
		2007		
		Non-poor	Poor	Total
2003	Non-poor	1390	2699	4089
		8.3%	16.2%	24.5%
	Poor	1324	11,265	12,589
		7.9%	67.5%	75.5%
	Total	2714	13,964	16,678
		16.3%	83.7%	100.0%
C. Poverty line: Rural food basket ×0.5				
		2007		
		Non-poor	Poor	Total
2003	Non-poor	4620	3777	8397
		27.7%	22.6%	50.3%
	Poor	1898	6383	8281
		11.4%	38.3%	49.7%
	Total	6518	10,160	16,678
		39.1%	60.9%	100.0%

Note Upper cells represent the number of households

Source Author’s calculations based on ENCEL (2003, 2007)

2.3 Empirical Analysis

2.3.1 Model

In this chapter, I conduct regression analyses using the probit model. The explanatory variable in Eq. 2.2 is binary, taking a value of 1 with probability p , and a value of 0 with a probability of $1 - p$.

$$y = \begin{cases} 1 & \text{with probability } p \\ 0 & \text{with probability } 1 - p \end{cases} \tag{2.2}$$

In this case, the regression equation is expressed as follows:

$$p_i \equiv \Pr[y_i = 1 | \mathbf{x}] = F(\mathbf{x}_i' \boldsymbol{\beta}) \quad (2.3)$$

The probit model assumes that $F(\cdot)$ is a cumulative density function of a standard normal distribution. $\mathbf{x}$ is the k vector of explanatory variables, and $\boldsymbol{\beta}$ is the vector of parameters to be estimated.

2.3.2 Regression Analysis and Results

For the regression analysis, I use two types of dependent variable y to estimate the probit model. The first estimation uses the group of households that had been non-poor in 2003. Those which fell into poverty in 2007 are denominated as the *impoverished households* ($y = 1$), while those that remained non-poor are expressed as $y = 0$ (this estimation is hereinafter referred to as the *impoverished household model*). The second estimation uses the group of households that had been classified as poor in 2003. Those that became non-poor in 2007 are denominated as the *improved households* ($y = 1$), while those that remained poor in 2007 are expressed as $y = 0$ (this estimation is hereinafter referred to as the *improved household model*). An illustration of the estimation methods is shown in Fig. 2.2.⁶

The dependent variables of these two models were created based on the per-capita total consumption used in Tables 2.1 and 2.2 and the poverty lines used in Table 2.2: the rural food basket $\times 1$, the rural food basket $\times 0.75$, and the rural food basket $\times 0.5$.

For the explanatory variables $\mathbf{x}$, I used the characteristics of the household head (education level, sex, age, marital status, ethnicity); variables that are supposed to affect household consumption behavior, such as the number of household members, presence of migrant members and remittances, receipt of conditional cash transfer (CCT) benefits, a land cultivation dummy, self-consumption, savings and debt,⁷ and

⁶Ideally, the selection into the initial poverty or non-poverty status should be endogenously determined by the household observable and unobservable characteristics, which may influence the results of the probit models (Imai and You 2014). However, for simplicity it is assumed here that the initial poverty status is exogenously determined.

⁷Ideally, *presence of migrant members* and/or *remittances* should be treated as endogenous variables, for instance, because the change in poverty status would facilitate migration through improved nutrition. However, because of the data limitations, these variables will be treated as exogenous in the model. The endogeneity concern may also be raised for *savings and debt*, as poverty status could influence the household capacity or incentives to save or borrow. However, this is also treated as exogenous for simplicity. CCT status can be considered random or exogenous due to the experimental design.

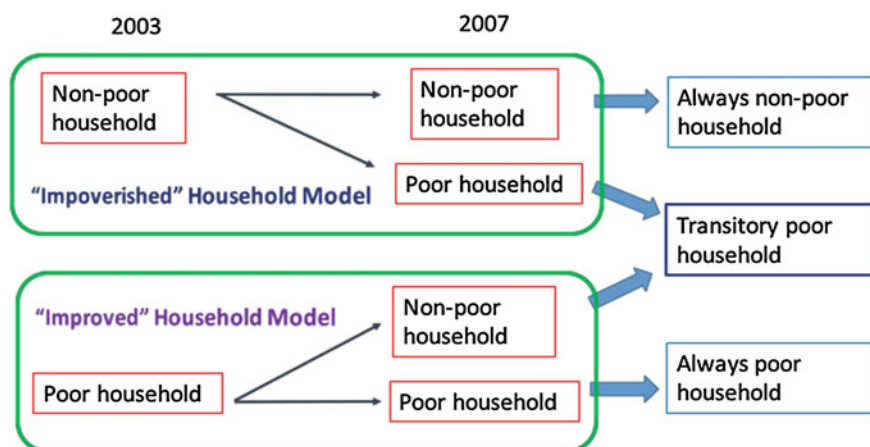


Fig. 2.2 Illustration of the estimation models. *Source* Author's elaboration

non-agricultural sales (proxied by wage labor and self-employment⁸); and changes in the real price of tortillas (staple food) at the village level to control for the effects of increasing food prices observed during the period.⁹

2.3.2.1 Summary Statistics

Table 2.3 presents summary statistics of the variables used in the regression analyses. The number of observations for the *impoverished* and *improved* households corresponds to the number of households that were classified as non-poor and poor in the base year (2003), respectively. In 2007, 73.8, 66.0, and 45.0% of non-poor households fell into poverty, respectively, according to the three different poverty lines, and likewise, 6.9, 10.5, 22.9% of poor households emerged from poverty, respectively. Households in either the *impoverished* or *improved* subsamples are regarded as *temporarily poor* and are the main focus of study in this chapter. The table clearly shows that the sample households suffered from impoverishment in the period.

