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Uchiyama, Naoko

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指導教員 濱口 伸明 教授

学籍番号 058I015I

氏名 内山 直子

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in Latin America and the Caribbean**

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Naoko UCHIYAMA

Kobe University

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The views expressed in this dissertation are entirely the author's and not those of the institutions described above. The author is responsible for any remaining errors.

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Abstract

Latin America and the Caribbean (LAC) suffered from a series of severe economic crises during the 1980s and 1990s starting with Mexican debt crisis in 1982. The region abandoned import substitution (ISI) policies to embark upon liberalization soon after the debt crises. Poverty degradation and rising inequality became not only economic but also social and political issues in LAC during the 1980s and 1990s. In contrast to those prior two decades, steady growth (largely driven by the global commodity boom) and sound economic policies during the 2000s improved the lives of millions in the region over the past decade. According to a World Bank (2013) report, for the first time ever, the number of people belonging to the middle class surpassed the number of poor people, a signal of LAC progress toward becoming a middle-class region. Despite impressive gains during the past decade, however, the region remains unequal, with some 82 million people subsisting on less than \$2.5 per day. Poverty and inequality remain as daunting social hurdles to be overcome.

This dissertation describes empirical studies of poverty and vulnerability in Latin America and the Caribbean. The studies specifically examine the cases of Haiti and Mexico using corresponding household survey data. LAC is, in reality, a region of diverse nations not only in political, historical, cultural, and climatic dimensions, but also in terms of economic development. In actuality, Haiti and Mexico are at opposite ends of the economic development spectrum among LAC. Mexico is a leading economy among LAC countries. It has been making the most of globalization in its economic development process, the most famous example of which is the North American Free Trade Agreement (NAFTA), which came into force in 1994. With respect to the reduction of poverty, Mexico implemented various poverty-reduction policies that are

now convergent into a program known as the first conditional cash transfer (CCT) program in the world. Despite all these efforts, Mexico suffers from high incidence of poverty and inequality. Haiti, in contrast, has been grappling with political instability and damage from natural disasters, even into the 1990s and 2000s, which have isolated the country almost completely from the globalized world. Consequently, Haiti remains an extremely poor country among world nations, with extremely high incidence of poverty, where a large proportion of people have no choice but to engage in subsistence agriculture.

Consequently, studying the cases of Haiti and Mexico will provide valuable insights to understand the fundamental issues of poverty and vulnerability in Latin America and the Caribbean. Their cases will enable us to draw many implications. Because Haiti and Mexico respectively occupy opposite ends of the spectrum, the scopes and methods for the study are expected to differ considerably. Considering the difficulties confronted by Haiti—specifically the lack of economic activities other than subsistence agriculture, an overly abundant rural labor force, and an extremely low level of human capital—the creation of sufficient job opportunities in non-agricultural sectors is urgently needed to reduce poverty in Haiti.

Mexico is a case in contrast: an upper middle income country with a highly globalized and industrialized economy among LAC countries, and even among world countries. Poverty has been decreasing during the recent decade, in line with macroeconomic stability and stable growth during the period until 2008, although the incidence of poverty remains high. However, that favorable trend has reversed with the global crisis caused by the Lehman Shock. Rising international commodity prices have also affected poor households directly. That fact should imply that Mexican poor people are actually

highly vulnerable to shocks, and that global shocks immediately influence poor people. Studies of Mexico's vulnerability examine the CCT effects, benefiting from the fact that the rural household data are designed for program evaluations.

The contents of this dissertation are as follows. Chapter 1 surveys the concepts and measures of poverty, inequality, and vulnerability. Continuously the discussion emphasizes major poverty-related issues: poverty profiles and pro-poor growth. Specific examination suggests a macroeconomic and poverty outlook of Latin America and the Caribbean, especially contrasting the cases of Mexico and Haiti, thereby providing an introduction to studies conducted in subsequent chapters.

Chapter 2 assesses the relation between poverty and employment issues in Haiti using the first and most comprehensive household survey in 2001. An overview of poverty circumstances and characteristics of household income sources leads to two empirical studies that were conducted. The first study, using a multinomial logit model, assesses occupational choice in Haiti, particularly addressing the hypothesis that the lack of job opportunity might be a cause of severe and persistent poverty. The second study estimates the probability of becoming a wage worker using a probit model. Then it estimates a wage equation using a sample selection model. Our findings from the multinomial logit model suggest that obtaining wage employment is the key to escaping poverty. However, such opportunities are limited to workers with secondary or higher education. The results also reveal that remittances are the key determinant in deciding whether to work or not. Regression results from the wage equation imply that education, living areas, and gender are important determinants of both participating in the wage market and raising wage income. Therefore, job creation in the non-agricultural sector and a larger supply of educated workers are necessary for long-run Haitian economic

development.

Chapter 3 analyzes the vulnerability of rural households of Mexico, emphasizing the discussion of causality between poverty degradation and the food price increases between 2003 and 2007 using rural household panel data. The chapter also examines the degree to which the *buffer* effects of the CCT program function in reality on the consumption of the rural poor households in Mexico when facing shocks. Empirical results show that poverty, as measured by food consumption, worsened significantly. Causality is supported by the fact that households with self-consumption were able to cancel out the consumption decrease almost completely by the food production as the theory predicts. Moreover, the cash transfer of CCT served as a partial buffer, but could not completely protect the poor people from price shocks.

Chapter 4 presents empirical analyses of risk-sharing mechanisms in rural Mexico, using the same rural household panel data to clarify the vulnerability of rural households. The study in this chapter examines *vulnerability* as a lack of ability to smooth consumption because of liquidity constraints. The empirical results reject full risk sharing, but they support the hypothesis that risk-sharing mechanisms in rural Mexico offer better insurance to secure basic needs such as food, and that they play important roles when households face negative income shocks. In addition, the CCT enhances existent risk-sharing mechanisms. The risk-sharing mechanisms, reinforced by CCT, serve to mitigate the liquidity constraints—the vulnerability—of poor households.

Contents

Chapter 1

Poverty and Vulnerability in Latin America and the Caribbean..... 1

1-1. Introduction..... 1

1-2. Concepts of Poverty and Vulnerability 4

1-3. Poverty and Inequality Measures..... 6

1-3-1. Inequality Measures 6

1-3-2. Poverty Measures 9

1-3-3. Dynamic Poverty Analysis using Panel Data 13

1-4. Poverty Profile and Determinants of Poverty 16

1-5. Pro-Poor Growth..... 18

1-6. Economic and Poverty Outlook of Latin America and the Caribbean..... 21

1-6-1. Overview..... 21

1-6-2. Economic and Poverty Outlook of Haiti and Mexico..... 22

1-7. Aims and Scopes of the Study 34

Chapter 2

Poverty and Employment Problems: The Case of Haiti..... 37

2-1. Introduction..... 37

2-2. Poverty and Inequality in Haiti 39

2-2-1. Overview..... 39

2-2-2. Household Income Sources 40

2-3. Lack of Job Opportunities and Occupational Choice	43
2-3-1. Overview.....	44
2-3-2. Model	49
2-3-3. Regression Results	49
2-4. Wage Regression	55
2-4-1. Literature Review	55
2-4-2. Regression Method	56
2-4-3. Summary Statistics	58
2-4-4. Regression Results	60
2-4-4-1. Probability of Being a Wage Worker.....	60
2-4-4-2. Wage Differentials	61
2-4-5. Implications.....	64
2-4-5-1. Gender	64
2-4-5-2. Education	65
2-4-5-3. Geographical Disparity.....	67
2-5. Concluding Remarks	68
APPENDIX	72

Chapter 3

The Impacts of the CCT and Rising Food Prices on the Consumption of Rural Poor in Mexico.....	73
3-1. Introduction.....	73
3-2. Characteristics of PROGRESA-Oportunidades and its Panel Data.....	75
3-3. Literature Review: Impacts of CCT and Food Price Increases on Poverty in Mexico	76

3-4. Poverty Trend in Rural Mexico and Food Price Increases: 2003-2007	79
3-4-1. Poverty Trend in Rural Mexico.....	79
3-4-2. Food Price Increases in Mexico	81
3-4-3. Impacts of Food Price Increases on Rural Poverty	
and the Effects of CCT	84
3-4-3-1. Impacts of Food Price Increases on Rural Poverty.....	84
3-4-3-2. <i>Buffer</i> Effects of the CCT on Poverty Degradation	86
3-5. Empirical Analysis	88
3-5-1. Methods	88
3-5-2. Results.....	89
3-6. Concluding Remarks	93

Chapter 4

Consumption Smoothing and Vulnerability in Rural Mexico	95
4-1. Introduction.....	95
4-2. Description of Panel Data.....	99
4-3. Risk-Sharing Model.....	100
4-3-1. General Model	100
4-3-2. Empirical Model	103
4-3-3. Model with Emphasis on Welfare Loss.....	104
4-4. Empirical Analyses and Results.....	105
4-4-1. Summary Statistics.....	105
4-4-2. Basic Model	108
4-4-3. Model with Emphasis on Welfare Loss.....	110
4-4-4. Model with CCT Effects	111

4-4-4-1. Outline of Mexico's CCT Program: PROGRESA-Oportunidades	111
4-4-4-2. Regression Results.....	113
4-5. Concluding Remarks	115
APPENDIX I	118
APPENDIX II.....	120
APPENDIX III	121
APPENDIX IV.....	122
APPENDIX V	123
REFERENCES.....	124

Chapter 1

Poverty and Vulnerability in Latin America and the Caribbean

1-1. Introduction

As represented by the United Nations Millennium Development Goals (MDGs), the most important and urgent issues in developing countries to be tackled today are poverty and inequality. Since the 1980s, many developing countries have implemented economic liberalization policies. The trend has been accelerated to catch up with and to take advantage of rapid globalization that has prevailed since the end of the Cold War. Neoliberal policies are undertaken with the idea that government intervention should be eliminated to the greatest degree possible so that a *liberalized* market can achieve sound economic performance and consequently engender economic growth. In addition, economic growth itself was expected to resolve poverty and inequality problems eventually through so-called *trickle down* effects, through which the fruits of economic growth pervade to poor people.

However, high economic growth had not been observed in many liberalized developing economies during the 1990s, except for some Asian countries. Moreover, many researchers argued that poverty and inequality had been worsened during the period. These criticisms of neoliberal policies promoted by the International Monetary Fund (IMF) and the World Bank compelled international organizations to emphasize development policies intended for sustainable development, assigning priority to the reduction of poverty and inequality. Less than two years remain for the targeted year of the Millennium Development Goals (MDGs) in 2015. World Bank (2013) reveals, however, that only 4 of the 21 specific

targets within the eight MDG goals have been met worldwide. Sala-i-Martin (2006) argues that reductions in global inequality during the 1980s and 1990s are mostly attributed to the Asian big economies such as China and India. He concluded that the spectacular reduction of worldwide poverty, virtually driven by East Asia and South Asia, hides the uneven (or even the opposite) performance of various regions, specifically Africa, throughout the world.

Latin America and the Caribbean (LAC) suffered from a series of severe economic crises during the 1980s and 1990s, starting with the Mexican debt crisis in 1982. The region gave up import substitution (ISI) to adopt neoliberal policies soon after the debt crises, in line with the conditionality of the IMF and the World Bank. Poverty degradation and rising inequality had become not only economic but also social and political issues in Latin America and the Caribbean in the 1980s and 1990s. In contrast to those preceding two decades, steady growth (largely driven by the global commodity boom) and sound economic policies during the 2000s improved the lives of millions throughout the region over the past decade. However, economic inequality and poverty remain as looming social problems: poor people remain vulnerable. Social services and infrastructure are still of poor quality, as World Bank (2013) shows.

Mexico has been a leading country not only in Latin America and the Caribbean but also in the world to implement and deepen the neoliberal reforms as represented by the North American Free Trade Agreement (NAFTA). Mexico became a member of OECD in 1994 and is regarded as a middle-income country in the world. However, poverty and inequality persist as important economic, social, and political issues in Mexico.

Mexico is also known as the first country to invent and implement the conditional cash transfer (CCT) program—a new and now popular targeted poverty reduction strategy in the world to replace the existent inefficient *pork-barrel* poverty reduction policies. The *success* of Mexico's CCT program has drawn special attention from international development

organizations such as the World Bank, which induced other developing countries in the world to introduce similar poverty-reduction policies.

Fifteen years have passed since Mexico's CCT program was implemented. Many evaluations of its short-term effects have been conducted. Now the medium-term and long-term effects should be discussed widely so that the Mexican experiment can contribute to poverty reduction of other developing countries.

Haiti, the poorest country in Latin America and the Caribbean, has the highest poverty ratio and inequality in the region. It is difficult, however, to assess the economic and poverty status of Haiti precisely because of its history of repeated political instabilities and natural disasters. In fact, the Haitian economy has fallen into a negative trend since the coup in 1991, and even today has not recovered the level of Gross Domestic Product (GDP) per capita that it had in 1990.

A household survey conducted in Haiti showed that, of its population, nearly 80 percent live below the poverty line. About 30 percent of main household providers are unemployed or inactive. Furthermore, opportunities for wage employment are extremely limited (only 10 percent of main household providers are engaged in it). Furthermore, it is estimated that 70–80 percent of the labor force is absorbed by the informal sector (Jadotte, 2004). It is indeed of urgent need to seek fundamental strategies for a truly sustainable economic development that enables poverty reduction. Therefore, researchers must devote more attention to the region's poorest country: Haiti.

The next two sections present an overview of the concepts and measures of poverty, inequality and vulnerability. The discussion is focused on the major poverty-related issues, i.e., poverty profiles in Section 1-4 and pro-poor growth in Section 1-5. Section 1-6 provides a macroeconomic and poverty outlook of Latin America and the Caribbean, especially contrasting against those of Mexico and Haiti. Section 1-7 presents the study aims and scope.

1-2. Concepts of Poverty and Vulnerability¹

According to the World Bank (2000), poverty is defined as “pronounced deprivation in well-being.” In the simplest approach, poverty is measured by comparing individuals’ income or consumption with some defined threshold: a *poverty line*. This most conventional view—poverty is regarded largely in monetary terms—is the starting point for most analyses of poverty. A second approach to well-being and poverty is to ask whether people are able to obtain a specific type of consumption good such as food, shelter, health, and/or education. In this view, the analysis is extended beyond the more traditional monetary measures of poverty.

A key building block in developing income and consumption measures of poverty is the poverty line—the critical cutoff in income or consumption below which an individual or household is determined to be poor (World Bank, 2000). There are various types of poverty lines. The internationally comparable lines are useful for producing global aggregates of poverty. In principle, they test for the ability to purchase a basket of commodities that is roughly similar across the world. The most widely used *international poverty lines* are those of the World Bank: 1.25 US dollars per day per person at 2005 Purchasing Power Parity (PPP) and 2 US dollars per day per person at 2005 PPP, representing extreme poverty and poverty lines, respectively². However, such a universal line is generally unsuitable for the analysis of poverty within the country. For that purpose, a *country-specific poverty line* must be constructed, reflecting the country’s economic and social circumstances. The construction of country profiles based on these country-specific

¹ The arguments of this section rely mainly on a report by Haughton and Khandker (2009).

² The international poverty line was revised in 2008 based on results of the International Comparison Program (ICP) 2005, a worldwide statistical initiative to collect comparative price data and estimate purchasing power parities (PPP) of the world’s economies (World Bank, 2008). The poverty line was raised from US\$ 1.08 (at 1993 PPP) to US\$1.25 (at 2005 PPP). Therefore, a simple term “US\$ 1 per day per person” is also used in many cases for the sake of convenience. See Chen and Ravallion (2008, 2010) for details of the re-estimation of world poverty using the revised poverty line.

poverty lines is now common practice (World Bank, 2000).

The broadest approach to well-being is the one articulated by Amartya Sen (1987), who argues that well-being comes from a *capability* to function in society. Consequently, poverty arises when people lack key capabilities, and so have inadequate income or education, or poor health, or insecurity, or low self-confidence, or a sense of powerlessness, or the absence of rights such as freedom of speech. Viewed in this manner, poverty is a *multi-dimensional* phenomenon and less amenable to simple solutions. For instance, while higher average incomes will certainly help reduce poverty, these must be accompanied by measures to *empower* poor people, or insure them against risks, or to address specific weaknesses such as inadequate availability of schools or corrupt health services.

A new concept that is closely related to poverty is *vulnerability*. Although the definition tends to vary depending on contexts and researchers, vulnerability is generally defined as the risk of falling into poverty in the future³, even if the person is not necessarily poor now. It is often associated with the effects of *shocks*. Vulnerability is a key dimension of well-being because it affects individuals' behavior in terms of investment, production patterns, and coping strategies, and in terms of the perceptions of their own situations.

Some important shortcomings of the study of poverty are that it specifically examines people who are currently poor (or were poor in the past), which means that poverty can be measured only *ex post*. However, governments and policymakers are typically more interested in the effects that their measures will have in the future. For this it would be valuable to be able to identify those who are expected to be poor *ex ante* (that is, in the future). Such households are regarded as *vulnerable to poverty*. Vulnerability to poverty results from either low expected consumption or high variation in consumption. A welfare shock is commonly measured as a change in consumption per capita⁴. The shock could be

³ Alwang et al. (2001) define poverty as “the propensity to suffer a significant welfare shock, bringing the household below a socially defined minimum level.”

⁴ We would overstate household well-being in good years and understate it in bad years if we were to use income as the measure of welfare.

negative or positive, although concern typically centers upon shocks related to harmful events.

The World Bank (2000) started to acknowledge the importance of vulnerability. It has encouraged the development and use of Risk and Vulnerability Assessments, which are intended to understand the source of risk, identify the most vulnerable, and design instruments to increase social protection. The vulnerability issue has become an area of active research. Measuring vulnerability, however, is especially difficult: because the concept is dynamic, it can be measured only with household panel data. Furthermore, many indicators of vulnerability have been proposed over the years, but there is a growing consensus that it is neither feasible nor desirable to capture vulnerability in a single indicator (World Bank, 2000).