With respect to household characteristics in the base year (2003), 63.7% of household heads had a primary education, while 9.6% had a secondary education

⁸As question items regarding non-agricultural income exist only in the 2007 survey, wage income (including day laborers) and self-employment (non-agricultural), which were comparable for both years, were used as proxies for the existence of non-agricultural income. According to the sample, 70% of households with non-agricultural activities were engaged in wage labor in 2007.

⁹Refer to Appendix 4.1 of Chap. 4 for the details of how these variables were created and the summary statistics of these variables.

Table 2.3 Summary statistics (All sample)

Variables	Obs	Mean	Std.	Min.	Max.
<Dependent variables>					
“Impoverished” households (food basket $\times 1$)	2141	0.738	0.440	0	1
“Impoverished” households (food basket $\times 0.75$)	4089	0.660	0.474	0	1
“Impoverished” households (food basket $\times 0.5$)	8397	0.450	0.498	0	1
“Improved” households (food basket $\times 1$)	14,537	0.069	0.254	0	1
“Improved” households (food basket $\times 0.75$)	12,589	0.105	0.307	0	1
“Improved” households (food basket $\times 0.5$)	8281	0.229	0.420	0	1
<Independent variables>					
Initial consumption level (log)	16,675	4.382	0.690	0.998	9.515
Primary03*	16,635	0.637	0.481	0	1
Secondary03*	16,635	0.096	0.295	0	1
High school03*	16,635	0.013	0.113	0	1
Technical school03*	16,635	0.007	0.086	0	1
University03*	16,635	0.003	0.057	0	1
Number of HH Members03	16,678	5.140	2.371	1	19
Female03*	16,669	0.124	0.329	0	1
Age03	16,665	46.597	15.347	2	98
Married03*	16,677	0.856	0.351	0	1
Indigenous03*	16,666	0.294	0.455	0	1
CCT03*	16,678	0.528	0.499	0	1
CCT07*	16,678	0.687	0.464	0	1
Remittances03*	16,678	0.193	0.395	0	1
Remittances07*	16,676	0.138	0.345	0	1
Migrant03*	16,678	0.326	0.469	0	1
Migrant07*	16,676	0.270	0.444	0	1
Land cultivation03*	16,668	0.594	0.491	0	1
Land cultivation07*	16,668	0.181	0.385	0	1
Self-consumption03*	16,678	0.060	0.238	0	1
Self-consumption07*	16,678	0.078	0.268	0	1
Savings03*	16,668	0.036	0.187	0	1
Savings07*	16,668	0.025	0.155	0	1
Debts03*	16,668	0.122	0.328	0	1
Debts07*	16,668	0.067	0.250	0	1
Wage Income03*	16,668	0.488	0.500	0	1
Wage Income07*	16,668	0.458	0.498	0	1

(continued)

Table 2.3 (continued)

Variables	Obs	Mean	Std.	Min.	Max.
Self-employment03*	16,668	0.265	0.441	0	1
Self-employment07*	16,668	0.229	0.420	0	1
Non-agricultural employment07*	16,678	0.300	0.458	0	1
Change of Tortilla Price0307	16,678	3.160	1.086	0.179	7.000
<Interaction terms>					
Land03only × Wage07only	16,678	0.089	0.284	0	1
Land03only × Remit07only	16,678	0.024	0.154	0	1
Land03only × Migrant07only	16,678	0.062	0.241	0	1
Land03only × Self-emp07only	16,668	0.165	0.371	0	1

Variables with asterisk represent dummy variables

and only 2.3% received a high school or higher education.¹⁰ The author's calculation revealed that more than half of the household heads who enrolled in primary school did not graduate, indicating a high dropout rate. Women headed 12.4% of the households. The average age of household heads was 47 years, and 88% were married. The average household size was 5.1 people.¹¹ 29% of the households were indigenous, that is, the household heads spoke indigenous languages. 53% of the households received benefits under the CCT program in 2003. This percentage increased to 68.7% in 2007 because by then, the eligible households in the newly added control group (hereafter denominated as *Control 2003*) began receiving benefits. 19% of the households received personal transfers (remittances) in cash or kind in 2003, whereas the percentage decreased to 13.8% in 2007. In addition, 33% of the households had members older than 15 years and lived away from home (migrants) in 2003. This percentage also declined to 27% in 2007. 59% of the households owned or cultivated land in 2003,¹² but the percentage sharply decreased to 18% in 2007, which I will discuss in Sect. 2.3.3. 6% of households reported self-consumption during the interview week, and this percentage slightly increased to 7.8% in 2007.

Households with savings and debts only account for 3.6 and 12.2% of the sample in 2003, respectively, but both declined to 2.5 and 6.7%, respectively, in 2007 because of the unfavorable economic situation of rising food prices. It is obvious that these rural households face severe credit constraints. In 2003, about 49

¹⁰According to the author's calculation based on the sample, about 24% of the household heads received no education.

¹¹According to the author's calculation based on the sample, the dependency ratio was 42.7%.

¹²According to the author's calculation based on the sample, a farming household has 4.8 ha. of land on average, but the median household only owned or cultivated 2 ha. of land, indicating a high number of small poor farmers and few large farmers. In addition, land with full or partial irrigation accounted for 9.3% of those who owned/cultivated land in 2003, suggesting that most of the land was rain-fed with poor yields.

and 27% of households received income from wage employment (including day labor) and self-employment, respectively, and these percentages slightly decreased in 2007 to 46 and 23%, respectively. Meanwhile, the main source of income for 30% of households, in 2007, was from non-agricultural employment. The local tortilla price increased by 2.52 pesos on average, which indicates prices in 2007 were 1.3 times higher than those in 2003,¹³ which perfectly corresponds to the Mexican national rate of increase in tortilla prices during the period, as indicated in Chap. 3.

The four variables of the interaction terms represent the households that completely abandoned land cultivation between 2003 and 2007 and shifted to rely on other non-agricultural income sources such as wages, remittances (migration), and self-employment, accounting for 8.9, 2.4, 6.2, and 16.5% of households, respectively.

2.3.2.2 Results: *Impoverished Household Model*

First, regarding the determinants of *impoverished households* in Table 2.4, nearly all of the education dummies were negative and significant. Furthermore, the higher the education level of the household head, the greater the absolute value of the coefficient. In particular, the probability of not falling into poverty noticeably tends to increase with education at or greater than the technical or vocational level. For food basket $\times 1$ [Models (1) and (2)], this increases the probability of not falling into poverty (marginal effects) by 88–105% points compared to non-education households. Next, since the number of household members is positive and significant across all models, we can conclude that households are more susceptible to fall into poverty when family size is larger. Households with female heads tend to become vulnerable to poverty—the coefficients turn positive and significant when the poverty line is lowered—whereas being married is not a determinant for impoverishment (almost all the coefficients are negative but insignificant). The age of the household head is positive and significant; however, since the value is extremely low, we can conclude that it is not a determining factor for impoverishment. On the other hand, being an indigenous household increases the probability of impoverishment by approximately 40% points. This supports what has been pointed out in much of the literature: that the indigenous peoples are poorer and more vulnerable to poverty.

¹³Here, the price for tortillas is used as a proxy for food price changes in 2003 and 2007. ENCEL data show that notable price changes were observed mainly in corn-related products, that is, tortilla and maize grain. Prices of other food products, such as wheat, rice, beans, fruit and vegetables, meats, and even eggs and milk, remained almost unchanged. Some food prices even dropped during the period. Attanacio et al. (2013) pointed out a price rise in meat and dairy products because of the rise in the price of feed grains; however, this price increase was not felt in the marginal rural areas, suggesting that villagers in these areas are self-sufficient in raising their own livestock. Detailed data will be made available upon request.

Table 2.4 Regression results of the *Impoverished household (=1)* Model

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Poverty lines (rural food basket)					
	×1	×1	×0.75	×0.75	×0.5	×0.5
Initial consumption level (log)	-0.0603	-0.0531	-0.126***	-0.121***	-0.241***	-0.240***
Primary03*	-0.195**	-0.172**	-0.145**	-0.138**	-0.127***	-0.129***
Secondary03*	-0.268**	-0.246**	-0.191**	-0.220***	-0.271***	-0.329***
High school03*	-0.266	-0.173	-0.400**	-0.400**	-0.294**	-0.336***
Technical school03*	-1.050***	-0.882***	-0.807***	-0.696***	-0.480***	-0.458***
University03*	-1.070***	-0.944***	-0.735***	-0.699***	-0.550***	-0.580***
Number of HH Members03	0.183***	0.159***	0.151***	0.149***	0.132***	0.131***
Female03*	0.00232	0.157	0.0185	0.135*	0.0847	0.150***
Age03	0.00126	0.007***	0.007***	0.012***	0.006**	0.011***
Married03*	-0.0862	0.0117	-0.0451	0.0594	-0.110**	-0.0345
Indigenous03*	0.409***	0.426***	0.303***	0.360***	0.361***	0.409***
CCT03*	-0.0352		0.0764*		0.111***	
CCT07*		0.139**		0.0946**		0.112***
Remittances03*	0.0133		-0.0333		0.0238	
Remittances07*		0.053		0.0811		0.0206
Migrant03*	0.778***		0.723***		0.642***	
Migrant07*		0.331***		0.253***		0.233***
Land cultivation03*	0.124*		0.183***		0.223***	
Land cultivation07*		0.280***		0.237***		0.182***
Self-consumption03*	-0.131		0.0338		0.171***	
Self-consumption07*		-0.137		-0.487***		-0.331***
Savings03*	-0.131		0.0499		-0.197***	
Savings07*		-0.369**		-0.493***		-0.376***
Debts03*	-0.00868		-0.00282		-0.0425	
Debts07*		-0.261**		-0.266***		-0.173***
Wage Income03*	-0.198***		-0.0612		-0.0212	
Wage Income07*		-0.0152		-0.0738		-0.119***
Self-employment03*	-0.177**		-0.112**		-0.0152	
Self-employment07*		0.0577		0.0676		0.0785**
Change of Tortilla Price0307	-0.0268	-0.0354	-0.0161	-0.0125	0.0148	0.0173
Constant	0.53	0.153	0.134	-0.0409	-0.0463	-0.0843
No. of observation	2126	2126	4065	4065	8358	8357

Notes *** p < 0.01, ** p < 0.05, * p < 0.1

Variables with asterisk represent dummy variables. Marginal effects at mean are shown in the table
Those of dummy variables represent marginal effects if the variables take 1

It is interesting to note that we do not observe a negative relationship between the receipt of CCT and impoverishment; that is, mitigation of poverty and vulnerability as a result of receiving the CCT transfer was not observed. This might imply a reverse causality, where CCT receipt is a consequence of being an *always-poor* household. Moreover, the fact that lowering the poverty line increases the significance of the coefficient of CCT may be considered proof that the targeting of Mexico's CCT program functions properly (that is, benefits are reaching the poor who have greater needs).

I now focus on the effects of remittance income and agricultural activity, which are considered most relevant to the poverty and vulnerability of rural households. The remittance dummies were not significant for either 2003 or 2007, indicating that remittance income has no effect on mitigating poverty and vulnerability. In addition, migrant dummies, which capture households with a migrant member over the age of 15 working domestically or abroad, were positive and significant in all models for both 2003 and 2007 (remittances and migration have no effect on mitigating poverty or vulnerability).