1-3. Poverty and Inequality Measures

1-3-1. Inequality Measures⁵

Gini Coefficient and Lorenz Curve

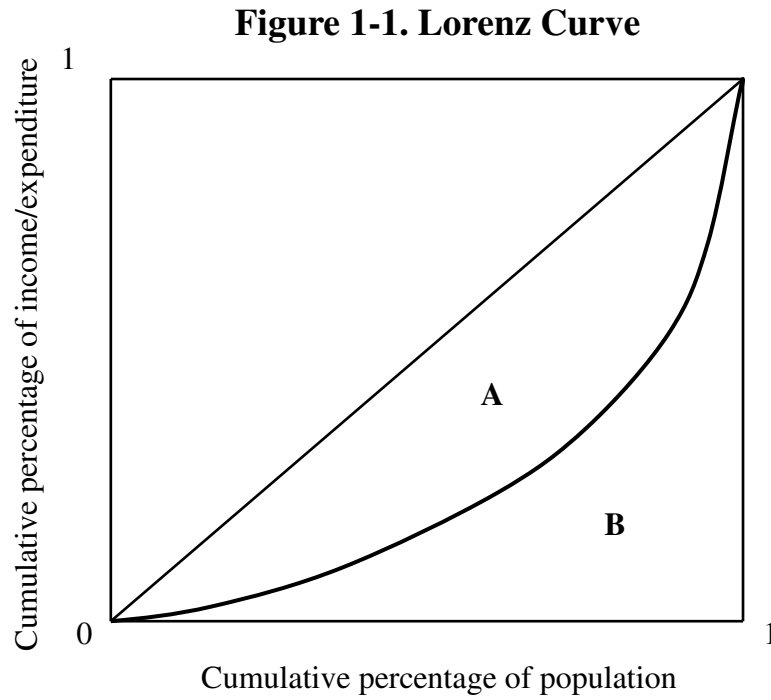
Inequality specifically relates to the distribution of attributes, such as income or consumption, across the population. The most widely used single measure of inequality is the Gini coefficient, which is based on the Lorenz curve, a cumulative frequency curve that compares distribution. The Lorenz curve consists of the cumulative percentage of households (from poor to rich) on the horizontal axis and the cumulative percentage of per capita expenditure (or income) on the vertical axis, as shown in Figure 1-1. The diagonal line represents perfect equality. The graph shows how inequally (equally) distributed the income or expenditure becomes as the curve gets farther from (closer to) the 45 degree diagonal line.

The Gini coefficient is defined as $A / (A + B)$, where A and B are the areas portrayed in

⁵ An explanation of this section mainly relies on Haughton and Khandker (2009).

Figure 1-1. The Gini coefficient ranges from 0 (perfect equality when $A = 0$) to 1 (perfect inequality when $B = 0$), and can also be calculated in terms of the covariance between income (or expenditure) c_i and their ranks $F(c_i)$:

$$G = \frac{2}{\mu} \text{cov}(c_i, F(c_i)) , \quad (1.1)$$



Source: Author's elaboration.

Generalized Entropy Measures

The Gini coefficient is the most widely used inequality index. Its major shortcoming, however, is that it cannot be decomposed. Shorrocks (1980) has shown that the only relative inequality measures which satisfy additive decomposability are generalized entropy measures. Their general formula is given as

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)} \left[\frac{1}{n} \sum_{i=1}^n \left(\frac{c_i}{\bar{c}} \right)^\alpha - 1 \right], \quad (1.2)$$

where $\bar{c}$ is the mean income (expenditure) per person. The values of GE measures vary

between zero and infinity, with zero representing an equal distribution and higher values representing higher levels of inequality. The parameter α in the GE class represents the weight given to distances between incomes at different parts of the income distribution. It can take any real value. For lower values of α , GE is more sensitive to changes in the lower tail of the distribution. For higher values, GE is more sensitive to changes that affect the upper tail. The most common values of α used are 0, 1, and 2. $GE(1)$ is Theil's T index, which might be written as

$$GE(1) = \frac{1}{n} \sum_{i=1}^n \frac{c_i}{\bar{c}} \ln \left(\frac{c_i}{\bar{c}} \right), \quad (1.3)$$

In fact, $GE(0)$, also known as Theil's L , and sometimes designated as the mean logarithmic deviation, is given as shown below.

$$GE(0) = \frac{1}{n} \sum_{i=1}^n \ln \left(\frac{\bar{c}}{c_i} \right) \quad (1.4)$$

The generalized entropy measures can be decomposed across subsamples: inequalities *between groups* and *within groups*, such as regions, households and personal characteristics (education, gender and occupation), as well as geographical location (urban or rural).

To decompose Theil's T index, letting C be the total income of all n individuals of the sample, and $\bar{c} = C/n$ be mean income, then C_j is the total income of a subgroup with n_j members, and $\bar{c}_j = C_j/n_j$ is the subgroup's mean income. Actually, T represents $GE(1)$ as

$$T = \sum_{i=1}^n \frac{c_i}{n\bar{c}} \ln \left(\frac{nc_i}{n\bar{c}} \right) = \sum_{i=1}^n \frac{c_i}{\bar{c}} \ln \left(\frac{nc_i}{c} \right) = \sum_j \left(\frac{C_j}{C} \right) T_j + \sum_j \frac{C_j}{C} \ln \left(\frac{C_j/C}{n_j/n} \right), \quad (1.5)$$

where T_j represents the value of $GE(1)$ for subgroup j . The first equation component represents within-group inequality. The second term measures between-group inequality.

A similar decomposition is possible for $GE(0)$, or Theil's L , given as shown below.

$$L = \sum_{i=1}^n \frac{1}{n} \ln \left(\frac{\bar{c}}{c_i} \right) = \sum_j \left(\frac{n_j}{n} \right) L_j + \sum_j \frac{n_j}{n} \ln \left(\frac{\bar{c}}{\bar{c}_j} \right), \quad (1.6)$$

Atkinson's Inequality Measures

Atkinson (1970) proposed another class of inequality measures. This class also has a weighting parameter ε , which measures aversion to inequality. Atkinson's measures are defined as presented below.

$$A_\varepsilon = 1 - \left[\frac{1}{n} \sum_{i=1}^n \left(\frac{c_i}{\bar{c}} \right)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}, \quad \varepsilon \neq 1,$$
$$A_\varepsilon = 1 - \frac{\prod_{i=1}^n (c_i^{(1/n)})}{\bar{c}}, \quad \varepsilon = 1, \quad (1.7)$$

1-3-2. Poverty Measures⁶

FGT Measures

Given information related to a welfare measure such as per-capita consumption (income), and a poverty line, the next issue is choosing an appropriate measure of aggregate poverty. Numerous studies of poverty measures have been published and many measures have been proposed (Kurosaki, 2009). The most widely used measure is the *headcount ratio*, which simply measures the proportion of the population that is counted as poor:

$$P_0 = \frac{q}{n}, \quad (1.8)$$

where q denotes the number of poor people and n is the total population (or sample).

The poverty headcount ratio represents the poverty *incidence*. The greatest virtue of the headcount index is that it is simple to construct and easy to understand. However, the measure presents some weaknesses. First, the headcount index does not incorporate consideration of the intensity of poverty. The index cannot reflect any transfers from a richer to a poorer person, which should improve the overall poverty in terms of welfare, unless the poor person moves above the poverty line, and *vice versa*. Moreover, the headcount index does not reflect how the poor people are, and therefore does not change if

⁶ The explanation of this section relies mainly on Haughton and Khandker (2009).

people below the poverty line become poorer, or *vice versa*⁷.

A moderately popular measure of poverty is the *poverty gap ratio*, which adds up the extent to which individuals on average fall below the poverty line, and expresses it as a percentage of the poverty line. The poverty gap ratio is defined as

$$P_1 = \frac{1}{n} \sum_{i=1}^q \left(1 - \frac{c_{it}}{z}\right), \quad (1.9)$$

where q represents the number of individuals i whose consumption at time t , denoted by c_{it} , is below a certain level of poverty line z . In addition, n represents the total population.

The poverty gap ratio represents the *depth* of poverty. This measure is the mean proportionate poverty gap in the population (where nonpoor people have a zero poverty gap). One might find it helpful to regard this measure as the minimum cost of eliminating poverty (relative to the poverty line) because it shows how much would have to be transferred to poor people to bring their incomes or expenditures up to the poverty line. The weakness of this measure, however, is that it reflects no transfers among poor people (transfers made among people below the poverty line).

To construct a measure of poverty that incorporates inequality among poor people, some researchers use the *squared poverty gap ratio*.

$$P_2 = \frac{1}{n} \sum_{i=1}^q \left(1 - \frac{c_{it}}{z}\right)^2, \quad (1.10)$$

This ratio is simply a weighted sum of poverty gaps (as a proportion of the poverty line), where the weights are the proportionate poverty gaps themselves. By squaring the poverty gap ratio, the measure implicitly assigns more weight to observations that fall well below the poverty line. The squared poverty gap ratio is referred to represent the *severity* of poverty. The measure, however, lacks intuitive appeal or concrete meaning. Therefore, it is not easy to interpret, in contrast to the poverty headcount ratio or the poverty gap ratio.

⁷ In this sense, the easiest means to reduce the headcount index is to target benefits to people who are only slightly below the poverty line because they are the “cheapest” to move across the line (Haughton and Khandker, 2009).

The three measures described above are generally written in a common equation known as the Foster–Greer–Thorbecke (FGT) indices proposed by Foster et al. (1984).

$$P_{\alpha} = \frac{1}{n} \sum_{i=1}^q \left(1 - \frac{c_{it}}{z}\right)^{\alpha}, \quad (1.11)$$

In that equation, q represents the number of individuals, identified by i , whose consumption at time t , denoted by c_{it} , is below a certain poverty line z . In addition, n represents the total population. When $\alpha = 0, 1$, or 2 , P_0, P_1 , and P_2 respectively represent the *Poverty head count ratio*, the *Poverty gap ratio*, and the *Squared poverty gap ratio*.

Sen Index and SST Index

Sen (1976) proposed an index that is intended to combine the effects of the number of poor people, the depth of their poverty, and the distribution of poverty within the group. The index is given as

$$P_S = P_0 \left[1 - (1 - G^P) \frac{\mu^P}{z}\right], \quad (1.12)$$

where P_0 represents the headcount ratio, μ^P stands for the mean income (or expenditure) of poor people, and G^P is the Gini coefficient of inequality among the poor. The measure can also be written as the average of the headcount (P_0) and poverty gap (P_1) ratios, weighted by the Gini coefficient of the poor as shown below.

$$P_S = P_0 G^P + P_1 (1 - G^P), \quad (1.13)$$

The Sen index, which has been widely discussed, has the benefit of incorporating the income distribution among poor people. However, the index is almost never used outside of the academic literature, perhaps because it lacks the intuitive appeal of some simpler measures of poverty, but perhaps also because it cannot be used to decompose poverty into contributions from different subgroups. In this sense, the squared poverty gap ratio has virtually replaced the Sen index as a similar poverty measure that can capture the income distribution among poor people.

A modified version of the Sen index is the Sen–Shorrocks–Thon (SST) index, proposed

by Shorrocks (1995), defined as

$$P_{SST} = P_0 P_1^P (1 + \hat{G}^P), \quad (1.14)$$

which is the product of the headcount ratio, the poverty gap ratio (applied to poor people only) and a term with the Gini coefficient of the poverty gap ratios for the whole population⁸. The SST index uses weights with the entire population as a reference group, rather than the subset of poor persons, which means that, when someone crosses the poverty line, the rankings do not change discontinuously. The strong transfer condition is satisfied.

The measure can be decomposed and can provide a good sense of the sources of change in poverty over time.

$$\Delta \ln P_{SST} = \Delta \ln P_0 + \Delta \ln P_1^P + \Delta \ln(1 + \hat{G}^P), \quad (1.15)$$

The decomposition shows the degree of contributions of these three factors: the percentage change in headcount ratio (if there are more poor people), the percentage change in poverty gap ratio among the poor (if the poor get poorer), and the percentage change in the Gini coefficient among the poor (if there is greater inequality among the poor).

*Clark–Watts Index*⁹

Another group of poverty measures was proposed by Clark et al. (1981) with the general form of

$$P_\beta = \frac{1}{n} \sum_{i=1}^q \frac{1}{\beta} \left\{ 1 - \left(\frac{c_{it}}{z} \right)^\beta \right\}, \quad \beta \leq 1, \quad (1.16)$$

where q represents the number of individuals, identified by i , whose consumption at time

⁸ The SST index is also written as the following by letting $x = (x_1, x_2, \dots, x_n)$ denote the distribution of normalized poverty gaps as

$$P_{SST} = \mu_x (1 + G_x), \quad x_i \equiv \max \left\{ \frac{z - c_i}{z}, 0 \right\},$$

where μ_x and G_x respectively denote the mean and the Gini coefficient for the distribution x (Shorrocks, 1995).

⁹ The explanation of the Clark–Watts index is based on Kurosaki (2006b) and Kurosaki (2009).

t , denoted by c_{it} , is below a certain poverty line z . In addition, n represents the total population. This group, known as Clark–Watts poverty measure, includes the poverty gap index (when $\beta = 1$) and Watts’ index ($\beta = 0$) as special cases ($P_\beta = 1/n \sum_{i=1}^q (\ln z - \ln c_{it})$). As $1 - \beta$ becomes more positive (β itself can be negative), the degree of sensitivity to the inequality among poor people is expected to be stronger¹⁰. The measure does not respond to inequality among poor people at all when $\beta = 1$.

The measure is used increasingly by researchers because it satisfies all theoretical properties that one might want in a poverty index. Ravallion and Chen (2001) argue that three axioms are necessary for any good measure of poverty¹¹. Under the *focus axiom*, the measure should not vary if the non-poor income varies. Under the *monotonicity axiom*, any income gain for poor people should reduce poverty. Under the *transfer axiom*, inequality-reducing transfers among poor people should reduce poverty (cited from Haughton and Khandker, 2009).

1-3-3. Dynamic Poverty Analysis using Panel Data¹²

It is often necessary to measure how poverty changes over time to monitor and evaluate the effects of specific shocks, policies, and projects on poverty. Changes in poverty rates are typically based on comparisons of cross-sectional data. In some cases, however, it is possible to collect panel data for which the same household (or individual) is surveyed at two or more points in time. Panel surveys have some important advantages. It is only with

¹⁰ Kurosaki (2009) argues that the merit of the Clark–Watts index is that it is highly consistent with the microeconomic theory on consumption smoothing. When $\beta < 1$, the function becomes strictly convex so that it has a property that risk always increases transient poverty. Clark–Watts poverty index are associated with constant relative risk aversion where Arrow–Pratt’s coefficient of relative risk aversion equals $1 - \beta$. Therefore, risk aversion ($\beta < 1$) also implies prudence (Kurosaki, 2006b).

¹¹ Kurosaki (2009) insists that the measure should be used more widely because of its virtue of high consistency for microeconomic theory on consumption smoothing.

¹² The arguments of this section are based mainly on Haughton and Khandker (2009) and Kurosaki (2009).

panel data that one can measure who moves into and out of poverty over time.

Some households are persistently poor, whereas others move into and out of poverty from year to year. An extremely valuable application of panel data is identification of who falls into each different category of poverty. It is common to distinguish four categories¹³: *Chronically poor* people have average consumption per capita over time ($\bar{c}$) that is at or below the poverty line (z). Clearly a priority in such cases is to help raise average consumption levels above the poverty line.

The second category is that of *persistently poor* people, who, among chronically poor people, never emerge from poverty, not even for a year or two. In this respect, they might be distinguished from those chronically poor people who have an occasional good year when they escape from poverty for a while. The third one is *transient poor* people, who are poor from time to time, but who are not poor on average. With better smoothing of their consumption stream they could, in principle, avoid all spells of poverty. The fourth one is *never poor* people or *always nonpoor* people, who do not drop into poverty even occasionally, at least in the time frame under study.

The transition matrix is an example to show the effects of the movement of households (or individuals) into and out of poverty over time. Table 1-1 shows the transition matrix of a series of rural household panel data from seven Mexican states called *Encuestas de Evaluación de los Hogares (ENCEL)*. The poverty line here is determined arbitrarily as 50 percent of the Mexican rural food basket.

According to categories proposed by Kurosaki (2009), the table shows that always poor households account for 56 percent and transitory poor households account for 30 percent (0.11 plus 0.19), whereas always nonpoor households are only 14 percent. The poverty headcount ratio worsened from 67 percent to 75 percent in this period. Nevertheless, it is noteworthy that the existence of transient poor people cannot be ignored and that

¹³ Kurosaki (2009), instead, uses three categories: “always poor,” “transient poverty,” and “always nonpoor.”

impoverished households amount to 19 percent, although the total poverty rate rose by 12 percent points. These facts can be traced only by application of the dynamic poverty approach using panel data.

Table 1-1. Transition Matrix of per capita Real Food Consumption in Rural Mexico, 2003-2007

(percentage of population)			
2003	2007		Total (2003)
	poor	not poor	
poor	0.56	0.11	0.67
not poor	0.19	0.14	0.33
Total (2007)	0.75	0.25	1.00

Notes:

1) Poverty line: 50 percent of the rural food basket (23 Mexican pesos per capita per day as of June, 2011)

2) The consumption level is deflated by average annual food CPI.

3) Sample size: 18,924 households

Source: Author's calculation based on ENCEL 2003, 2007.

*Decomposition of Poverty Measures*¹⁴

Ravallion (1988) proposed a decomposition of poverty measures into transient and chronic factors using household panel data. Let c_{it} represent the consumption level of individual i in time t , and P_t an economy's cross-sectional mean of an individual's poverty measure p_{it} . Any poverty measure is expected to be neutral with a given poverty line z . Consequently, the poverty score function is defined as $p_{it} = p(x_{it})$, where $x_{it} \equiv c_{it}/z$. The function $p(\cdot)$ becomes $p(x_{it}) = 0$ when $x_{it} \geq 1$ (not poor), and becomes $p(x_{it}) > 0$ and $\partial p(x_{it})/\partial x_{it} \leq 0$ when $x_{it} < 1$ (poor). If c_{it} is stochastic, then the expected value of P_t , P_t^P , can be decomposed into chronic poverty and transient poverty.

¹⁴ Equation formats are based on Kurosaki (2009).

$$\text{Overall Poverty: } P_t^P \equiv E \left[\frac{1}{n} \sum_{i=1}^n p_{it} \right] = \frac{1}{n} \sum_{i=1}^n E[p(x_{it})] \quad (1.17)$$

$$\text{Chronic Poverty: } P_t^C \equiv \frac{1}{n} \sum_{i=1}^n p(E[x_{it}]) \quad (1.18)$$

$$\text{Transient Poverty: } P_t^T \equiv P_t^P - P_t^C = \frac{1}{n} \sum_{i=1}^n \{E[p(x_{it})] - p(E[x_{it}])\} \quad (1.19)$$

If $p(x_{it})$ is strictly convex with x_{it} in the case of $x_{it} < 1$, then consumption risks always increase transient poverty (if $\alpha > 1$ in FGT measures, and $\beta < 1$ in the Clark–Watts index) (Kurosaki, 2009).