One of the reasons that these variables are contradictory to the expected results is that remittances from migrants do not reach the household in a timely manner, especially in case of an emergency, as argued by Fafchamps (1999), who points out that in such cases the remittances are just regarded as a regular income source rather than the mean of *ex post* strategies for consumption smoothing.¹⁴

In addition, in terms of agricultural activities (captured by land cultivation and self-consumption dummies), the land cultivation dummy was positive and significant for both 2003 and 2007. We can infer that poorer households with consumption levels below the food basket are more likely to be engaged in agriculture. On the other hand, with the exception of poverty line $\times 1$, the self-consumption dummy for 2007 is negative and significant. This indicates that the probability of falling into poverty decreases by 33–50% points if a household below the food basket $\times 0.75$ and $\times 0.5$ poverty lines has self-consumption. It is interesting, however, to note that the situation is the opposite for 2003: The coefficients for self-consumption are insignificant (Models 1 and 3), or positive and significant (Model 5: the lowest poverty line). This phenomenon could imply causality between the rise in food prices and the impoverishment of rural households during this period, which will be discussed mainly in Chap. 3. Furthermore, the sample's summary statistics shows that a large number of households abandoned agriculture from 2003 to 2007 (decline in the percentage of land cultivation from 59.4 to 18.1%).¹⁵ I discuss this topic in the next section.

With regard to a household's access to credit (savings and debt), it is interesting to note that the probability of impoverishment decreases not only for households

¹⁴On the other hand, considering the argument that remittances are *ex post* strategies for consumption smoothing (Skoufias 2007), we can also infer that this result captures reverse causality, where a family member migrates upon an increase in poverty and vulnerability.

¹⁵The summary statistics will be made available upon request.

with savings (including money stored at home), but also for those with debt. The coefficients for savings and debt are both negative and significant, particularly in 2007. This suggests that restrictions to the access to credit markets in rural areas impede households' consumption smoothing and drive them into poverty, the results of which are consistent with the existing theories of rural poverty and vulnerability.

Finally, it is also shown that a household's head having access to non-agricultural income sources decreases the probability of falling into poverty. Specifically, I used wage and self-employment dummies as comparable proxies for the availability of non-agricultural income sources between 2003 and 2007.¹⁶ While the coefficients of the wage dummy for both 2003 and 2007 are negative (except for self-employment in 2007), it is noteworthy that they become significant in the models with higher poverty lines ($\times 1$) for 2003, but with a lower poverty line ($\times 0.5$) for 2007. These results would suggest that the access to wages was particularly important for consumption smoothing during the period of rising food prices. On one hand, the self-employment dummy for 2003 was negative and significant for Models 1 and 3, but became positive in all the models and even significant for the lowest poverty line ($\times 0.5$) in 2007, indicating that engaging in self-consumption does not contribute to mitigating vulnerability, especially for the poorest households. This implies that the poorest households that abandoned agriculture shifted to informal self-employment and remain poor because of the shocks, which I discuss in the next subsection.

On the other hand, the impact of price changes in tortillas was insignificant. Paradoxical to the hypothesis on the relationship between rising food prices (especially of grains) and the increase in poverty, the regression results show that price increases have no direct effect on impoverishment. However, tortillas are a staple food with extremely low price elasticity whose consumption accounts for the greatest part of poor households' daily expenditure. As such, households cannot manage to smooth their consumption against the price rise in tortillas, suggesting that rural households (especially those that do not self-consume) still had to buy tortillas at higher prices, and, consequently, their food consumption (mainly of tortillas) levels remained unchanged or even increased in real terms. This point requires further examination and will be discussed in detail in Chap. 3.

2.3.2.3 Results: *Improved Household Model*

Table 2.5 presents the estimation results for the *improved* household model. The education variables become positive and significant as the poverty line lowers, with

¹⁶I also conducted a regression using the non-agricultural employment dummy for 2007. The dummy becomes negative and significant at the 1% level, indicating that the access to non-agricultural employment decreases the probability of impoverishment by approximately 31% points. Unfortunately, as I could only obtain non-agricultural employment data for 2007, a comparison with 2003 could not be carried out. This result will be made available upon request.

Table 2.5 Regression results of the *Improved household (=1) Model*

Variables	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
	Poverty lines (rural food basket)					
	×1	×1	×0.75	×0.75	×0.5	×0.5
Initial consumption level (log)	0.377***	0.400***	0.398***	0.416***	0.423***	0.421***
Primary03*	−0.0903**	−0.0813*	−0.0414	−0.0292	0.0417	0.0479
Secondary03*	0.0806	0.119*	0.0945	0.137**	0.0861	0.128*
High school03*	0.346***	0.388***	0.302**	0.332**	0.330*	0.375**
Technical school03*	0.264	0.243	0.434***	0.400**	0.574***	0.506***
University03*	0.495*	0.573**	0.752**	0.809**	−0.0174	0.144
Number of HH Members03	−0.079***	−0.077***	−0.080***	−0.081***	−0.118***	−0.122***
Female03*	0.007	−0.013	−0.037	−0.055	−0.112	−0.155**
Age03	−0.001	−0.004***	−0.003***	−0.007***	−0.004***	−0.008***
Married03*	−0.0856	−0.134**	−0.0381	−0.0689	0.00276	−0.0538
Indigenous03*	−0.0696*	−0.123***	−0.178***	−0.227***	−0.272***	−0.312***
CCT03*	−0.0910***		−0.127***		−0.093***	
CCT07*		−0.110***		−0.153***		−0.132***
Remittances03*	0.0780*		0.053		0.0748*	
Remittances07*		−0.0567		−0.0342		−0.00761
Migrant03*	−0.446***		−0.387***		−0.539**	
Migrant07*		−0.214***		−0.175***		−0.135***
Land cultivation03*	−0.115***		−0.150***		−0.157***	
Land cultivation07*		−0.0532		−0.0812*		−0.111***
Self-consumption03*	−0.170**		−0.206***		−0.107	
Self-consumption07*		0.304***		0.327***		0.359***
Savings03*	0.242***		0.141		0.211**	
Savings07*		0.218**		0.160*		0.196*
Debts03*	0.0325		0.0614		0.0222	
Debts07*		0.0796		0.0929		0.147**
Wage Income03*	−0.0312		−0.0177		−0.052	
Wage Income07*		0.00788		0.0192		0.0727**
Self-employment03*	−0.00665		0.0443		0.0636	
Self-employment07*		−0.0334		−0.0478		0.00802
Change of Tortilla Price0307	0.0131	0.00825	−0.00147	−0.0035	−0.0119	−0.0104
Constant	−2.369***	−2.402***	−2.012***	−2.008***	−1.108***	−1.062***
No. of observation	14,465	14,463	12,526	12,524	8233	8232