Datt and Ravallion (1992) decomposed poverty measures into growth and redistribution components¹⁵. $F_t(c_{it})$ represents an economy's cumulative distribution function of the individual consumption (c_{it}) at time t . Actually, the mean consumption μ_t and a parameterized Lorenz curve L_t can be calculated from $F_t(c_{it})$. Once μ_t , L_t and a poverty line z are given, any poverty measure explained above can be calculated as $P_t = P(z, \mu_t, L_t)$. Then the change in P_t is decomposed as follows.

$$\begin{aligned} P_{t+1} - P_t &= P(z, \mu_{t+1}, L_{t+1}) - P(z, \mu_t, L_t) \\ &= \{P(z, \mu_{t+1}, L_t) - P(z, \mu_t, L_t)\} + \{P(z, \mu_t, L_{t+1}) - P(z, \mu_t, L_t)\} \\ &\quad + [\{P(z, \mu_{t+1}, L_{t+1}) - P(z, \mu_t, L_{t+1})\} \\ &\quad - \{P(z, \mu_{t+1}, L_t) - P(z, \mu_t, L_t)\}] , \end{aligned} \quad (1.20)$$

The equation's first term is interpreted as the *growth component*. The second term represents the *redistribution component*. The third term is a residual.

1-4. Poverty Profile and Determinants of Poverty¹⁶

A poverty profile sets out major facts on poverty (and also inequality). Then we examine the patterns of poverty to ascertain how it varies by geography (by region, urban or rural, and so on), by community characteristics (e.g., infrastructure and access to public

¹⁵ The equation formats of this decomposition are based on those of Kurosaki (2009).

¹⁶ Discussions of this section are based mainly on Haughton and Khandker (2009) and Kurosaki (2009).

goods and services such as schools and clinics), and by household or individual characteristics (education, household size, assets, sex, age, employment, and so on). Therefore, a poverty profile is a comprehensive poverty comparison presenting the degree to which and the manner in which poverty varies across subgroups of society. A well-presented poverty profile can be extremely informative and useful for assessing how the sectoral or regional pattern of economic change is likely to affect aggregate poverty. It typically uses basic techniques such as tables and graphs, but it can also be estimated using decomposition methods of the poverty and inequality measures discussed above.

A poverty profile describes the pattern of poverty well, but is not principally intended to shed any light on its causes. A satisfactory explanation of why some people are poor is necessary so that one might tackle the roots of poverty. In this respect, regression analyses are commonly undertaken to identify the effects of each characteristic described above on income (or consumption) per capita. A regression estimate shows how closely each independent variable is related to the dependent variable (consumption or income per capita), controlling for all other variables.

Two types of poverty regression analysis can be used. The first method is to explain the level of expenditure (or income) per capita—the dependent variable—as a function of different variables—the independent variables. In this case, the independent variables are typically those characteristics discussed above: geographic, communal and household or individual-specific variables.

$$\ln \frac{c_i}{z} = X_i b + e_i, \quad (1.21)$$

Therein, c_i represents the household consumption or income per capita, z stands for the poverty line, X_i is a vector of independent variables, b is a vector of parameters to be estimated, and e_i represents an error term. The dependent variable, $\ln(c_i/z)$, can be replaced by $\ln c_i$ or c_i .

The other method is to explain whether a household is poor using a probit (or logit)

regression. In this case, the dependent variable is expected to be binary, usually taking a value of 1 if the household is poor and 0 otherwise. For example, the probit model is

$$Prob(H_i) = \Phi(X_i b), \quad (1.22)$$

where H_i represents an binary variable such as headcount ratio that takes 1 if the household i is poor and 0 otherwise.

According to Kurosaki (2009), one should restrict the use of the probit or logit model to the case in which the consumption or income data do not exist. Therefore, whether the household is poor or not is the only information available. He argues that poverty regressions using poverty measures are econometrically inefficient because the poverty measures are those derived from each household's consumption or income *per se*. Consequently, it is sufficient to calculate the *ex-post* probability for a household to be below the poverty line using the fitted value obtained from Equation (1.21) as shown below.

$$Prob(H_i = 1) = Prob(X_i b + e_i < 1), \quad (1.23)$$

In addition to consumption or income regression, there is scope for a wide variety of regressions: measures related to capabilities such as child nutrition and schooling, determinants of employment or labor income, and estimations of agricultural production functions.

1-5. Pro-Poor Growth

Sala-i-Martin (2006) estimated the World Distribution of Income (WDI) by integrating individual income distributions for 138 countries between 1970 and 2000. His estimations of poverty and income inequality based on WDI demonstrated that poverty rates in 2000 were between one-third and one-half of what they were in 1970 for all four different lines. He also estimated eight indexes of income inequality implied by WDI, concluding that all of them show reductions in global inequality during the 1980s and 1990s. He also

confirmed that this poverty reduction and income convergence are attributed to the dramatic growth rates of China, India, and the remaining Asian countries from the 1970s, which offset the increasing poverty ratio and divergent incomes of African countries. He argues, therefore, that unless the incomes of these African citizens start growing rapidly, world income inequality will start rising again.

Although few economists doubt that economic growth is necessary for the long-term reduction of poverty, disputes have arisen related to the link between the two factors. If the incomes of poor people rise closely in line with incomes overall, the key to poverty reduction is rapid economic growth. However, if the relationship is weak, other policies such as targeted subsidies are likely to be important and the concept of *pro-poor growth* has greater relevance (Haughton and Khandker, 2009).

Dollar and Kraay (2002) presented from their empirical results obtained with a sample of 92 countries spanning four decades that average incomes of the poorest fifth of a country on average rise or fall at the same rate as the country's average incomes do. Additionally, they argued that their study was unable to relate the changes in the income distributions across countries and over time to average incomes (economic growth), or to any of the various proxies for policies and institutions that matter for growth and poverty reduction. Consequently, they concluded that growth, on average, does benefit poor people as much as anyone else in society, and that standard growth-enhancing policies should be at the center of any effective poverty-reduction strategy.

Datt and Ravallion (1992) decomposed changes in poverty measures into growth (in average income) and redistribution (of income) components, applying the methodology to the cases of Brazil and India in the 1980s. They showed that redistribution alleviated poverty in India, although growth was quantitatively more important. In contrast, worsening distribution in Brazil, associated with the macroeconomic shocks of the 1980s, mitigated poverty alleviation through the limited growth that occurred. The World Bank

(2000) applied the methodology of Datt and Ravallion (1992) to various countries and concluded that even if the growth effects dominate in the medium term, distributional considerations play a non-negligible role.

Kakwani et al. (2004) proposed a definition of *relative* pro-poor growth, insisting that a measure of pro-poor growth should incorporate not only reduction in poverty but also improvement in inequality. They argued that the term *pro-poor* means that poor people should receive more but not fewer benefits than nonpoor people, criticizing that the *absolute* concepts of pro-poor growth of the World Bank and others, which regard growth to be pro-poor if it reduces poverty.

With respect to the relation between growth, inequality, and poverty reduction, the World Bank (2000) presents the point that even when the distribution of income itself does not change with growth, countries with similar rates of growth can have markedly different poverty outcomes depending on the initial inequality. Ravallion (2004) also confirms that initial inequalities in a number of dimensions, not just incomes, and how they evolve overtime can be crucial to the extent of poverty reduction, insisting that they can affect both the extent of growth and how its benefits are shared. He referred to the rapid economic growth and poverty reduction in China during the 1980s and 1990s concluding that the pace of poverty reduction would have been even higher if not for the steep rise in income inequality. In other words, growth was definitely pro-poor in China, but rising inequality made it less so.

In addition, a recent study conducted by Ravallion (2012) using household survey data for 90 developing and transient countries with more than two periods revealed a lack of poverty convergence despite the existence of mean consumption convergence. It also revealed that growth generally reduces poverty. The findings of Ravallion (2012) point to three distinct consequences of being a poor country for subsequent progress against poverty. The usual neoclassical convergence effect is the inference that countries starting

with a lower mean consumption, thereby usually having a higher poverty rate, grow faster and therefore enjoy faster poverty reduction than otherwise similar countries. Countervailing against this pattern is an adverse direct effect of poverty on growth, such that countries with a higher initial incidence of poverty tend to experience a lower rate of growth, controlling for the initial mean consumption. Additionally, a high poverty rate makes it harder to achieve any given proportionate impact on poverty through growth in the country's mean consumption.

1-6. Economic and Poverty Outlook of Latin America and the Caribbean

1-6-1. Overview

According to World Bank (2013), the Gross Domestic Product (GDP) in Latin America and the Caribbean (LAC) grew 3 percent in 2012. Growth is expected to remain robust, at 3.5 percent, as strong as domestic demand compensates for weak global economic conditions. Especially during the 2000s, LAC countries enjoyed steady growth after the so-called “lost decade” of the 1980s and economic instability with repeated financial crises in the 1990s. In this respect, the OECD (2010) acknowledged that the 2009 global economic crisis affected LAC economies severely, but several economies in the region displayed noteworthy resilience, reversing the downturn fairly quickly despite LACs' high level of integration with international markets and their poor or negative growth reported in 2009¹⁷. However, the report by the OECD et al. (2013) warns that LAC is currently experiencing a slowdown in growth attributable to the downturn in external demand and the structural limitations of its economies.

The steady economic growth and sound economic policies improved the lives of millions of people in the region over the past decade, with more than 70 million people

¹⁷ OECD (2010) reports that major external factors contributing to this good performance in LAC were Chinese demand for commodities and timely monetary action of the international community.

lifted out of poverty and 50 million joining the ranks of the middle class during 2003–2011. For the first time ever, the number of people belonging to the middle class surpassed the number of poor people, a sign that LAC countries are progressing toward becoming components of a middle-class region. Despite the impressive gains of the past decade, the region remains unequal, with some 82 million people living on less than \$2.5 per day. Creating opportunities for vulnerable people is the priority issue to be addressed (World Bank, 2013). Galiani (2007) also insists that the elimination of poverty continues to be a main challenge facing the region and remains at the top of its policy agenda.

According to Global Monitoring Report 2013¹⁸, Latin America and the Caribbean region performance in attaining the 9 out of 21 MDG targets is impressive. Nevertheless, like most other regions, it is also lagging significantly in terms of maternal health and access to sanitation-related MDGs. At the country level, the region's starting position was already close to the MDG goals. However, it continues to lag in terms of MDGs related to health and sanitation. No country has achieved a maternal health related MDG. Only 14 countries have achieved the MDGs related with access to safe water, and 10 countries with access to sanitation. This performance is attributable mostly to slow progress during the last few years. Moreover, only 14 Latin American countries have either met or made sufficient progress to achieve MDGs related with extreme poverty reduction. Only 18 have achieved gender parity in terms of primary education.

Among the 33 countries in Latin America and the Caribbean, Haiti and Mexico—two countries treated as case studies in this dissertation—should provide us a remarkable contrast in discussing not only economic, but also poverty-related issues in the region.

¹⁸ Global Monitoring Report 2013: Regional Brief
http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1327948020811/8401693-1355753354515/8980448-1366122085455/LAC_RegionalBrief_GMR2013_Eng.pdf (Accessed on Dec. 1, 2013)

1-6-2. Economic and Poverty Outlook of Haiti and Mexico

Haiti is the poorest country in Latin America and the Caribbean (LAC) and, as one of the world's poorest countries, its Gross Domestic Products (GDP) per capita was US\$734 in 2011 (ECLAC, 2012) and its Human Development Index (HDI) was 0.532 (UNDP, 2013), ranked 161st among 187 countries in 2012. Its population was about 10.1 million in 2012 (ECLAC, 2012), making it the most densely populated country in the Western Hemisphere.

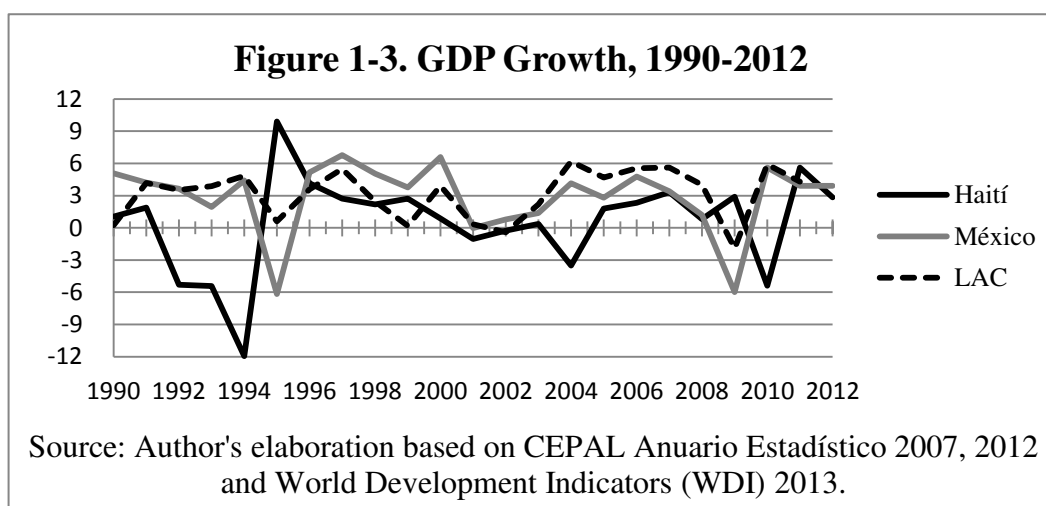
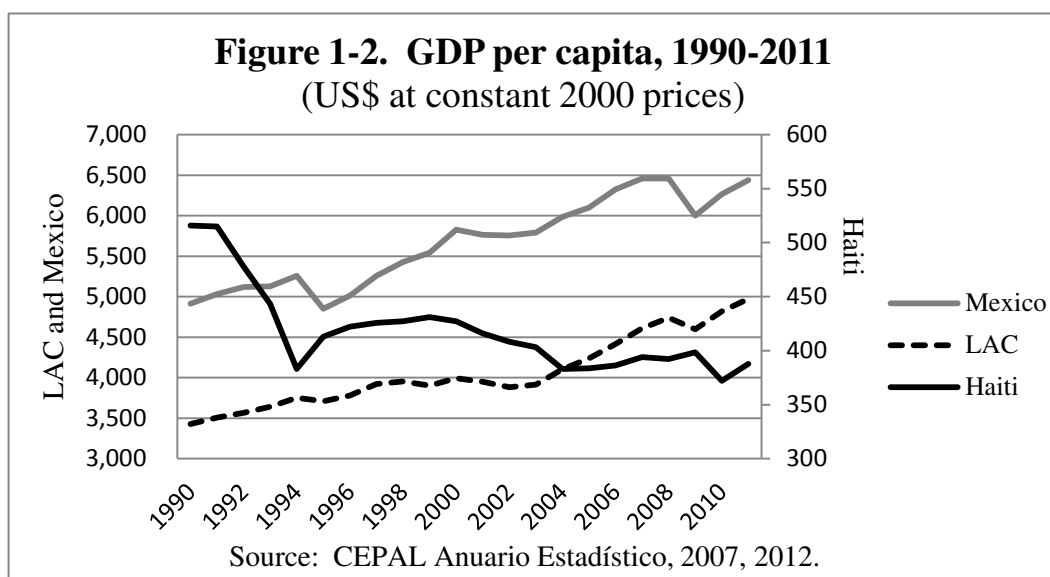
In contrast, Mexico is the second largest country in LAC in terms of population as well as economy size after Brazil. Its GDP per capita amounted to US\$10,130 in 2011 (ECLAC, 2012) and its HDI was 0.775 (UNDP, 2013), ranked 61st among 187 countries in 2012. Its population is about 114.8 million in 2012 (ECLAC, 2012). In contrast to Haiti, Mexico, being an OECD member, is regarded as an upper middle income country of the world and a leading country among Latin American and Caribbean nations.

The Haitian economy fell into a negative trend after a coup in 1991, which was followed by political instability and an embargo period. In 2004, further political turmoil occurred when then-President Aristide went into forced exile. Since President Preval was elected in 2006 with the active intervention of the international community, the economic and social situation has been improving. Although economic growth had resumed from 2004, the country was again shocked in every way by a devastating earthquake in 2010. Consequently, Haiti has still not recovered to the level of GDP per capita that it had in 1990, as shown in Figure 1-2.

Mexico undertook neoliberal economic and political reforms¹⁹ after its debt crisis in 1982, in line with the conditionality of the IMF and the World Bank. The series of reforms concluded with the North American Free Trade Agreement (NAFTA) that came into force

¹⁹ The neoliberal reforms in Mexico consisted of macroeconomic stabilization, trade liberalization, capital and financial liberalization, privatization, deregulation, tax reform, reduction in public expenditures, and so on (Uchiyama, 2007).

in 1994. NAFTA is well known as the very first free trade agreement (FTA) involving developed countries (United States and Canada) and a developing country (Mexico). Mexico's drastic policy reforms from import substitution (ISI) in the 1970s drew special attention worldwide as an ambitious experiment of neoliberalism²⁰.



²⁰ With respect to trade liberalization in Mexico, the (weighted) average tariff rates decreased from 23.5 percent in 1985 to 12.5 percent in 1990. The coverage of import licenses dropped from 92.2 percent to 19.9 percent in 1990 (Feliciano, 2001). Furthermore, all tariffs on imports from the NAFTA member countries, except for a small part of “sensitive” agricultural products, were abolished instantaneously when NAFTA came into force (Hamaguchi and Nishijima, 2007).

The economic growth recovered around 1990 in Mexico after its “lost decade” in the 1980s triggered by the debt crisis, but it was hit by a financial crisis called the “Tequila Shock” at the end of 1994, which brought negative growth of -6.2 percent in 1995. Since then, the Mexican economy seemed to have fully recovered and enjoyed a stable growth period in the 2000s until the Lehman Shock in 2008. Mexico posted negative GDP growth of as much as -6.0 percent in 2009, which was much greater than the LAC average (-1.9 percent), which indicates clearly that the Mexican economy is closely linked to the US economy.