Notes *** p < 0.01, ** p < 0.05, * p < 0.1

Variables with asterisk represent dummy variables. Marginal effects at mean are shown in the table
Those of dummy variables represent marginal effects if the variables take 1

the exception of the elementary school dummy. In particular, the high school dummy, which was insignificant in the *impoverished household* model (Table 2.4) on the food basket $\times 1$ line (Models 1 and 2), is now significant, and the probability of emerging from poverty rises by 30–39% points. In the case of the technical/vocational school dummy, the probability of emerging from poverty increases by 40–43% points on the $\times 0.75$ line (Models 9 and 10), and 50–57% points on the $\times 0.5$ line (Models 11 and 12), while for the university level, the probability increases by 50–57% points on the $\times 1$ line (Models 7 and 8), and by 75–81% points on the $\times 0.75$ line. The negative and insignificant coefficient for the university dummy in the lowest poverty line (Models 11 and 12) could be due to the small sample size of household heads with university education.

Similar to Table 2.4, the household head's sex (female = 1), age, and marital status have little effect, with the exception of the *female* dummy for the $\times 0.5$ line, in the sense that the coefficients are mostly insignificant or the magnitudes are extremely small. On the other hand, the number of household members and indigenous dummies are negative and significant. The probability of emerging from poverty decreases with larger family size and for indigenous households.

The fact that the CCT dummy, which presents the probability of a household's emerging from poverty by receiving the benefits, is negative and significant seems contradictory, but suggests that the CCT program targets well the poorest households in rural Mexico. This is also consistent with the results of the impoverishment model in Table 2.4. Meanwhile, the remittance dummy is positive and significant at the 10% level for 2003, but becomes negative and insignificant on all the poverty line levels for 2007, suggesting that mitigating effects for vulnerability are rather weak and cannot be confirmed, especially for 2007 amid an unexpected shock of rising prices. In addition, the migrant dummy is negative and significant for both 2003 and 2007, indicating that it increases the probability of remaining in poverty. As in the *impoverished household* model of Table 2.4, this implies that households do not rely on their migrant members, regardless of their remittances, to mitigate shocks that force them to fall into poverty.

With respect to agriculture-related variables, the land cultivation dummy is negative in all models and is significant in all models for 2003. Furthermore, its significance increases for 2007 as the poverty line becomes lower. This may suggest that agriculture is not lucrative at all and thus is the last resort when there are no other income choices. Meanwhile, the coefficient for the self-consumption dummy is significant, but the signs are opposite between 2003 and 2007 (negative for 2003 and positive for 2007), indicating that self-consumption mitigates the shock of increasing food prices. These results are all consistent with Table 2.4.

The coefficient of the variables pertaining to *access to credit*, represented by savings and debt dummies, are all positive, indicating the importance of access to credit in emerging from poverty. In addition, those of savings are significant on the $\times 1$ line and $\times 0.5$ line for 2003, confirming that holding deposits in 2003, prior to the food price shock, increases the probability of emerging from poverty by 21–24% points. On the other hand, the debt dummy is all insignificant with the exception of the $\times 0.5$ line for 2007. Moreover, the results in Table 2.4 show that

households are more likely to emerge from poverty if they have savings when applying a higher poverty line [its coefficient becomes significant at the $\times 1$ line (Models 7 and 8)], whereas the debts matter when setting a lower poverty line [its coefficient is only significant at the $\times 0.5$ line (Models 11 and 12)].

When looking at the effects of non-agricultural employment, the coefficients of wage income are negative for 2003, but turn positive for 2007 although they are statistically significant only on the lowest poverty line ($\times 0.5$) for 2007. In addition, those of the self-employment dummy show both positive and negative signs depending on the model, and are insignificant for both years in all models, indicating that there are few mitigating effects for vulnerability in the case of wage income and no effects in the case of self-employment.¹⁷ The effects of the changes in tortilla prices, again, are not observed in Table 2.5.