Table 1-2. Sector Production and Employment

		Haiti		Mexico	
		1999	2010	1999	2010
Value Added (% of GDP)	Agriculture	27.3	25.0	4.7	3.9
	Industry	15.1	16.4	28.7	34.7
	Manufacturing	7.6	6.9	21.0	18.1
	Services	50.1	51.7	66.6	61.4
Employment (%)	Agriculture	50.6	-	20.5	13.1
	Industry	10.7	-	25.4	25.5
	Services	38.7	-	53.6	60.6

Source: Author's calculation based on World Development Indicators 2013.

When looking at the domestic economic structures in Table 1-2, it is notable that the Haitian economy remains agriculture-dominated and that the industry sector (especially the manufacturing sector) is too small and underdeveloped. The agricultural sector accounts for as much as 27.3 percent of GDP and more than half of the employment in 1999 in Haiti, whereas it accounts for only 4.7 percent of GDP and 20.5 percent of employment, respectively, during the same period in Mexico. Mexico reduced the share of the

agricultural sector both in GDP and in employment in 2010 (especially, employment decreased from 20.5 percent to 13.1 percent), but the situation is apparently almost unchanged in Haiti although employment data in 2010 are unavailable. Mexico has expanded the industrial sector in terms of GDP and ex-farmers were absorbed into the service sector during 1999–2010, whereas the GDP contributions of the industry and manufacturing sectors remained almost unchanged in Haiti during that period.

As discussed thoroughly in Chapter 2, the *Living Conditions Survey in Haiti* in 2001 shows that nearly 80 percent of the population subsists below the poverty line. About 30 percent of the main household providers are unemployed or inactive. In addition, the opportunities for wage employment are extremely limited (only 10 percent of main household providers are engaged in it). Furthermore, it is estimated that 70–80 percent of the labor force is involved in the informal sector in Haiti (Jadotte, 2004).

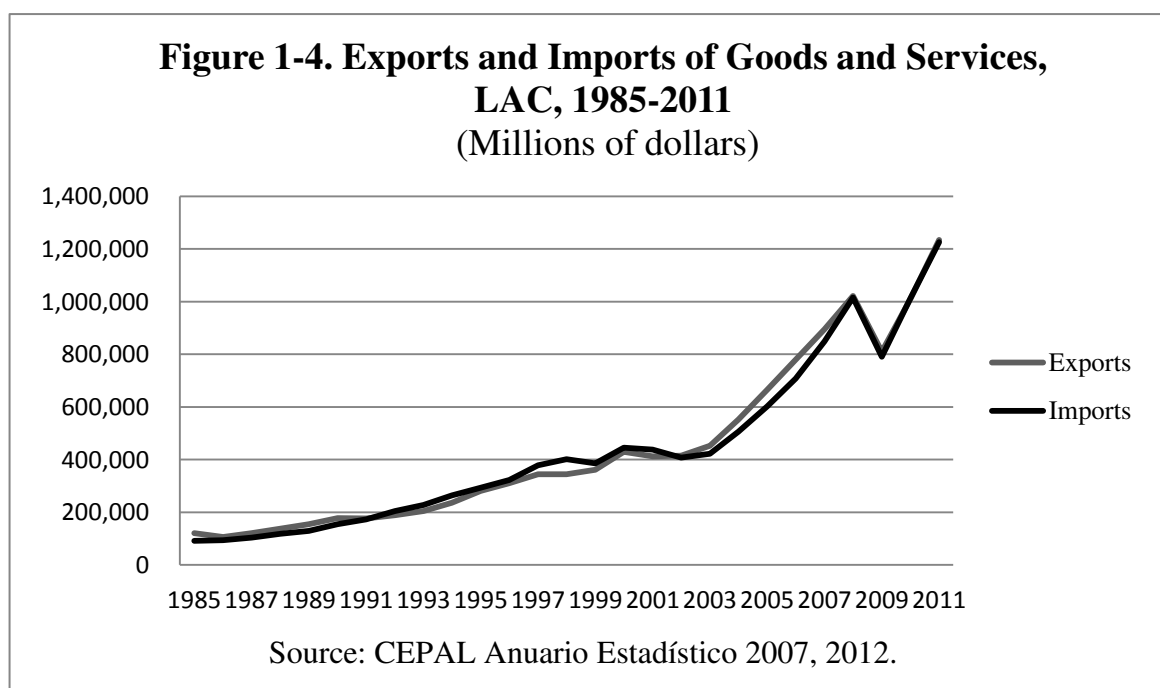
With respect to the external sectors, Figure 1-5 shows that Haiti's external balance is extremely negative: imports exceed exports to a great degree. The trade deficit has been growing since the 1990s, which indicates not only that Haiti has failed to develop export industries, but also that its domestic industries are virtually non-existent. Figure 1-7 shows that there had been virtually no foreign direct investment (FDI) during the embargo period, after the 1991 coup, which ended in 2004. It is noteworthy that the FDI inflows were even negative in Haiti in 1992–1994, although Latin America and the Caribbean as a whole experienced a FDI booming period in the 1990s, including Mexico.

Mexico almost always has a trade deficit, as do most Latin American and Caribbean countries. However, as Figure 1-6 shows, Mexico drastically increased its trade volume (both exports and imports) since the 1990s, in line with the neoliberal reform process. The trade grew even more in the 2000s until the Lehman Shock in 2008, except for a couple of years of stagnation in the early 2000s attributable to recession in the United States²¹.

²¹ Mexico's largest trade partner, both in exports and imports, is the United States. The second largest partners were the European Union in the 1980s and 1990s, but Asia replaced

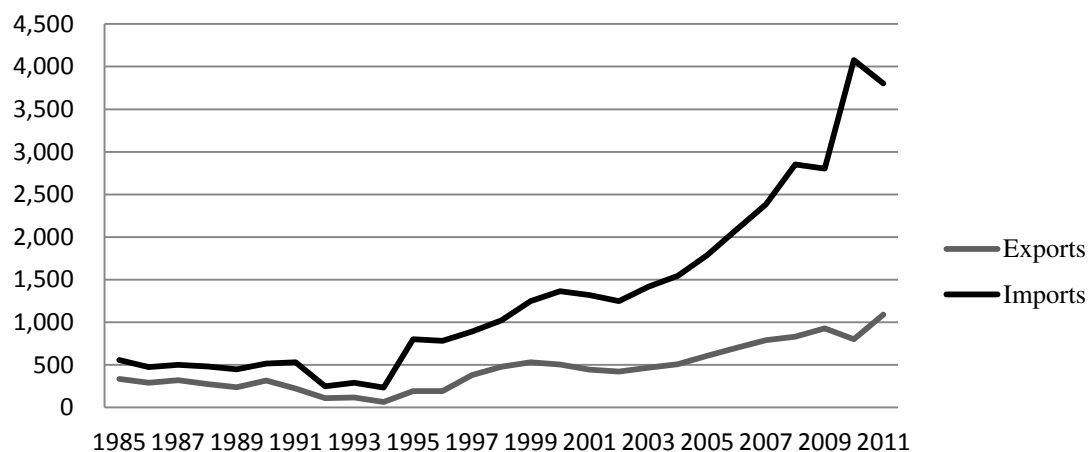
Figure 1-4 shows that Latin American trade growth was slower in the 1990s (especially compared to that of Mexico), but it accelerated in the 2000s mainly because of the commodity boom.

Many households in Latin American and the Caribbean rely on foreign remittances from family members and relatives. Haiti and Mexico are no exceptions. Figure 1-8 shows, however, how heavily the Haitian economy depends on remittances. Amuedo-Dorantes et al. (2010) reported that workers' remittances as a share of GDP increased from 5 percent in 1996 to more than 20 percent in the 2000s. In addition, data from the *Living Conditions Survey in Haiti* (ECVH, 2001) show that a quarter of all households with main providers are aged 15–65 receive remittances. Consequently, consumption levels have been maintained by remittances, which have increased continually since the mid-1990s, in response to the decline of GDP per capita because of political and economic turmoil (World Bank, 2006), a phenomenon that is discussed thoroughly in Chapter 2.



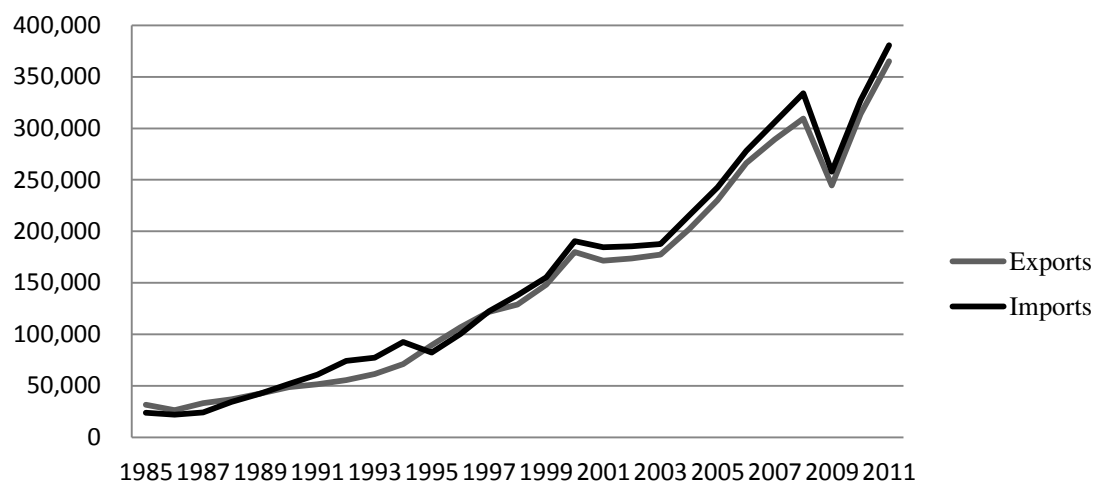
the EU as the second largest import partner after the 2000s. The import share from Asia is growing rapidly in the 2000s (Uchiyama, 2007).

**Figure 1-5. Exports and Imports of Goods and Services,
Haiti, 1985-2011**
(Millions of dollars)



Source: CEPAL Anuario Estadístico 2007, 2012.

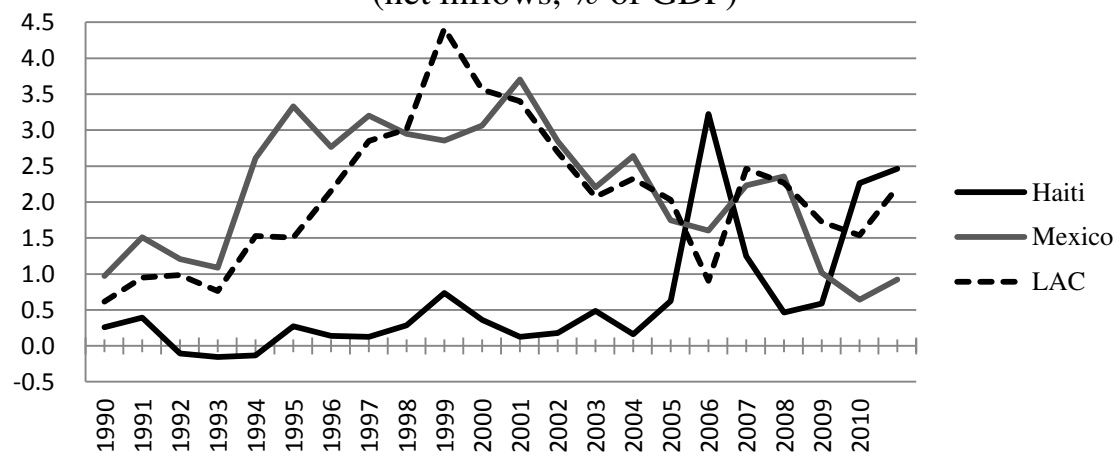
**Figure 1-6. Exports and Imports of Goods and Services,
Mexico, 1985-2011**
(Millions of dollars)



Source: CEPAL Anuario Estadístico 2007, 2012.

**Figure 1-7. Foreign Direct Investment (FDI),
1990-2010**

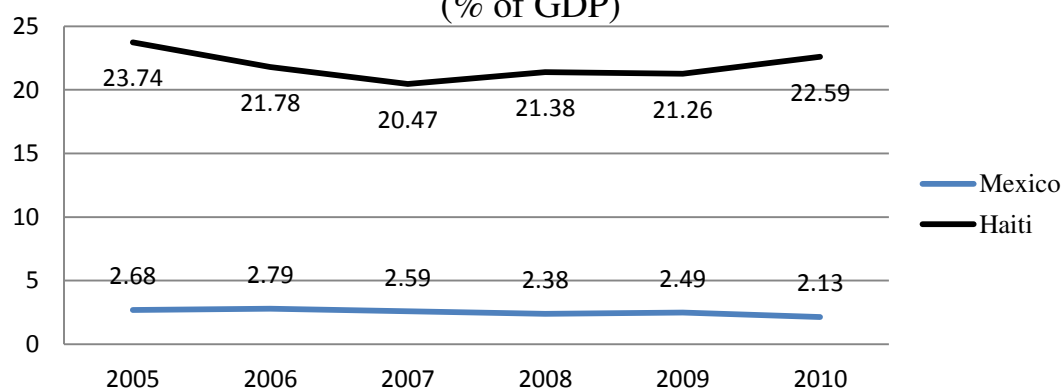
(net inflows, % of GDP)



Source: Author's elaboration based on CEPAL Anuario Estadístico 2007, 2012 and World Development Indicators (WDI) 2013.

Figure 1-8. Remittance Inflows

(Workers' remittances and compensation, total received)
(% of GDP)



Source: Author's elaboration based on CEPAL Anuario Estadístico 2007, 2012 and World Development Indicators (WDI) 2013.

Table 1-3 presents a comparison of major demographic and social development indicators of Latin America and the Caribbean (LAC), Haiti, and Mexico. The data show that Haiti is far below the LAC average in any indicator, whereas Mexico ranks over the

LAC average. Specifically, Haiti is well behind in human development that is expected to be related to poverty: life expectancy at birth only 62.1 years (vs. 74.7 in LAC and 76.5 in Mexico); the infant mortality rate is quite high at 43.6 per thousand (vs. 18.9 in LAC and 13.7 in Mexico); the adult literacy rate is 48.7 percent (vs. 91.4 percent in LAC and improvement from 91.6 percent in 2005 to 93.1 percent in 2010 in Mexico); and the HDI is among the world's worst.

Table 1-3. Demographic and Social Indicators

	Year/Period	Country/Region		
		LAC ^a	Haiti	Mexico
TOTAL POPULATION (Thousands of persons, at mid-year)	2010	590,082	9,884	112,364
TOTAL POPULATION GROWTH RATE (Average annual rate per 100 inhabitants)	2010–2015	1.10	1.23	1.03
PERCENTAGE OF URBAN POPULATION (Percentage of total population)	2010	78.80	45.30	78.00
LIFE EXPECTANCY AT BIRTH (Years, average)	2010–2015	74.70	62.10	76.50
INFANT MORTALITY RATE (Per thousand live births)	2010–2015	18.90	43.60	13.70
LITERACY RATE (Percentage of the population aged 15 years and older)	2005	91.40	48.70	91.60
	2010	91.40	-	93.10
HUMAN DEVELOPMENT INDEX ^b (World ranking among 187 countries in parentheses)	2012	-	0.456 (161)	0.775 (61)

Notes:

a) LAC stands for Latin America and the Caribbean.

b) UNDP International Human Development Indicators:

<http://hdrstats.undp.org/en/indicators/103106.html> (accessed on Dic. 11, 2013)

Source: Author's elaboration based on CEPAL Anuario Estadístico 2012.

Table 1-4 shows the Gini coefficients. Latin America and the Caribbean have the highest income inequality in the world (higher than Sub-Saharan Africa). Mexico's inequality is higher than the regional average, but Haiti is the most unequal country in LAC, along with Brazil.

Table 1-4. Gini Coefficients

Haiti ^a	0.59
Mexico ^b	0.50
LAC ^c	0.49
Sub-Saharan Africa ^c	0.47
South Asia ^c	0.32

Notes:

a) 2001 based on World Development Indicators (WDI) 2013.

b) 2002 based on WDI 2013.

c) Based on Jadotte (2007) Table 1 (originally from WDI 2001).

Source: WDI 2013 and Jadotte (2007).

Table 1-5 presents the poverty headcount ratio by different poverty lines of LAC, Haiti and Mexico. The high incidence of poverty in Haiti is readily apparent: about 62 percent of people subsist on less than 1.25 US dollars (PPP) per day (extremely poor) and about 78 percent subsist on less than 2 US dollars (PPP) per day (poor). The table's second row shows that as many as 88 percent of rural population are poor in Haiti. In contrast, only 3.9 percent subsist on less than 1.25 US dollars (PPP) per day and 13.5 percent subsist on less than 2 US dollars (PPP) per day in Mexico. One should note, however, that Mexico's poverty persists as a major development issue when applying different poverty lines. The poverty incidence rises to 54 percent (at the national level) when using the World Bank based country-specific poverty line, and to 33 percent in case of ECLAC based poverty

line. In this sense, Mexico presents a good example of how the magnitude of poverty ratios is prone to fluctuate depending on which poverty line to use, as discussed in the previous section. Mexico's poverty ratios are slightly lower than the LAC average in three dimensions. Still, rural poverty is also outstanding in Mexico.