2.3.2.4 Summary: Determinants of Household Vulnerability to Poverty

There were several cases in which explanatory variables' impact on the change of household poverty status measured by consumption were insignificant for 2003, but significant for 2007 in both the *impoverished* and *improved* household models of Tables 2.4 and 2.5, respectively. These dummy variables, such as savings, debt, and wages resulted in important determinants to mitigate household vulnerability in the face of shocks. Furthermore, the signs on the self-consumption dummy mostly turned from positive in 2003 to negative in 2007 for the *impoverished* model (Table 2.4) and vice versa in the *improved* model (Table 2.5), implying that the food price rise must be the major cause of impoverishment between 2003 and 2007. In this chapter, the time-variant variables for 2003 and 2007 were estimated separately in different regression models in Tables 2.4 and 2.5. However, all the results remained mostly unchanged even when the variables were estimated simultaneously.¹⁸

In summary, the two regression results were mostly consistent with one another in the sense that almost all the explanatory variables displayed opposite signs, as expected (see Table 2.6). In other words, the *impoverished* and *improved* household models are two sides of the same coin. It can be concluded from Table 2.6 that the households vulnerable to poverty are those who are indigenous, with migrant members (regardless of receiving remittances), who are engaged in agriculture (land cultivation), who are without self-consumption in 2007, and who have restricted or no access to credit. Meanwhile, households resistant to falling into poverty when facing shocks were those with a highly educated head, with access to non-agricultural income (especially wage income, and not self-employment) and to a credit market (especially in 2007, after the food price shock occurred).

¹⁷The coefficients of the non-agricultural income dummy for 2007 itself are positive and significant in all models, confirming a certain effect on emerging from poverty that is the same as the results in Table 2.4. The results will be made available upon request.

¹⁸The regression results will be made available upon request.

Table 2.6 Summary of regression results

<i>Impoverished</i> household Model (Table 2.4)		<i>Improved</i> household Model (Table 2.5)	
Positive and Significant		Negative and Significant	
No. of HH Members03	Female03	No. of HH Members03	Migrant03
Age03	(except for x1)	Age03	Migrant07
Indigenous03	Migrant03	Indigenous03	Land cultivation03
CCT03	Migrant07	CCT03	Land cultivation07
(except for x1)	Land cultivation03	CCT07	(except for x1)
CCT07	Land cultivation07	Self-consumption03	(except for x1)
Negative and Significant		Positive and Significant	
Primary03	Self-consumption07	Secondary03	Remittances03
Secondary03	(except for x1)	High school03	(except for x0.75)
High school03	Savings03	Technical school03	Self-consumption07
(except for x1)	(only x0.5)	(except for x1)	Savings03
Technical school03	Savings07	University03	(except for x0.75)
		(except for x0.5)	Savings07
University03	Debts07		
	Wage Income07		
	(only x0.5)		
Non-significant		Non-significant	
Married03	Savings03	Primary03	
Remittances03	(except for x0.5)	(except for x1)	Wage Income03
Remittances07	Wage Income03	Female03	Wage Income07
Self-consumption03	(except for x1)	(except for x0.5)	(except for x0.5)
(except for x0.5)	Wage Income07	Married03	Self-employment03
Self-consumption07	(except for x0.5)	Remittances07	Self-employment07
(only x1)	Self-employment07	Debts03	
Debts03	(except for x0.5)	Debts07(except for x0.5)	
Change of Tortilla Price0307		Change of Tortilla Price0307	

Source Author's elaboration based on Tables 2.3 and 2.4

2.3.3 *De-agriculturalization and Vulnerability of Rural Households*

As mentioned in the previous section, notable de-agriculturalization was observed between 2003 and 2007: The proportion of sample households cultivating land declined from 59 to 18% as a whole. Table 1.1 in Chap. 1 already indicated that agricultural employment fell by 5% points in the last decade at the national level, which was almost entirely absorbed by the service sector over the same period. In this subsection, I verify the relationship between this substantial de-agriculturalization

and the vulnerability of rural households by extending the probit model used in the previous subsection. The results are shown in Table 2.7.

Specifically, I created three types of land cultivation dummy variables to identify de-agriculturalized households: (i) whether a household cultivated land only in 2003 (*land03only*), (ii) whether a household cultivated land only in 2007 (*land07only*), and (iii) whether a household cultivated land in both 2003 and 2007 (*land03&07*). Then, I made interaction terms of the aforementioned three land cultivation dummies with dummy variables that are supposed to be substitutes for agricultural income wages in 2007, namely, wage, remittances/migration and self-employment. This allows us to focus on what impacts the shift from agriculture to non-agricultural employment has had on rural households' vulnerability. Further, the time-variant explanatory variables used in Tables 2.4 and 2.5 are transformed in a different form for the purpose of a robustness check by separating them into the same categories (*2003 only*, *2003 & 2007*, and *2007 only*) as those of the land cultivation dummies mentioned above.

Table 2.7 presents the estimation results of the *impoverished* household model (A) and the *improved* household model (B). Since the overall results were mostly consistent with Tables 2.4 and 2.5 above, I would like to focus solely on the aspect pertaining to a household's de-agriculturalization and vulnerability. The absolute value of the coefficients for the land cultivation dummy in Table 2.7, as well as its significance, tends to increase as the poverty line lowers, with the exception of land cultivation for both 2003 and 2007 (*Land03&07*) for the *Impoverished household* model (Models 1–3), which shows the decreasing trend. This indicates that the probability of falling into poverty increases for households engaged in agriculture, or, in other words, poorer and more vulnerable households are more likely to be engaged in agriculture. Furthermore, at the lowest poverty line ($\times 0.5$), in contrast to the other poverty lines, the probability of impoverishment increase for households that cultivated land *only* in 2007 (*Land07only*, coefficients 0.38) is greater than for those cultivating land *only* in 2003 (*Land03only*, 0.24–0.25) and for those cultivating in *both* 2003 and 2007 (*Land03&07*, 0.22–0.23). This implies that the impoverished households measured by the lowest threshold fell into poverty because they might not be able to obtain other means in non-agricultural sectors but to cultivate land for consumption smoothing during the period.¹⁹ However, such a clear difference in the magnitude of the coefficients according to the land cultivation period, as indicated in the *impoverished* household model (Models 1–3), is not observed even in the lowest poverty line ($\times 0.5$) in the *improved* household model of Table 2.7. This might indicate that engaging in agriculture would not allow rural households to emerge from poverty.

With regard to the results of interaction terms that represent the impacts of de-agriculturalization on households, those with the wage dummy show the

¹⁹According to a field report by Fitting (2011), costs are higher for cultivating corn by rainfed agriculture, resulting in an operating loss. Hence, she reports that the only people engaged in farming are the elderly or those who are unable to find any other work, while young people aspire to work as wage laborers in the nearby maquila factories.

Table 2.7 Regression results of the De-agriculturalization

A. Impoverished household (=I) Model				B. Improved household (=I) Model		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	×1	×0.75	×0.5	×1	×0.75	×0.5
Initial consumption level (log)	-0.042	-0.114**	-0.237***	0.382***	0.399***	0.421***
Primary03*	-0.191**	-0.162***	-0.128***	-0.0842*	-0.0366	0.0463
Secondary03*	-0.250*	-0.200**	-0.268***	0.086	0.103	0.0953
High school03*	-0.13	-0.353**	-0.278**	0.353***	0.312**	0.334*
Technical school03*	-0.943***	-0.724***	-0.411**	0.235	0.384**	0.538***
University03*	-0.986***	-0.709***	-0.475**	0.478*	0.693**	-0.0237
No. of HH Members03	0.176***	0.155***	0.132***	-0.075***	-0.076***	-0.119***
Female03*	0.0035	0.0253	0.09	0.0166	-0.0268	-0.105
Age03	0.001	0.006***	0.005***	-0.001	-0.003**	-0.004***
Married03*	-0.0709	-0.0361	-0.111**	-0.0869	-0.0325	0.00404
Indigenous03*	0.367***	0.273***	0.341***	-0.0707*	-0.177***	-0.263***
CCT03only*	-0.0393	0.098	0.157***	-0.141*	-0.158**	-0.0586
CCT07only*	0.221**	0.0951	0.068	-0.0926*	-0.118***	-0.0697
CCT03&07*	0.051	0.0993*	0.135***	-0.136***	-0.195***	-0.139***
Remit03only*	0.106	0.0238	0.0528	0.0808*	0.0506	0.0513
Remit07only*	0.226*	0.190**	0.0883	-0.0886	-0.0577	-0.0238
Remit03&07*	-0.0711	0.0511	0.0766	-0.00948	-0.0064	0.0435
Migrant03only*	0.932***	0.808***	0.681***	-0.412***	-0.387***	-0.541***
Migrant07only*	0.156	0.0819	0.0514	-0.102	-0.0823	-0.0398
Migrant03&07*	0.693***	0.672***	0.634***	-0.551***	-0.449***	-0.568***
Land03only*	0.171*	0.238***	0.250***	-0.129***	-0.139***	-0.188***
Land07only*	0.0946	0.184	0.380***	0.0122	-0.0793	-0.168*
Land03&07*	0.325***	0.294***	0.225***	-0.122**	-0.163***	-0.193***
Self-cons03only*	-0.0808	0.0599	0.202***	-0.158*	-0.209***	-0.130*
Self-cons07only*	-0.155	-0.525***	-0.350***	0.314***	0.336***	0.375***
Self-con03&07*	-0.943**	-0.715**	-0.542**	0.045	0.204	0.467**
Savings03only*	-0.0963	0.0354	-0.181**	0.229**	0.116	0.211**
Savings07only*	-0.330*	-0.575***	-0.347***	0.184*	0.144	0.198*
Savings03&07*	-0.391	-0.0555	-0.532**	0.445*	0.441	0.446
Debts03only*	-0.0324	-0.0128	-0.0228	0.0426	0.0635	0.00305
Debts07only*	-0.265**	-0.230***	-0.0742	0.0542	0.0623	0.104
Debts03&07*	-0.098	-0.0997	-0.187*	0.0461	0.0641	0.207
Wage03only*	-0.0709	0.0135	0.0663	-0.0234	0.0122	-0.0845*
Wage07only*	0.235**	0.0843	0.00636	-0.00715	0.043	-0.012

(continued)

Table 2.7 (continued)

A. Impoverished household (=1) Model				B. Improved household (=1) Model		
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	×1	×0.75	×0.5	×1	×0.75	×0.5
Wage03&07*	−0.195*	−0.109	−0.109**	−0.0285	−0.0104	0.0101
Self-empl3only*	−0.178**	−0.0679	0.00492	−0.0331	0.0155	0.0615
Self-empl7only*	0.147	0.131	0.0558	−0.0351	−0.0154	0.00337
Self-emp03&07*	−0.172	−0.128	0.0002	0.0283	0.0589	0.0942
<Interaction terms>						
Land03only						
x Wage07only	−0.366**	−0.255**	−0.0921	0.0574	0.00614	0.086
x Remit07only	−0.0592	−0.0524	−0.0851	−0.0477	−0.119	0.0174
x Migrant07only	0.0337	−0.0288	0.114	0.0798	0.0864	0.00485
x Self-emp07only	−0.138	−0.0454	0.0259	−0.00828	−0.0641	0.012
Change of Tortilla Price0307	−0.034	−0.0136	0.0138	0.0128	0.0003	−0.0103
Constant	0.282	0.0296	−0.0703	−2.385***	−2.017***	−1.095***
No. of observation	2128	4069	8363	14,473	12,532	8238

Notes *** p < 0.01, ** p < 0.05, * p < 0.1

Variables with asterisk represent dummy variables. Marginal effects at mean are shown in the table. Those of dummy variables represent marginal effects if the variables take 1

expected signs, that is, negative in all the models of the *impoverished* household model (A) and positive in all the models of the *improved* household model (B), but these become significant only for the ×1 and ×0.75 lines of the *impoverished* household model (Models 1 and 2). On the other hand, the signs of the coefficients are indeterminate for the interaction terms with self-employment and remittance/migrant [positive and negative signs are all mixed in both models (A and B)]. In addition, all the coefficients of these interaction terms except for those with the wage dummy become insignificant in both models (A and B). To summarize, the findings suggest that it would be possible for de-agriculturalized households to mitigate vulnerability to a certain degree with access to wages. However, as Fafchamps (1999) points out, relying on remittances and migrant work or being engaged in self-employment would not mitigate vulnerability.