Table 1-5. Poverty Headcount Ratio by Different Poverty Lines
(% of population)

	LAC ^c 2002	Haiti 2001	Mexico 2002
\$1.25 a day (PPP)	–	62	4
\$2 a day (PPP)	–	78	13
<i>(World Bank based country-specific)^a</i>			
National poverty line	–	78	54
Rural poverty line	–	88	69
Urban poverty line	–	45	44
<i>(ECLAC based)^b</i>			
National poverty line	36	–	33
Rural poverty line	53	–	45
Urban poverty line	32	–	27

Notes:

a) Based on World Development Indicators (WDI) 2013.

b) Percentage of households having incomes amounting to less than twice the cost of a basic food basket. Includes indigent households.

c) LAC Estimate based on 19 countries

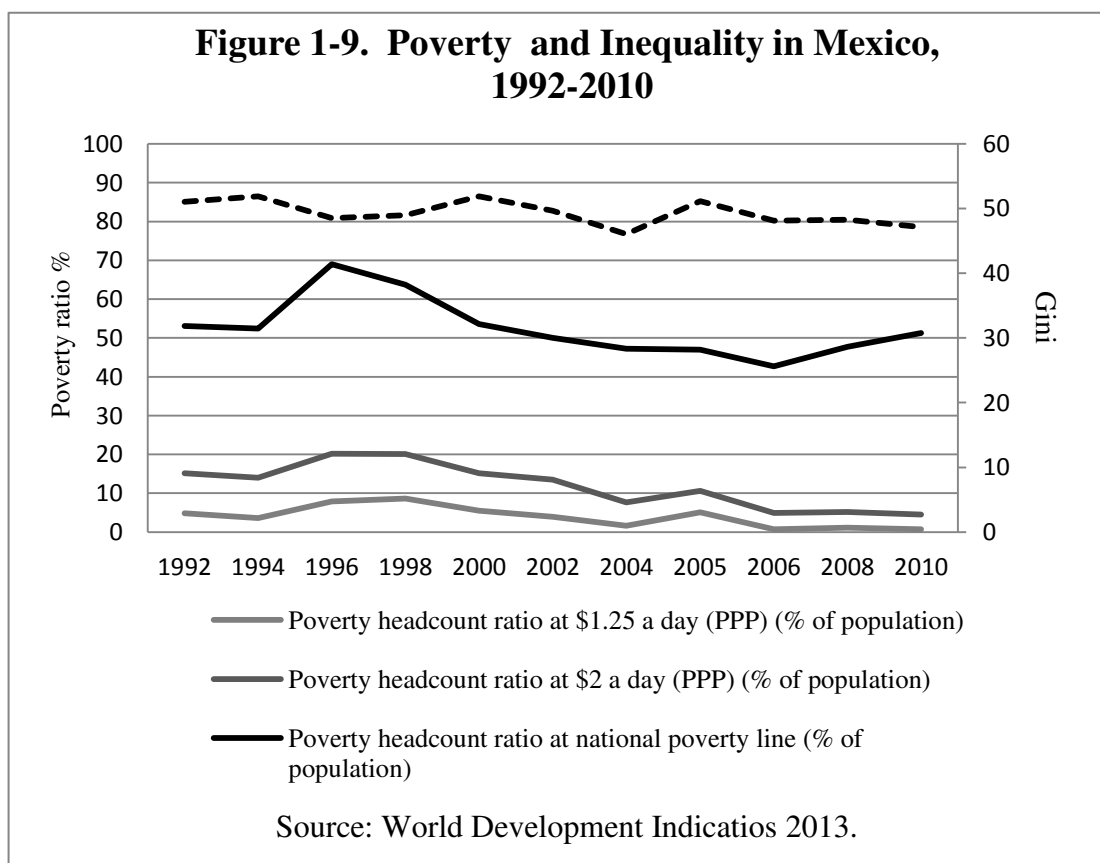
Source: WDI 2013 and CEPAL Anuario Estadístico (ECLAC Statistical Yearbook) 2003.

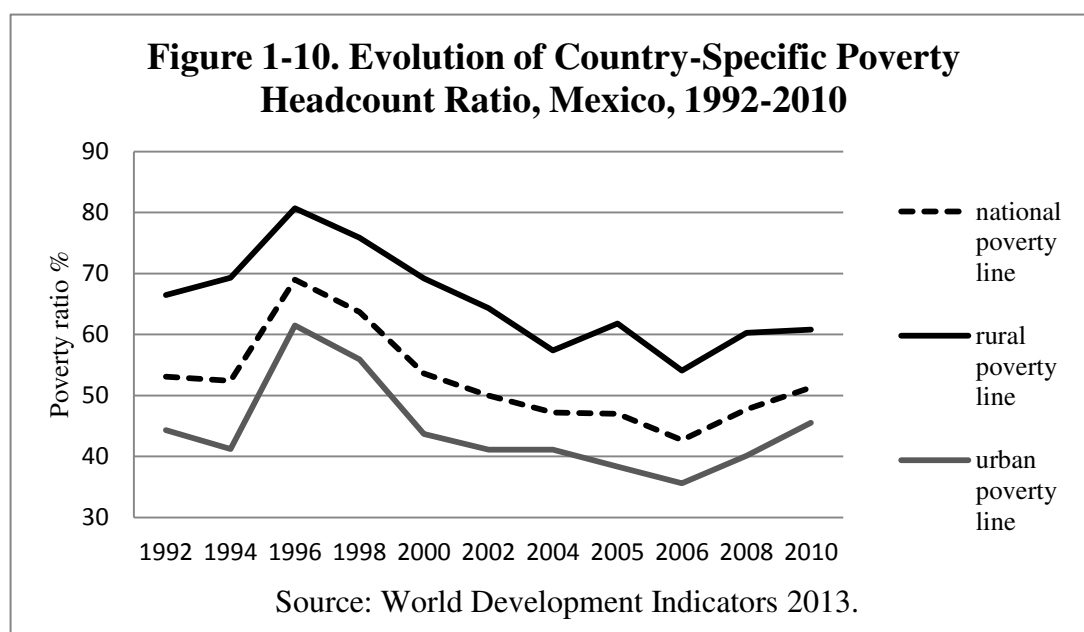
Figure 1-9 presents evolutions of poverty and inequality in Mexico after the 1990s²². The Gini coefficient has not changed much, but it has exhibited a decreasing trend. The poverty headcount ratios, as represented by 1.25 US dollars and 2 US dollars per day (international poverty lines), decreased greatly since the late 1990s mainly because of the stable economic growth of the period. The headcount ratio at the national poverty line was also in a decreasing trend along with the international poverty lines until 2006, but it reversed since then. Figure 1-10 shows poverty trends using the country-specific poverty line. It reveals that the national as well as rural and urban poverty ratios rose between 2006

²² Haiti's poverty-related indices are available only for 2001 in any of the World Development Indicators.

and 2008. However, the rural poverty ratio remained unchanged in 2008–2010, although the national poverty ratio continued to rise in the same period because of worsening of the urban poverty ratio. The major factors of this poverty degradation are expected to be the Lehman Shock and the consequent economic recession and the food price crisis caused by the commodity boom that occurred during that period, as discussed in Chapter 3.

Causes of the recent poverty degradation in Mexico must be identified. One might say, however, that the recent poverty degradation caused by uncertain international economic situations strongly implies that Mexican people (specifically poor people) remain vulnerable to shocks and fall easily into a poverty trap, as discussed in Chapter 4.





1-7. Aims and Scopes of the Study

This chapter presented overviews of concepts and measures of poverty, inequality, and vulnerability, with continued discussion of major poverty-related issues: poverty profiles and pro-poor growth. We specifically examined the macroeconomic and poverty outlook of Latin America, especially contrasting those of Mexico and Haiti. Based on the discussions presented in the chapter, we set the aims and scopes of the study.

First, the chapter revealed that poverty and vulnerability persist as extremely important issues in Latin America and the Caribbean. That region, generally regarded as a middle income region with the recent stable growth and sound macroeconomic performances after the 2000s, is in reality a diverse region not only in political, historical, cultural, and climatic dimensions, but also in terms of the degree of economic development among its nations. One can readily observe that Haiti and Mexico are respectively situated at either end of the development spectrum in LAC. Mexico is a leading economy among LAC countries, making the most of globalization in its development process and implementing various poverty reduction policies that are now convergent to the CCT program. Despite

all these efforts, Mexico retains a high incidence of poverty and vulnerability. Haiti, in contrast, has been struggling with political turmoil and damage from natural disasters even into the 1990s and 2000s, which has isolated the country almost completely from the global world, although it receives humanitarian aid such as United Nations Stabilization Mission (MINUSTAH). In consequence, Haiti remains an extremely poor country among world nations, with extremely high incidence of poverty and inequality, where a large proportion of people have no choice but to engage in subsistence agriculture.

Consequently, studying the cases of Haiti and Mexico will provide valuable insights to understand fundamental aspects of poverty and vulnerability in Latin America and the Caribbean, and will enable us to draw many implications. Because Haiti and Mexico occupy each end of the development spectrum, the scopes and methods for their study are expected to be different. Considering the difficulties of Haiti discussed in the preceding sections—specifically the lack of economic activities other than subsistence agriculture, abundant rural labor force and extremely low level of human capitals—the creation of sufficient job opportunities in non-agricultural sectors is urgently necessary to reduce poverty in Haiti. From this perspective, Chapter 2 presents discussion of poverty in Haiti with emphasis on employment issues.

In Mexico, an upper middle income country with a highly globalized and industrialized economy among LAC nations and indeed among world nations, poverty has maintained a decreasing trend in the recent decade, even though its incidence remains high as a result of macroeconomic stability and stable growth during the period until 2008. Nevertheless, that favorable trend has reversed with the global recession caused by the Lehman Shock. Rising international commodity prices have also directly and adversely affected poor households. This fact implies that poor Mexicans are actually highly vulnerable to shocks, and that global shocks immediately influence poor people. Considering these facts, Chapters 3 and 4 present analyses of rural household vulnerability in Mexico, particularly addressing the

impacts of rising international food prices (Chapter 3) and rural risk-sharing mechanisms (Chapter 4). Both chapters also examine effects of the conditional cash transfer (CCT) program on rural vulnerability in Mexico.

Chapter 2

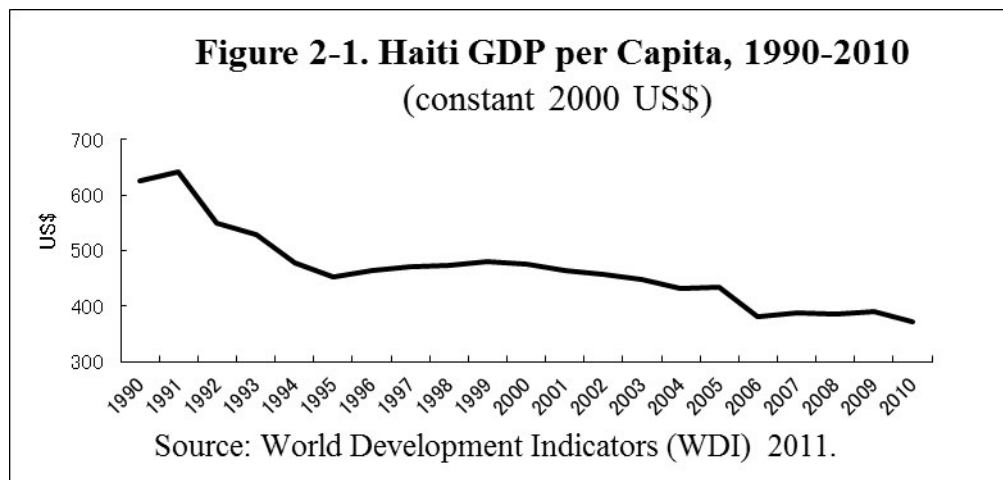
Poverty and Employment Problems: The Case of Haiti

2-1. Introduction

Haiti is the poorest country in Latin America and the Caribbean (LAC)¹: its Gross Domestic Products (GDP) per capita was US\$729 in 2008 and its UNDP Human Development Index (HDI, 2009) was 0.532, ranked 149th among 182 countries. Its population is about 9.9 million in 2009, making it the most densely populated country in LAC. The Haitian economy has fallen into a negative trend after the coup in 1991, which was followed by political instability and the embargo period. In 2004, another political turmoil occurred when the then President Aristide went into exile forced. Since President Preval was elected in 2006 with the active interventions of the international community, the economic and social situation has been improving. Even though the economic growth has resumed since 2004, Haiti has still not recovered the level of GDP per capita it had in 1990, as shown in Figure 2-1.

According to Lundahl (1983; 2004), the causes of poverty in Haiti lie in the low productivity and overpopulation of the small farming sector that dominates the Haitian economy. As a result, the falling income in the countryside pushes people into the cities, especially to Port-au-Prince, which displays all the characteristics of overcrowding, with high open unemployment, most of the urban labor force in informal self-employment, insufficient physical infrastructure, etc. (Lundahl, 2004)

¹ World Bank Country Brief: <http://web.worldbank.org/> (accessed on Aug. 6, 2010)



The *Living Conditions Survey in Haiti* in 2001 shows that nearly 80 percent of the population lives below the poverty line, and about 30 percent of main household providers are unemployed or inactive. In addition, the opportunity for wage employment is very limited (only 10 percent of main household providers are engaged in it). Furthermore, it is estimated that between 70 and 80 percent of the labor force is absorbed by the informal sector (Jadotte, 2004). Thus economic development and the creation of sufficient job opportunities are urgently needed to reduce poverty in Haiti. However, the devastating earthquake in January 2010 has virtually destroyed its economy that had just started to recover. The fact that there had not been an autonomous economy in Haiti even before the earthquake will present great challenges for rebuilding a new structure. Taking into account these difficulties, this study considers wage income a key factor for poverty reduction in Haiti. The discussion in this chapter will be focused on the relationship between poverty, inequality and the occupational choice of a household, and subsequently on the probability of becoming a wage worker and on the determinants of wage income.

The next section presents an overview of the poverty and inequality in Haiti as well as the characteristics of households' income sources. Wage income is identified as an

important income source that is useful for escaping poverty. In Section 2-3, we conduct an empirical analysis of the job selection of main household providers using a multinomial logit model. Our analysis reveals the lack of job opportunities in Haiti, and underscores that education and remittance income play important roles in determining the occupations of main providers. Section 2-4 estimates the probability of becoming a wage worker using a probit model and then estimates a wage equation using a sample selection model. Section 2-5 concludes this chapter and presents the implications for job creation and consequently, for poverty reduction.

2-2. Poverty and Inequality in Haiti

2-2-1. Overview

Table 2-1 presents the geographical distribution of poverty in Haiti. At the national level, 77 percent of the population lived below the poverty line of US\$2 per day and 56 percent of the population lived in extreme poverty (less than US\$1 per day) in 2001. It is noteworthy that poverty was mainly a rural phenomenon because two-thirds of the total population lived in rural areas, of which 67 percent and 88 percent were extremely poor and poor, respectively. A weighted average (by population) indicated as ‘H1 contribution’ in the table shows that 77 percent of the extreme poor lived in rural areas.

Table 2-1. Geographical Distribution of Poverty in Haiti, 2001
(Percent)

	Extreme Poverty (H1) ^a	Poverty (H2) ^b	Contribution (H1)	Population Share
Metropolitan area	23	45	9	23
Other urban area	57	76	14	14
Rural area	67	88	77	63
National	56	77	100	100

Notes:

a) less than US\$1 per day

b) less than US\$2 per day

Source: Sletten and Egset (2004) Table 3.

Haiti is not only the poorest countries, but also the one with the most unequal distribution of income in LAC, a region that is known as the most unequal region in the world. As shown in Table 2-2, Haiti's Gini coefficient is 0.65² in 2001, making it higher than that of Brazil, the country that had always been regarded as the most unequal among the LAC countries (Jadotte, 2007).

Table 2-2. Gini Index

Haiti	0.65
Brazil	0.60
LAC	0.49
Sub-Saharan Africa	0.47
South-Asia	0.32

Source: Jadotte (2007) Table 1.

2-2-2. Household Income Sources

As we see in Figure 2-2, the main income sources of Haitian households are self-employment (36.6 percent), wages (20.6 percent), and transfers (25.5 percent). One of the characteristics of Haiti's income composition is that the wage share is relatively small (only 20.6 percent) while self-employment (36.6 percent) is the principal source and transfers (three-quarters of them consist of foreign remittances) are the second most important (25.5 percent). In fact, consumption levels have been maintained by remittances that have been increased since mid 1990s while GDP per capita declined because of political and economic turmoil (World Bank, 2006). However, rural people have only a limited access to wages and transfers, which are important income sources to alleviate poverty in Haiti³. Self-employment (43.3 percent) and self-consumption

² Calculation based on household survey data in 2001 (Jadotte, 2007).

³ Wages and transfers account for only 9.1 percent and 16.4 percent of the total average

(24.7 percent) are the most important source in rural areas.

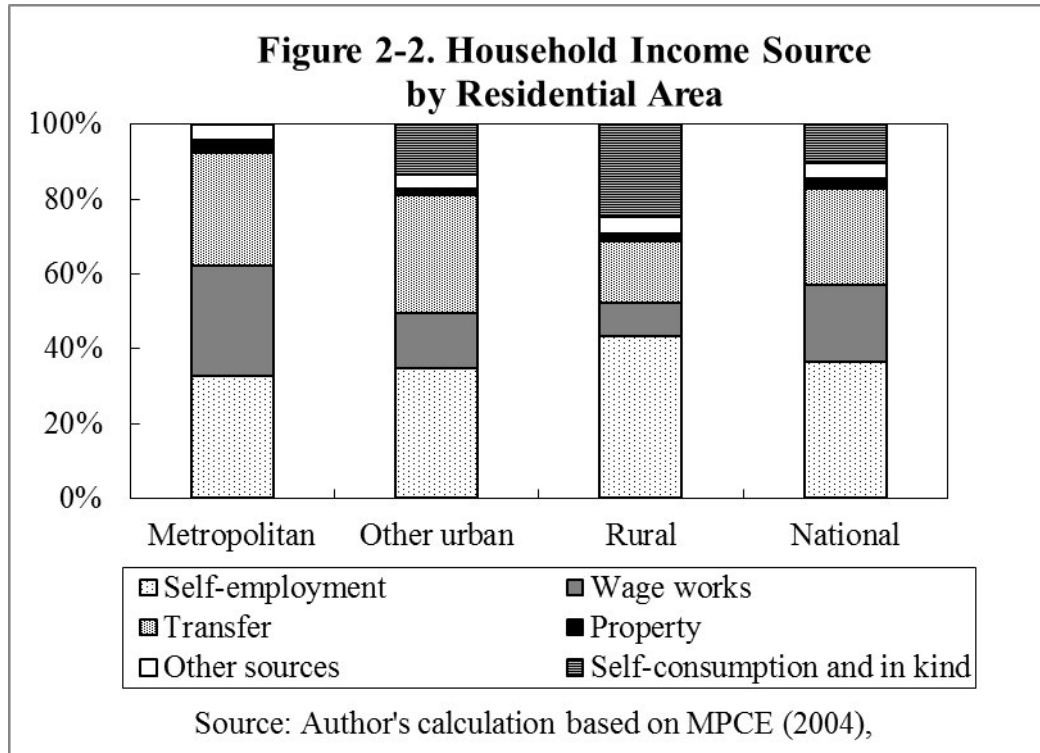
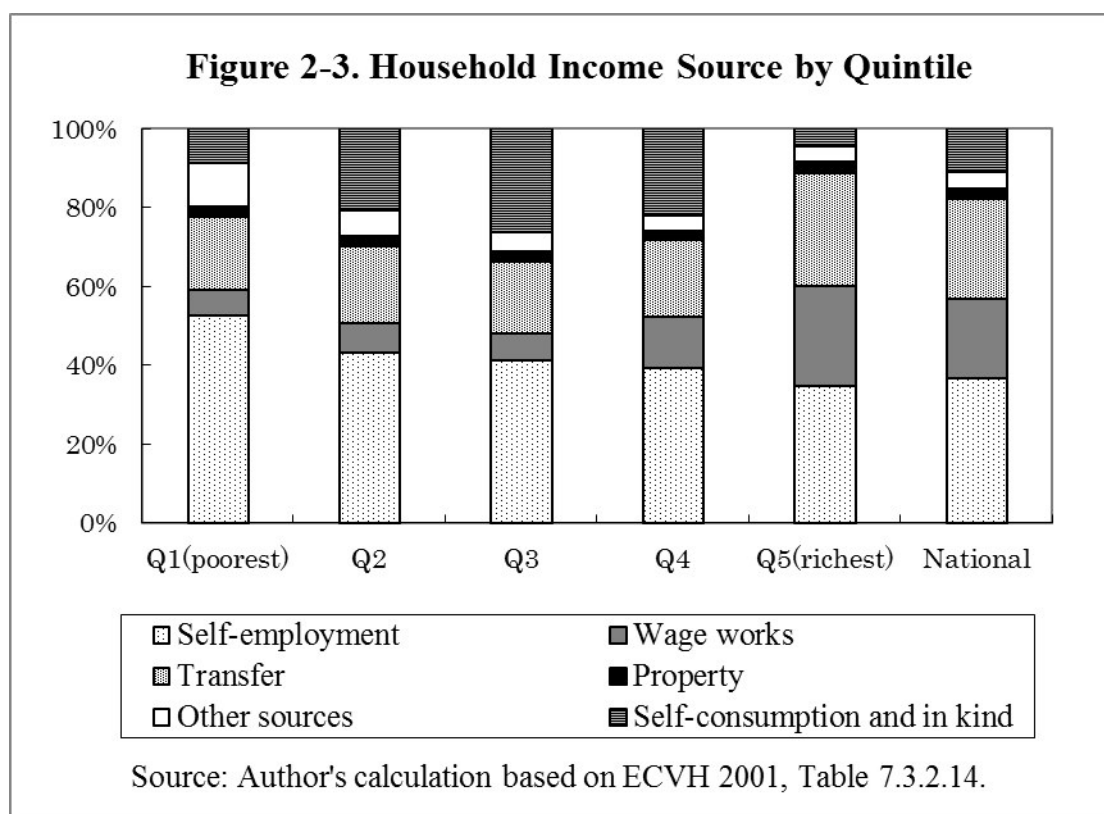


Figure 2-3 presents the income composition of the average household in each income quintile. It should be noted that self-employment is the most important income source for all the quintiles. Specifically, it accounts for 52.4 percent of the total income in Q1 (the poorest). However, the share of self-employment decreases and that of wage income increases in households of richer quintiles. For instance, wage income accounts for more than 25 percent in the richest quintile (Q5), although its share is well below 10 percent in Q1–Q3. It is also notable that self-consumption is the second most important source of income for Q2–Q4 households, which indicates that the households in these quintiles (Q2–Q4) are most likely engaged in agriculture. In contrast, it is likely that

income in rural areas, while their shares are 29.6 percent and 30.0 percent in the metropolitan area and 14.7 percent and 31.6 percent in other urban areas, respectively (MPCE, 2004).

most people who belong to Q5 have non-agricultural work because self-consumption is extremely low.



In summary, i) Haiti is characterized by extremely high poverty incidence and inequality. ii) The rural population is still dominant and most of the rural poor depend mainly on self-employment and self-consumption. iii) The fact that 77 percent of the population lived below the poverty line suggests that most households belonging to Q1–Q4 are poor, and that self-employment is their principal income source. Access to wage income and transfers plays an important role in enabling escape from poverty in Haiti.

In this respect, agricultural development and increasing wage employment are expected to be key factors for economic growth and poverty reduction in Haiti. Although numerous research efforts have elucidated agricultural development⁴, few

⁴ For rural poverty analyses and agricultural development, see World Bank (2005; 2006) and Verner (2005; 2008). Arias et al. (2006) examine coffee sector, which has

studies have examined issues relating to wage job opportunities. Furthermore, agricultural development itself could have limitations due to difficult natural conditions in Haiti, such as the demographic pressure that causes the division of arable land into smaller plots (in 2001, nearly 78 percent of farmers owned less than 2 ha. of land), a mountainous topography in which two-thirds of the farmland have slopes of more than 20 percent, and severe soil erosion. (World Bank, 2005; MPCE, 2007). Also, as Table 2-3 shows, although one half of the employment is in agriculture, its value-added is relatively low (less than 30 percent) compared to other sectors. Therefore, in addition to agricultural reform, the development of non-agricultural sectors which have higher productivity would be indispensable for Haitian economic development, as many development theories suggest, in order to absorb rural overpopulation.

Table 2-3. Sector Production and Employment

	1999			2002		
	Agriculture	Industry	Service	Agriculture	Industry	Service
Value Added (% of GDP)	29.7	16.2	54.1	27.9	16.8	55.3
Employment (%)	50.6	10.7	38.7	50.4*	8.0*	41.3*

Note: Data with asterisk are those of 2001 by own calculations based on ECVH 2001.

Source: World Development Indicators (WDI) 2011.

For these reasons, the remainder of this chapter is devoted to employment problems in Haiti, with a special emphasis on wage employment.

2-3. Lack of Job Opportunities and Occupational Choice

In this section, issues of the occupational choice of main household providers will be analyzed using the *Living Conditions Survey in Haiti 2001 (Enquete sur les Conditions de Vie en Haiti: ECVH-2001)*. This is a multi-topic national household survey

been the most important sector for agricultural export. For the government's agricultural development strategies, see I-PRSP (2006), MPCE (2007), and so on.

commissioned by the UNDP and implemented by the Haitian statistical office (*Institut Haitien de Statistique et d'Informatique: IHSI*) in collaboration with Fafo⁵. The data reflect the responses of 7,810 households and 33,007 individuals nationwide. This household survey is the only one available and is most comprehensive microdata on Haiti to date.

2-3-1. Overview

Table 2-4 presents the principal jobs of main providers (age 15–65) of households. Main providers who are inactive or unemployed account for as much as 30 percent of the total, not only at the national level, but also in both urban and rural areas. Wage employees are only about 11 percent of the total at the national level (19 percent in urban areas and only 6 percent in rural areas). The rest (about 60 percent) are categorized as self-employed either in agricultural or non-agricultural sectors at the national level. The data clearly indicate that job opportunities are limited in Haiti.

Table 2-4. Principal Jobs of Main Providers (Age 15–65), 2001

	(percent)		
	All	Urban	Rural
Inactive	19.55	17.99	20.41
Unemployment	10.12	14.11	7.9
Wage Employment	10.73	18.72	6.28
Self-employment (non-agriculture)	27.52	33.56	24.16
Self-employment (agriculture)	32.09	15.62	41.25
Total	100	100	100
Sample Size	5,771	2,062	3,709

Note: 'Family assistance' and 'wage employment in agriculture' are excluded.

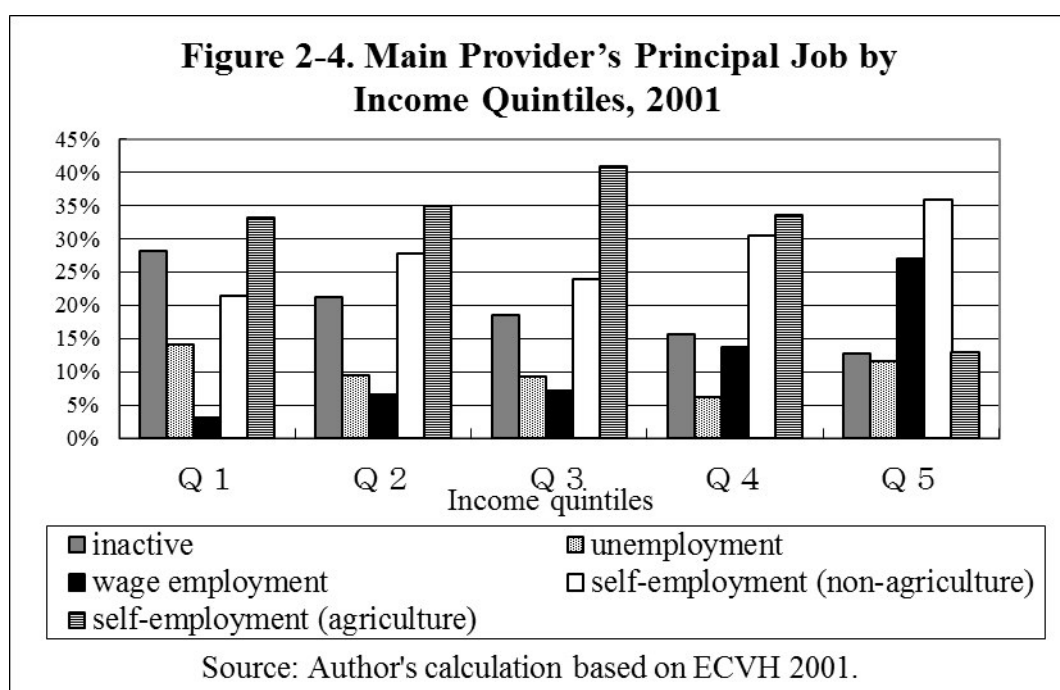
Source: Author's calculation based on ECVH 2001.

The relationship between occupational distribution and poverty and inequality can be

⁵ Fafo is a Norwegian independent and multidisciplinary research foundation.

described as follows. Figure 2-4 presents the main provider's occupational choice by income quintiles of households. The share of wage employment is sharply higher (26.9 percent) among main providers in the richest quintile (Q5), while the share of agricultural self-employment is remarkably low (12.9 percent). Underscoring the clear difference of job choice between poor (Q1–Q4) and non-poor households (Q5), we can again infer that access to wage employment (especially in the non-agricultural sector) must play a key role in a person's escape from poverty.

Previous studies on the job market in Haiti have revealed the importance of education in obtaining wage labor. Verner (2005; 2008) reported that the probability of getting employment in the non-farm sector is positively and significantly related to education levels in Haiti. Other regression results of earnings functions (income per capita or wage) reveal that education level has positive and strong effects on the level of earnings in Haiti (Sletten and Egset, 2004; Verner, 2008; Jadotte, 2006).



Wage employment requires higher skills than those of other occupations. Table 2-5 shows the employment sectors of active workers' primary jobs. Almost 70 percent of wage employment derives from the service sector. It is also notable that the service sector's labor force includes jobs that require high skills such as public administration (8.6 percent), education (23.1 percent), and health (6.7 percent), which suggests that only workers with high skills (signaled by high education) are eligible to become wage workers.

Table 2-5. Employment Sectors of Active Worker's Primary Job, 2001
(Percent)

	Average ^a	Wage employment	Self- employment
Agriculture, Fishing and Extracts	50.4	5.9	55.1
Agriculture	48.8	5.3	53.2
Fishing	1.3	0.1	1.6
Extraction	0.3	0.5	0.3
Industry and Construction	8.0	20.1	6.2
Manufacturing	5.6	12.4	4.6
Electricity, gas and water production	0.2	0.7	0.1
Construction	2.3	7.1	1.5
Commerce	27.3	5.9	32.6
Services	14.0	68.1	5.7
Hotels and restaurants	1.3	1.1	1.4
Transports and communication	1.6	4.6	1.3
Financial	0.2	1.0	0.0
Real estate and business services	1.1	4.7	0.5
Public administration and services	1.2	8.6	0.1
Education	3.4	23.1	0.3
Health and social action	1.2	6.7	0.3
Other community, social and personal services	2.0	7.7	1.1
Other services	2.0	10.6	0.7
Total	100	100	100

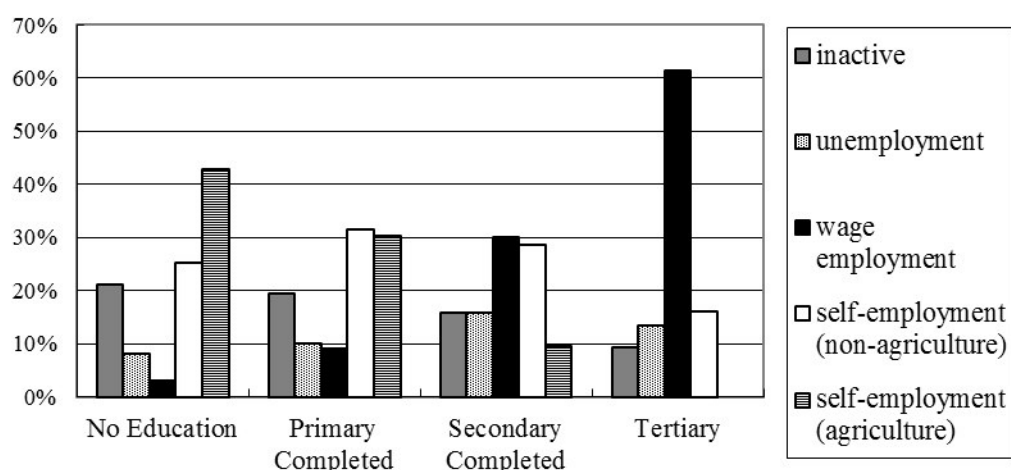
^a) 'Average' includes wage employment, self-employment and family assistance.

Source: Author's calculation based on ECVH 2001.

Figure 2-5 shows the correlation between a main provider's principal job and their education level. A clear correlation exists between wage employment and tertiary

education: more than 60 percent of those who have tertiary education are engaged in wage employment, although only 10 percent of workers that have completed a primary education live on wages. The share is almost zero for those who have not completed any level of education. Workers with higher education are more likely to be wage workers. We can also observe that the share of self-employment in agriculture is lower for higher education levels. None of the main providers with tertiary education lives on agriculture work.

Figure 2-5. Main Provider's Principal Job by Education Level, 2001

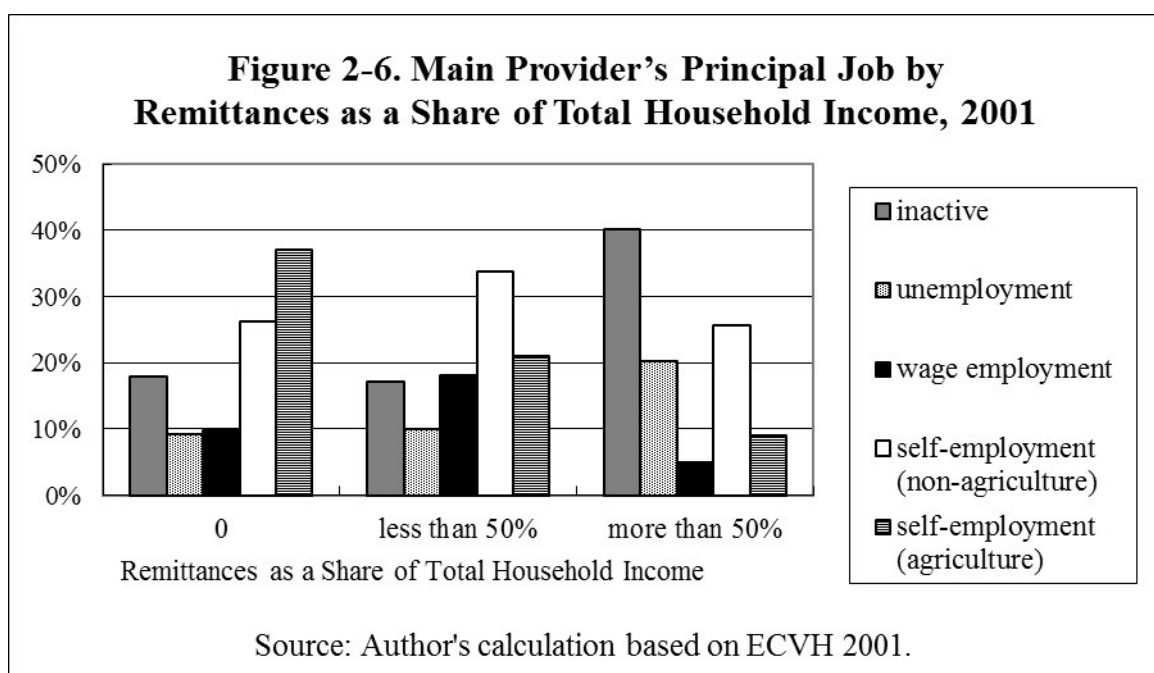


Notes: 'No education' includes those who have not completed primary education and 'Tertiary' includes those who have not completed tertiary-level education.

Source: Author's calculation based on ECVH 2001.

Another important determinant of occupational choice is remittances from abroad. As described in the previous section, transfers are the second major income source for Haitian households at an aggregate level (Fig. 2-3). The importance of transfers,

especially remittances from abroad⁶, is pointed out in many studies⁷. When it comes to the remittance inflows, Haiti's figures are outstanding compared to other Latin American countries: workers' remittances as a share of GDP increased from 5 percent in 1996 to 21.5 percent in 2006 (Amuedo-Dorantes et al., 2010). More remarkably, workers' remittances as a share of exports of goods amount to 211.1 percent in 2006 (Amuedo-Dorantes et al., 2010). In addition, data from the *Living Conditions Survey in Haiti* (ECVH 2001) shows that a quarter of all households whose main providers are aged 15–65 receive remittances. Consequently, consumption levels have been maintained by remittances that have increased continually since the mid-1990s, while GDP per capita declined due to political and economic turmoil (World Bank, 2006).



⁶ Three quarters of the transfers are foreign remittances (Sletten and Egset, 2004). According to Lundahl (2004), the Ministry of Haitians Living Abroad estimates about 2.5 million Haitian emigrants living in the United States, Canada, the Dominican Republic, Caribbean countries, and France, which represent more than a quarter of the total population of Haiti.

⁷ See Orozco (2006) for details about remittance economy in Haiti especially the conditions of migrants in the United States.

Figure 2-6 presents the relationship between job choice and the share of remittances in total household income. The figure shows that main providers are most likely to be self-employed (both in agriculture (37 percent) and in non-agriculture (26 percent)) if they do not receive remittances at all. In contrast, the share of self-employment (especially in agriculture) declines and the respective shares of those who are inactive and unemployed increase as the proportion of remittances exceeds 50 percent. This fact suggests a correlation between job choice (and especially the choice of whether to work or not to work) and the receipt of remittances. The following subsections describe econometric analyses of this occupational choice using a multinomial logit model.