2.4 Concluding Remarks

In this chapter, I discussed the poverty increase in Mexico from 2006, particularly focusing on the impoverishment of the most marginalized rural localities, for which survey data were originally collected for the external evaluation of the CCT program. Using ENCEL panel data for 2003 and 2007, I conducted empirical analyses

from the perspective of *household vulnerability to poverty*. The aim of this chapter was to elucidate the dynamics of this recent *unexpected* poverty increase by incorporating dynamic concepts through the use of panel data to analyze the characteristics of vulnerable households susceptible to falling into poverty, which cannot be captured by a cross-sectional poverty analysis.

In Sect. 2.2, I calculated the FGT indices using the above-mentioned rural household panel data to reveal the increasing poverty headcount ratio as well as the worsening disparity within poor households as evidenced by the growing poverty gap and squared poverty gap. Furthermore, an analysis using a transition matrix illustrated that there is a high % of *vulnerable* households in the sense that they oscillate up and down a poverty line, even with the use of different poverty line levels. Their presence could be completely ignored by a cross-sectional analysis.

In Sect. 2.3, I conducted regression analyses using the probit model to examine the determinants of poverty and vulnerability of rural households, looking at both *impoverishment of non-poor households* and *improvement of poor households*. The results indicate that vulnerable households that are susceptible to falling into poverty include those that are indigenous, with a migrant family member (regardless of remittances), engaged in agriculture (proxied by land cultivation), without self-consumption, especially in 2007, after the food price shock, and/or without access to credit. Meanwhile, the results indicate that households with highly educated heads, and those with access to a credit market (not only savings, but also debt) and non-agricultural income, specifically wage income, especially in 2007, after the food price shock, are less susceptible to falling into poverty (i.e., less vulnerable). In addition, the regression results of Table 2.6 show that de-agriculturalized households during the period in the sample villages were able to reduce vulnerability to poverty to some extent when they obtained access to wage income, but not in the case of self-employment, migration, or remittances.

However, I cannot deny the possibility of the endogeneity problem caused by unobservable omitted variables that might bias the results. Thus, these regression results should be complemented by some qualitative analyses. Specifically, case studies are necessary to examine further the relationship between de-agriculturalization and increasing vulnerability of rural households, which cannot be captured well enough from this quantitative analysis. Furthermore, it would be ideal to keep revising and confirming these results when updated data after 2007 become available, taking into consideration the continued increase of poverty and vulnerability under the 2008 global economic crisis and soaring international food prices, which peaked in 2011.

References

- Attanasio O, DiMaro V, Lechene V, Phillips D (2009) The welfare consequence of increases in food prices in rural Mexico and Colombia. Mimeograph. http://www.homepages.ucl.ac.uk/~uctpjrt/Files/food%20prices%20mexcol%20d9_2_09.pdf. Accessed 20 May 2013

- CONEVAL (2011) Nota Técnica: Instrucciones para consultar del contenido y valor de la canasta básica (Technical notes: Instructions for the content and value of the food basket). http://www.coneval.org.mx/Medicion/MP/Paginas/Pobreza_2014.aspx. Accessed 15 Jan 2013
- Encuestas de Evaluación de los Hogares (Household Evaluation Surveys, ENCEL) (2003, 2007) https://www.prospera.gob.mx/EVALUACION/es/eval_cuant/bases_cuanti.php. Accessed 01 Jul 2012
- Fafchamps M (1999) Rural poverty, risk and development, report submitted to Food and Agriculture Organization (FAO). <https://web.stanford.edu/~fafchamp/fao3.pdf>. Accessed 30 Sep 2015
- Fitting E (2011) The struggle for Maize: campesinos, workers, and transgenic corn in the Mexican countryside. Duke University Press, Durham
- Foster J, Greer J, Thorbecke E (1984) A Class of decomposable poverty measures. *Econometrica* 52:761–766
- Imai K, You J (2014) Poverty dynamics of households in rural China. *Oxford Bull Econ Stat* 76 (6):898–923
- Kurosaki T (2009) Hinkon no Zeijakusei no Keizai Bunseki (Economic analysis of poverty and vulnerability). Keiso Shobo, Tokyo
- Skoufias E (2007) Poverty alleviation and consumption insurance: evidence from PROGRESA in Mexico. *J Socio-Econ* 36:630–649
- Valero-Gil JN, Valero M (2008) The effects of rising food prices on poverty in Mexico. *Agric Econ* 39:485–496
- Wood B, C Nelson, L Nogueira (2009) Food price crisis: welfare impact on Mexican households. Paper presented at the International Agricultural Trade Research Consortium (IATRC). https://www.researchgate.net/publication/255572075_Food_Price_Crisis_Welfare_Impact_on_Mexican_Households. Accessed 20 May 2013
- World Bank (2000) World development report 2000/2001: attacking poverty. Oxford University Press, New York

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Uchiyama, N.

2017, X, 96 p. 13 illus., 4 illus. in color., Softcover

ISBN: 978-981-10-4102-0