2-3-2. Model

We assume that the occupational choice of workers can be described by the following multinomial logit function:

$$p_{ij} = \frac{\exp(\mathbf{x}_i' \boldsymbol{\beta}_j)}{\sum_{l=1}^m \exp(\mathbf{x}_i' \boldsymbol{\beta}_l)}, \quad (2.1)$$

where p_{ij} represents the probability that individual i chooses job j . There are m kinds of different job alternatives: five in this case (inactive, unemployment, wage employment in the non-agricultural sector, self-employment in the non-agricultural sector, and self-employment in the agricultural sector). In addition, $\mathbf{x}_i$ represents a vector of case-specific independent variables including a constant, variables related to education and remittances, and other control variables that are presumed to affect job choice.

2-3-3. Regression Results

Table 2-6 presents the regression results of the model described above. The sample only includes main household providers aged 15–65. The summary statistics are in

Appendix (Table A2-1). The control variables are *age*, *age squared*, *female* dummy (female=1), *marriage* dummy (married=1), *rural* dummy (equal to 1 if the main provider lives in rural areas at present), *born in Ouest* dummy (equal to 1 if the main provider was born in the Ouest (capital) region). Education related variables (dummies) are *primary* (equal to 1 if the main provider has completed primary education) and *secondary* (equal to 1 if the main provider has completed at least a secondary education, including those who have tertiary education). Regarding remittance-related variables, a dummy (equal to 1 if the household receives foreign remittances irrespective of its amount) is used in the first model and the share of foreign remittances in the total household income is used in the second model. The results of the two models are similar, but the second model fits slightly better than the first.

The results portray the likelihood of being inactive, unemployed, a wage worker or self-employed in agriculture relative to self-employment in non-agriculture. The estimated coefficients are transformed to relative risk ratios⁸.

First, the effect of education on job choice is positive and significant only for wage employment (the relative risk ratio is larger than 1). Having a certain level of education increases the likelihood of wage employment (relative to self-employment in non-agriculture): the odds of choosing wage employment are about 1.7 times greater if a main provider has completed primary education. The amount increases to more than five times if secondary or higher education is completed, compared to no education completed, which indicates that wage employment demands relatively higher skills (education attainment) than other occupations. In contrast, the probabilities of choosing

⁸ The odds ratio or relative risk ratio of choosing alternative j rather than alternative 1 (base) is given as

$$\frac{\Pr(y_i = j)}{\Pr(y_i = 1)} = \exp(\mathbf{x}_i' \boldsymbol{\beta}_j)$$

so $\exp(\beta_{jk})$ gives the proportionate change in the relative risk of choosing alternative j rather than alternative 1 (base) when x_{jk} changes by one unit (Cameron and Trivedi, 2009: p.486).

other job alternatives (inactive, unemployment, or self-employed in agriculture) decrease relative to self-employment in non-agriculture as the education level increases. In particular, main providers engaged in agriculture have a lower educational level even compared to those who are inactive or unemployed (in the case of primary education completed, the odds decrease by about 27–34 percent for inactive and unemployed individuals, and by more than 50 percent for agriculture). The coefficient of the *secondary* dummy for unemployment is not significant and the odds relative to self-employment in non-agriculture do not change (the relative risk ratio is nearly 1), which might imply that those who have certain education levels seek job opportunities other than agriculture whereas those with much higher education are more likely to become wage workers. Agriculture might not be profitable at all and might serve as the last resort for Haitian households.

The regression results reveal that those who have a certain level of education tend to choose non-agricultural jobs (including unemployment); they are more likely to choose wage employment if they have higher education. However, we might also infer the existence of a strong eligibility for wage employment because of the limited supply of skilled workers. In fact, Haitian educational levels are well below the LAC average. For example, the youth (aged 15–24) illiteracy rate in 2005 was 34 percent in Haiti, in contrast with 2–3 percent in Mexico and 6 percent in the Dominican Republic and throughout the LAC region (Amuedo-Dorantes et al., 2010). Additionally, data from ECVH 2001 show that half of the main providers aged 15–65 had completed no education, although almost 20 percent had completed secondary education; moreover, those who had completed tertiary education comprised only 1 percent.

The problem of education in Haiti is that public resources devoted to education are scarce compared to many other countries in the LAC region. According to Amuedo-Dorantes et al. (2010), the private sector—the primary vehicle by which access

to education is possible in Haiti—has become a substitute for public investment rather than a complement. Almost 90 percent of all schools in Haiti are private or parochial. Despite a constitutional guarantee of free education, public schools are costly and are of very low quality. Consequently, access to education remains problematic for vulnerable groups; it can be a heavy financial burden whether the child attends public or private schools (Amuedo-Dorantes et al., 2010). Improving both the education level and quality in Haiti, therefore, is of utmost importance.

However, improvements in education and increases in job opportunities are rather medium or long term objectives. The most practical and only way to earn flow income for the immediate improvement of living conditions, especially after the earthquake, must be via remittances from abroad.

With respect to the effect of foreign remittances on the occupational choice, the regression results show that the likelihood of being inactive or unemployed is higher when the main provider has remittance income and increases concomitantly with the increasing share of total household income. For inactive people, for example, the odds relative to self-employment in non-agriculture becomes 1.3 times higher if the main provider receives some sort of remittance (as in the first model) and four times greater if the household income consists only of remittances (as in the second model). In contrast, main providers are less likely to be engaged in wage employment or in agriculture (compared to self-employment in non-agriculture) if they receive remittances, and such employment likelihood continues to decrease concomitantly with an increase in remittances in the total income. This result suggests that remittance income makes main providers choose not to work, since remittances increase their reservation wages⁹.

⁹ Jadotte (2009) assesses the impact of remittances on labor market outcomes using data from ECVH 2001. He indicates that remittances increase the recipients' reservation wages because of the access to the non-market income flow. Furthermore, when we compare the average wage earnings between remittance receivers and non-receivers, remittance receivers earn higher wage (statistically significant at 5 percent). However,

Alternatively, it could be said that they become reliant on remittances because job opportunities are very limited and they cannot earn sufficient income to satisfy their daily needs.

Some other control variables also present interesting implications. First, female main providers are more likely to choose self-employment in non-agriculture than any other job alternative (the relative risk ratios of the coefficients of the female dummy are all less than 1). With respect to the *rural* dummy, it can be concluded that living in rural areas increases the probability of choosing agriculture or being inactive compared to self-employment in non-agriculture, and reduces the probability of choosing wage employment. Furthermore, it turns out that whether the main provider was born in the capital region or not is an important determinant of job choice: those who were born in Ouest are more likely to be wage workers or unemployed. Easier access to the capital city could be an advantage in choosing a better job (especially when it comes to choosing wage employment). In this respect, the reason why the likelihood of unemployment increases for those who were born in Ouest can be explained by the lack of job opportunities: people might wait for a good job opportunity, taking advantage of easier access to the capital city (and, therefore, to better information and infrastructure). Age and marriage, on the other hand, seem to have only weak effects on job choice because the magnitude of relative risk ratios is close to unity for most alternatives.

there is no statistically significant difference between wage workers in urban areas, but rural wage workers do have significant differences.

Table 2-6. Results of Multinomial Logit Model

	Model 1				Model 2			
	inactive	unemployment	wage employment	agriculture	inactive	unemployment	wage employment	agriculture
	VS self-employment	VS self-employment	VS self-employment	VS self-employment	VS self-employment	VS self-employment	VS self-employment	VS self-employment
<i>age</i>	0.771*** (-11.59)	0.847*** (-5.912)	0.997 (-0.0849)	0.955* (-1.878)	0.771*** (-11.46)	0.848*** (-5.865)	0.993 (-0.207)	0.954* (-1.901)
<i>squared age</i>	1.003*** (11.69)	1.002*** (4.946)	1.000 (-0.571)	1.001** (2.319)	1.003*** (11.48)	1.002*** (4.854)	1.000 (-0.424)	1.001** (2.312)
<i>female</i>	0.746*** (-3.304)	0.525*** (-6.123)	0.208*** (-13.71)	0.089*** (-27.33)	0.688*** (-4.174)	0.491*** (-6.717)	0.216*** (-13.29)	0.088*** (-27.40)
<i>married</i>	0.994 (-0.0758)	0.881 (-1.202)	0.723*** (-2.860)	0.902 (-1.166)	1.021 (0.238)	0.907 (-0.916)	0.690*** (-3.261)	0.897 (-1.224)
<i>rural</i>	1.494*** (4.628)	0.852 (-1.533)	0.711*** (-3.097)	2.817*** (11.37)	1.587*** (5.241)	0.892 (-1.084)	0.693*** (-3.331)	2.825*** (11.39)
<i>born in Ouest</i>	0.853 (-1.489)	1.624*** (4.165)	1.374** (2.542)	0.597*** (-4.670)	0.803** (-2.033)	1.543*** (3.703)	1.420*** (2.789)	0.590*** (-4.770)
<i>primary</i>	0.701*** (-3.612)	0.726** (-2.527)	1.676*** (3.280)	0.470*** (-7.957)	0.664*** (-4.133)	0.696*** (-2.870)	1.691*** (3.332)	0.458*** (-8.234)
<i>secondary</i>	0.647*** (-3.527)	1.035 (0.244)	5.171*** (10.48)	0.173*** (-12.52)	0.563*** (-4.613)	0.922 (-0.582)	5.411*** (10.87)	0.164*** (-12.95)
<i>remittance (dummy)</i>	1.318*** (3.006)	1.184 (1.496)	0.864 (-1.224)	0.689*** (-3.589)				
<i>remittance (share)</i>					4.222*** (8.768)	3.054*** (5.762)	0.360*** (-3.726)	0.496*** (-2.837)
Observations	5703				5703			
LR χ^2	2852				3000			
Pseudo R^2	0.166				0.174			

Notes:

- 1) *** p<0.01, ** p<0.05, * p<0.1
- 2) z statistics in parentheses.
- 3) Estimated coefficients are transformed to relative risk ratios (exp(β)).
- 4) Base: self-employment in non-agriculture.
- 5) Hausman test of independence from irrelevant alternatives (IIA) was not rejected at 5 % level for both models.

2-4. Wage Regression

In this section, a wage regression is conducted to analyze the determinants of this important income source for Haitian economic development and poverty alleviation. We use the sample selection model in estimating the wage equation taking into account the facts that the access to wage works is extremely limited in Haiti as we have analyzed in the previous sections. The probability of being a wage worker is estimated by using a probit model before the wage regression to see the determinants of the participation in the wage market. Policy implications will be suggested after the regression analysis. The data used hereafter is also the *Living Condition Survey* in Haiti 2001 (ECVH 2001), but the sample unit are individuals this time.

2-4-1. Literature Review

Some researchers have already estimated income equations of Haiti. Sletten and Egset (2004) carried out an income regression in Haiti. The results show that living in rural areas has a strong negative impact on household income, and that education and household main provider's employment status (especially being a wage worker) has positive impacts.

Verner (2005; 2008) conducts a quintile regression to analyze the determinants of the labor income (wage workers and self-employed workers). The main results are as follows; education plays an important part in the income determination process and face decreasing returns across the income distribution (as people belong to a richer group). Returns to experience (proxied by age) are very low and also falling across the income distribution. Females earn more than men at the median income quintile in urban areas, whereas they are paid less in 25th and median quintiles in rural areas. Incomes in agriculture are lower than other sectors (such as industry and services). She also estimates the probability of being employed in non-agricultural sector by using the

probit model and finds that education, gender, location and migration status are the important factors (Verner, 2005; 2008).

Different from previous studies discussed above, we will put emphasis exclusively on wage income as we have identified that wage income is one of the key factors to get out of poverty in the previous sections even though the opportunity for wage employment is very limited in Haiti.

2-4-2. Regression Method¹⁰

As mentioned above, we use the maximum likelihood version of the Heckit sample selection model to estimate the wage equation. For incidental truncation, the sample is representative of the entire population, but the observations on the dependent variable are truncated according to a rule whose errors are correlated with the errors from the equation of interest. We do not observe y (in this case, wage income) because of the outcome of some other variable, which generates the selection indicator, s (whether workers participate in the wage market or not). We can imagine fitting a binominal probit model that predicts the individual's probability of participation. In this circumstance, s_i is set to one if they participate in the wage market and zero otherwise.

$$\begin{cases} y_i = \mathbf{x}_i\boldsymbol{\beta} + u \\ s_i = I(\mathbf{z}_i\boldsymbol{\gamma} + v \geq 0) \end{cases} \quad (2.2)$$

where we assume that the explanatory factors in $\mathbf{x}$ satisfy the zero-conditional mean assumption $E(\mathbf{x}u) = 0$. The $I(\cdot)$ function equals 1 if its argument is true and is zero otherwise. We observe y_i if $s_i = 1$. The selection function (the second one of the equation (2.2)) contains a set of explanatory factors $\mathbf{z}$. The error term in the selection equation, v , is assumed to have a zero-conditional mean: $E(\mathbf{z}v) = 0$. We assume that v follows a standard normal distribution.

¹⁰ The explanation of this section is mainly based on Baum (2006).

As mentioned above, incidental truncation arises when there is a nonzero correlation between u and v . If these error terms are both normally distributed with zero means, the conditional expectation of u is $E(u|v) = \rho v$, where ρ is the correlation between u and v . Then from the equation (2.2),

$$E(y | \mathbf{z}, v) = \mathbf{x}\boldsymbol{\beta} + \rho v \quad (2.3)$$

We cannot observe v , but s is related to v by (2.2). Equation (2.3) then becomes

$$E(y | \mathbf{z}, v) = \mathbf{x}\boldsymbol{\beta} + \rho E(v | \mathbf{z}, s) \quad (2.4)$$

The conditional expectation $E(v|\mathbf{z}, s)$ for $s_i = 1$ is merely λ , the inverse Mills ratio (IMR). Therefore, we must augment the equation (2.2) with the IMR:

$$E(y | \mathbf{z}, s = 1) = \mathbf{x}\boldsymbol{\beta} + \rho \lambda(\mathbf{z}\boldsymbol{\gamma}) \quad (2.5)$$

If $\rho \neq 0$, OLS estimates from the incidentally truncated sample will not consistently estimate $\boldsymbol{\beta}$ unless the IMR term is included. However, if $\rho = 0$, the OLS regression will yield consistent estimates.

To compute the IMR term for each observation y_i ($s_i = 1$), we use a binominal probit model:

$$\Pr(s = 1 | \mathbf{z}) = \Phi(\mathbf{z}\boldsymbol{\gamma}) \quad (2.6)$$

This two-step procedure is often termed the Heckit model.

Instead, we can use a maximum likelihood (ML) procedure to jointly estimate $\boldsymbol{\beta}$, $\boldsymbol{\gamma}$, and ρ . According to Wooldridge (2002), the ML procedure will be more efficient than the two-step procedure under joint normality of u and v . If we introduce the stronger assumption that (u, v) is a bivariate normal with mean zero, $Var(u) = \sigma_1^2$, $Cov(u, v) = \sigma_{12}$, and $Var(v) = 1$, then partial maximum likelihood estimation can be used. The partial log likelihood is obtained by summing $l_i(\boldsymbol{\theta})$ across all observations¹¹:

$$\begin{aligned} l_i(\boldsymbol{\theta}) = & (1 - s_i) \log[1 - \Phi(\mathbf{z}_i\boldsymbol{\gamma})] \\ & + s_i \left\{ \log \Phi \left[\left(\mathbf{z}_i\boldsymbol{\gamma} + \sigma_{12}\sigma_1^{-2}(y_i - \mathbf{x}_i\boldsymbol{\beta}) \right) \times (1 - \sigma_{12}^2\sigma_1^{-2})^{-1/2} \right] \right. \\ & \left. + \log \phi((y_i - \mathbf{x}_i\boldsymbol{\beta})/\sigma_1) - \log(\sigma_1) \right\} \end{aligned} \quad (2.7)$$

¹¹ See Wooldridge (2002: p.566) for more details.

where $s_i = 1$ picks out when y_i is observed.

2-4-3. Summary Statistics

Table 2-7 shows the variables used in the regression. The sample is limited to economically active¹² individuals whose age is between 15 and 65. Wage income (per year in local currency (gourdes¹³)) includes income from any kind of wage works and excludes any other income sources such as self-employment, transfers or property incomes. It has a large disparity from 0 to 510,000 gourdes. When taking log, wages that equal to zero become a missing value. This implies that only 21.8 percent of the sample (1573 individuals) are wage workers, whose number is very small compared to other countries.

Haiti has 9 regions and the capital (Port-au-Prince) is in Ouest region. Thus Ouest is the most developed region, where most of the Haitian industrial sector is located, followed by Nord region. Other regions are exclusively agriculture-oriented. With respect to the education, it is surprising that half of the sample have not completed the primary education (no education) and only 2 percent have tertiary education. Those who have enough command of French¹⁴, which is correlated with the level of secondary education or higher and can be served as a proxy of human capital, account for 29 percent of the sample. As to employment sectors, agriculture and service and commerce are the leading sectors with 45 percent and 46 percent of employment respectively while industry and construction only accounts for 9 percent.

We first analyze what kinds of individuals are more likely to become a wage worker by using the probit model. Then, we estimate the wage equation by using the Heckit

¹² About 34 percent of the sample (age 15–65) is categorized as economically inactive. Still quite a few of them live on income transfers (domestic as well as foreign) and self-consumption in case of farmers since they are one of the most important income sources for Haitians (See Figures 2-2 and 2-3 in Section 2-2).

¹³ 38.35 Gourdes for 1 US dollar for 2004 (World Development Indicators 2007).

¹⁴ Haiti has two official languages: French and Creole.

sample selection model.

Table 2-7. Summary Statistics for Wage Regressions

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>wage</i>	7212	3,270.84	16,262.29	0	510,000.00
<i>logwage</i>	1573	8.21	1.78	2.48	13.14
<i>age</i>	7212	39.88	12.23	15	65
<i>sqage</i>	7212	1,740.08	1,009.36	225.00	4,225.00
<i>female</i>	7212	0.46	0.50	0	1
<i>married</i>	7212	0.65	0.48	0	1
Living Areas					
<i>metropolitan</i>	7212	0.14	0.35	0	1
<i>other urban</i>	7212	0.15	0.36	0	1
<i>rural</i>	7212	0.71	0.45	0	1
Regions					
<i>ouest</i>	7212	0.27	0.44	0	1
<i>sudest</i>	7212	0.09	0.28	0	1
<i>nord</i>	7212	0.07	0.26	0	1
<i>nordest</i>	7212	0.04	0.19	0	1
<i>artibonite</i>	7212	0.13	0.33	0	1
<i>centre</i>	7212	0.11	0.31	0	1
<i>sud</i>	7212	0.11	0.31	0	1
<i>grandanse</i>	7212	0.11	0.32	0	1
<i>nordouest</i>	7212	0.08	0.27	0	1
Education and Human Capital					
<i>no education</i>	7212	0.50	0.50	0	1
<i>primary</i>	7212	0.30	0.46	0	1
<i>secondary</i>	7212	0.19	0.39	0	1
<i>superior</i>	7212	0.02	0.14	0	1
<i>french</i>	7138	0.29	0.45	0	1
Employment Sectors					
<i>agriculture</i>	7212	0.45	0.50	0	1
<i>industry & construction</i>	7212	0.09	0.28	0	1
<i>service & commerce</i>	7212	0.46	0.50	0	1

Note: 'sqage' means age squared.

2-4-4. Regression Results

2-4-4-1. Probability of Being a Wage Worker

Table 2-8 shows the results of the probit model that estimates the probability of being a wage worker. The dependent variable is binary and equals 1 if an individual is a wage worker and zero otherwise. Thus the probability of being a wage worker rises when the coefficients have a positive sign and the probability decreases when the coefficients are negative. The independent variables we use in the probit model are age, age squared, living area dummies (metropolitan or rural compared to other urban areas) or regional dummy (Ouest compared to other regions), marital status dummy (married=1), female dummy (female=1), and human capital dummy proxied by *french* (whether the individual has a good command of French). We use the living area dummies and the regional dummy separately because the metropolitan areas virtually correspond to Ouest region. Marginal effects of the coefficients are shown in the table.

The results shows *age* is positive and *age squared* negative (but the marginal effects are virtually zero) and both are statistically significant in both columns. Individuals are more likely to be a wage worker when they get older. But its effect is relatively small. Living area and regional dummies have expected signs and are statistically significant. People living in the metropolitan area have 8.3 percent more possibility of being a wage worker and those living in rural areas have 4.4 percent less possibility than those living in other urban areas. The possibility increases by 5.9 percent in case of people living in the capital region (Ouest), compared to those living in other regions. Married dummy is negative and becomes statistically significant in both columns. Female dummy is negative and statistically significant in both columns; being female decreases the probability of becoming a wage worker by about 15 percent. Finally, the results indicate that human capital is an important determinant of the participation in the wage market; having a good command of French increases the probability by 11.8 percent in the first

column and by 14.5 percent in the second column.

Table 2-8. Regression Results: Probability of being a Wage Worker (Probit)

	dy/dx		dy/dx	
	(1)		(2)	
<i>age</i>	0.009	(3.44)***	0.010	(3.82)***
<i>sqage</i>	-0.000	(4.03)***	-0.000	(4.44)***
<i>metro*</i>	0.083	(4.29)***		
<i>rural*</i>	-0.044	(2.96)***		
<i>ouest*</i>			0.059	(5.04)***
<i>married*</i>	-0.030	(2.69)***	-0.031	(2.81)***
<i>female*</i>	-0.158	(16.79)***	-0.151	(16.14)***
<i>french*</i>	0.118	(9.31)***	0.145	(12.12)***
Observations	7138		7138	
LR chi2	638.42		594.10	
Prob > chi2	0.000		0.000	
Pseudo R2	0.086		0.080	

Notes:

1) Absolute value of z-statistics in parentheses.

2) * significant at 10%; ** significant at 5%; *** significant at 1%

3) Variables with asterisk(*) mean dy/dx is for discrete change of dummy variable from 0 to 1.

In summary, having enough human capital and living in the capital (the metropolitan area) increase the probability of becoming a wage worker, while females and those who live in rural areas are less likely to be a wage worker.

2-4-4-2. Wage Differentials

Table 2-9 shows the regression results of the maximum likelihood version of the Heckit model. The table shows only the results of the wage equation and those of selection equation are omitted. The wage equation is based on the Mincer type model and we use the following independent variables: age and age squared as proxies for experience, living area dummies (metropolitan and rural compared to other urban areas) or regional dummy (Ouest compared to other regions), female dummy, education

dummies (primary or secondary education completed or tertiary education compared to no education completed), and employment sector dummies (non-agricultural sectors compared to agricultural sector) as control variables. we use the same variables as in Table 2-8 (probit model) for the selection equation.

Table 2-9. Regression Results: maximum likelihood Heckit Model

(Only Wage Equation)				
dependent variable: logwage				
	(1)		(2)	
<i>age</i>	0.051	(2.69)***	0.054	(2.75)***
<i>sqage</i>	-0.000	(2.06)**	-0.001	(2.04)**
<i>metro</i>	0.599	(5.03)***		
<i>rural</i>	-0.286	(2.64)***		
<i>ouest</i>			0.480	(5.43)***
<i>female</i>	0.133	(1.16)	0.206	(1.80)*
<i>primary</i>	0.376	(4.43)***	0.424	(4.88)***
<i>secondary</i>	0.646	(6.05)***	0.792	(7.18)***
<i>superior</i>	1.534	(8.85)***	1.816	(10.36)***
<i>industry & construction</i>	0.928	(8.00)***	1.172	(10.04)***
<i>service & commerce</i>	1.122	(12.73)***	1.276	(14.40)***
<i>Constant</i>	7.410	(16.53)***	7.027	(14.86)***
Observations	7138		7138	
Uncensored obs	1548		1548	
Wald chi2	790.63		824.79	
Prob > chi2	0.000		0.000	
LR test of indep. eqns. (rho = 0):				
chi2(1)	12.12		16.12	
Prob > chi2	0.001		0.000	

Notes:

1) absolute value of z-statistics in parentheses

2) * significant at 10%; ** significant at 5%; *** significant at 1%

3) The same variables as those of Table 2-8 are used in the selection equation.

The results indicate that all the variables but female dummy have expected signs and

statistically significant. An individual can earn more when he/she gets older. Living in the metropolitan area raises wage levels by 59.9 percent while living in rural areas lowers them by 28.6 percent compared to living in other urban areas. Also, those who are in the capital region (Ouest) can get 48.0 percent more wages than those in other regions. We should note that the female dummy becomes positive in both columns and is statistically significant at 10 percent level in the second column since we usually expect that the dummy becomes negative in this type of wage regressions. This means that in Haiti, different from many other countries in the world, females earn the same or even higher wage than males, other things being controlled, once they enter in the wage market (note that female dummy is negative in the probit model). However, this result is consistent with that of other income regressions such as Verner (2005; 2008). We will discuss this issue in the next subsection.

Education has positive effects on wage levels and the returns to education are not constant. There exist wage premiums for workers with higher education. Primary completed workers can get 37.6 percent more wages than primary uncompleted workers while those with secondary completed and superior education get 64.6 percent and 153.4 percent more wages respectively in the first column. The percentage is even higher in the second column. Working in non-agricultural sectors such as industry and construction and service and commerce is also an important factor to increase wages since those working in these non-agricultural sectors earn more than double the wages of agricultural sectors, controlling for all the other variables.

In summary, gender, living areas and education (human capital) have effects both in entering the wage market and in determining wage levels. We will study each of these factors in details in the next subsection and draw some implications.

2-4-5. Implications

2-4-5-1. Gender

The results of the wage equation indicate that in Haiti, different from many other countries, females can earn the same as or even higher wages than males, other things being controlled while females have more difficulties in participating in the wage market. This is very unique to Haiti and thus we might need to look for the reasons. One possible answer is the different employment structure between men and women¹⁵.

Table 2-10 shows the wage workers' employment structure by gender. We can note that female wage workers are concentrated exclusively in the service and commerce sector (especially in public service sectors) and account for 70 percent while almost half of the male wage workers are in the agricultural sector (47.1 percent). Since non-agricultural sector (and especially the service sector) is more skilled than agricultural sector, we can infer that this remarkable difference in employment structure favors female wages. Also, urban-rural differences should be counted in as Verner (2008) points out. Even though we have controlled the employment structure by sector and living area/region dummies in the wage regression, we will need some robustness checks of the regression results by taking into account these facts more precisely. we will leave this issue for the future tasks.

Still we should be careful that female participation in the wage market is limited compared to males since more than 70 percent of the wage workers are males in Table 2-10. This gender discrimination of participation is also proved in the probit regression in Table 2-8 (*female* dummy was negative). In any cases, we can draw an important implication from these regression results that Haiti should promote the female participation in the wage market both in terms of the advantage of getting higher wages and in terms of the disadvantages of becoming a wage worker.

¹⁵ Verner (2008) also suggests that one of the reasons of this gender-earnings gap may, to some degree, be explained by choice of jobs by women in urban and rural areas.

Table 2-10. Wage Workers' Employment Structure by Gender

	Male		Female	
	Freq.	Percent	Freq.	Percent
Agriculture, Fishing and Extracts Industry	536	47.1	96	22.07
Agriculture	529	46.49	95	21.84
Fishing	4	0.35	0	0
Extracts	3	0.26	1	0.23
Industry and Construction	155	13.62	32	7.36
Manufacturing	90	7.91	30	6.9
Electricity, gas and water production	1	0.09	1	0.23
Construction	64	5.62	1	0.23
Services and Commerce	447	39.27	307	70.58
Wholesale and retail commerce, vehicle repair	61	5.36	68	15.63
Hotels and restaurants	3	0.26	7	1.61
Transports and communication	43	3.78	1	0.23
Financial	8	0.7	2	0.46
Real estate and business services	34	2.99	13	2.99
Public services (include Education and Health)	266	23.37	172	39.55
Public administration and services	67	5.89	15	3.45
Education	121	10.63	103	23.68
Health and social action	27	2.37	37	8.51
Other community, social and personal services	51	4.48	17	3.91
Other services	32	2.81	44	10.11
Total	1138	100	435	100

Source: Author's calculation based on ECVH 2001.

2-4-5-2. Education

There's no doubt that human capital is crucial to a country's economic development and education plays a key role in human capital development. The same as many other countries in the world, there exists a strong correlation between income (wage) levels and educational attainments in Haiti. We have also proven in the regression results that human capital is also an important determinant factor in participating in the wage market, which implies that higher skills are required in the wage market.

Another interesting point is the high wage premium for more educated (superior) workers. Table 2-11 shows the wage premium of each level of education compared to its lower level calculating from the wage regression results in Table 2-9. The wage

premium declines from primary to secondary level but increases sharply from secondary to tertiary level in both columns. Oshio (2002) points out in this respect that the increase of returns from secondary to tertiary education is due to the strong demand for high skills, or due to the ‘rationing’ that restricts the supply of high-educated workers. The latter would be the case for Haiti since only 2 percent of the economically active population aged 15–65 have tertiary education (Table 2-7).

Table 2-11. Wage Premium across Education Levels

	(1)	(2)
No education-Primary	0.376	0.424
Primary-Secondary	0.270	0.368
Secondary-Superior	0.888	1.024

Note: Wage premium is the difference of the coefficients between each education level.

Source: Author's calculation based on Table 2-9.

However, we shouldn’t disregard the importance of primary education in Haiti. Psacharopoulos (1985) summarizes the returns to education for over 60 countries in the world and concludes that primary education is the most profitable educational investment opportunity, followed by secondary education. This is, according to him, because of the interaction between the low cost of primary education (relative to other levels) and the substantial productivity between primary school graduates and those who are illiterate. In fact, primary education completed workers earn about 40 percent more wages than those who haven’t completed any education in Table 2-11.

There are serious educational problems not only in higher education but also in basic education in Haiti: we can see from Table 2-7 that among the economically active population aged 15–65, half of them are categorized as no education completed. 30 percent completed primary education and 19 percent secondary education. According to

Lundahl (2004), Haiti is far from achieving the complete enrollment rate. Yet today, almost half of children aged 6-12 are not in school, and of those enrolled, only one-third reach fifth grade. Public education spending (1.7 percent of GDP) and the capacity to deliver education services are too low. In fact, about 90 percent of primary schools are non-public (run by private organizations and NGOs). This extremely poor capacity of the government also causes low quality in education (World Bank, 2006). Haitian government and the international society should take urgent and comprehensive measures to improve both the education level and quality to achieve economic development in Haiti.

2-4-5-3. Geographical Disparity

The regression results indicate that there is a big disparity between metropolitan, other urban and rural areas, and also between the capital (Ouest) and the other regions, in determining the probability of the participation in the wage market as well as the wage levels. These differences in wages can be explained by urban production externalities or agglomeration effects. Such external effects are the main explanation for why productivity is usually the highest in those areas of a country where economic activity is densest (Ciccone, 2006). There is some disagreement about the strength of urban production externalities, but even weak urban production externalities can explain large spatial differences in productivity (Ciccone, 2006). These differences in productivity could have been reflected in the job opportunity and wage differentials between living areas (regions).

Table 2-12. Household Access to Infrastructure by Living Areas and Regions

	Metropolitan	Other Urban	Rural	Ouest	Other Regions
Electricity	91.5%	22.5%	9.8%	58.3%	11.1%
Road to the Dwelling	60.0%	61.3%	37.8%	47.7%	45.3%
Paved Road to the Dwelling	15.0%	7.3%	3.4%	10.4%	4.2%
Piped Drinking Water	17.7%	9.4%	3.2%	11.3%	4.8%

Source: Author's calculation based on ECVH 2001.

One example of the regional disparity in Haiti is the access to infrastructure. Table 2-12 shows the household access to infrastructure by living areas and regions. We can see a big geographical disparity: more than 90 percent of the households in metropolitan areas can access to electricity while its percentage is 22.5 percent in other urban areas and only 9.8 percent in rural areas. Also, the difference between Ouest and other regions is large in electricity. There's not much difference in road access (including dirt roads) as electricity between metropolitan and other urban areas (but except for rural areas) as well as between Ouest and other regions. However, the situation is not the same when we limit to the paved road. There is also a disparity in the supply of safe drinking water between living areas and regions. This inequality in access to infrastructure should affect the development of industry and service sectors outside the capital, and thus the employment opportunity and income levels. As Jadotte (2007) points out, balanced levels of infrastructure and access to services among the different regions should be among policy priority.

2-5. Concluding Remarks

This chapter began with an overview of the situation of poverty and inequality in Haiti in Section 2-2, which indicated that wage employment is expected to be the key to escaping poverty. However, household survey data revealed that employment opportunities are very limited in Haiti: the share of wage employment is small (only 10

percent) and access to wage employment is virtually restricted to non-poor households (mostly to the richest quintile). In Section 2-3, an empirical analysis using the multinomial logit model was conducted to identify the determinants of occupational choice of main household providers. The results present a clear correlation between education and wage employment. However, the fact that only 10 percent of the main providers live on wages also implies a higher eligibility of becoming a wage worker because of the limited supply of highly skilled workers. With respect to the effect of remittances from family members and others in foreign countries, the regression results showed whether main providers receive remittances or not; more importantly, the share of remittances of the total household income is crucial in their decision of whether or not to work.

The wage regression results in Section 2-4 have shown that education (human capital), living areas/regions and gender are important factors in determining the participation in the wage market as well as the wage levels. The results, examining each of these factors in detail, drew the following implications: i) one of the reasons of the female advantage in wage levels might be the difference of employment structure between men and women, and we will need some robustness checks for future analyses; ii) there is a high wage premium for educated workers (especially superior education) due to the limited access to higher education in Haiti, but investing in basic education is also important; iii) the geographical disparity could be explained by urban production externalities and one example is the difference of access to infrastructure between living areas (regions).

As mentioned in Section 2-2, many studies propose agricultural development as a means of improving Haiti's economy. However, considering the disadvantages and limitations of Haitian agriculture (especially those related to overpopulation), it is crucial to expand job opportunities (and in particular, wage employment) by developing

non-agricultural industries across the country to reduce severe poverty and inequality in Haiti. In fact, even though the employment rate in the industrial sector is small (9 percent), more than 90 percent of total Haitian exports come from the industrial (manufacturing) sector¹⁶ (UN Comtrade data 2005). Production assembly was the sole and most viable industrial sector of the Haitian economy for more than 30 years. Prior to the coup in 1991, the industrial sector was more diversified and there were a number of foreign-owned firms. Today, employment in this sector has been reduced to about two-thirds and virtually all of the companies are owned by Haitians (I-PRSP, 2006; Lundahl, 2004). As a result, a lot of qualified people migrated from Haiti during the embargo years (Lundahl, 2004). Thus, inviting foreign direct investments (FDIs) by taking advantage of Haiti's abundant labor must be one of the crucial strategies for a rapid and efficient development of these sectors¹⁷.

At the same time, improving the educational level and quality is indispensable to supplying qualified workers to the labor market and fostering the economic development mentioned above and poverty reduction as pointed out in Sections 2-3 and 2-4. However, improvement in education cannot be achieved in the short run.

Meanwhile, considering the scarcity of job opportunities that has further been reduced by the damage of the earthquake, and the crucial dependence on remittances by Haitian households, as discussed in this chapter, remittances are the only way for Haitians to be financially supported in the short run. Amuedo-Dorantes et al. (2010) points out that remittances ameliorate the negative disruptive effect of household

¹⁶ Haiti could take advantages of the geographical proximity to the United States once the infrastructure and institutional capacity are improved. Also, there is a preferential treatment for Haitian export of textile and garment (HOPEII) to the United States.

¹⁷ With respect to the service sector, while tourism was once a vital sector of the Haitian economy (representing over 20 percent of exports (MPCE, 2007)), it has also been seriously damaged by political and social turmoil since the 1960s. Haitian government recognizes the importance of these two non-agricultural sectors for the country's development as well as agricultural improvement. See, for example, I-PRSP (2006) and MPCE (2007) for the government's development strategies.

out-migration on children's schooling in some migrating communities and therefore, contribute to the accumulation of human capital in the midst of extreme poverty. Developed countries could accept Haitian migrants more actively under appropriate conditions so that remittance income could contribute not only to the reconstruction of the economy, but also to poverty reduction. It would also be necessary to establish a scheme that would make more efficient use of foreign remittances by directing them towards investments in education¹⁸.

Finally, this study is mainly based on one-year household survey data from 2001. Therefore, it has limitations in obtaining robust conclusions and policy implications. More detailed analyses using new comparative micro data will remain for a future study.

¹⁸ IDB has started a project to channel remittances toward human capital accumulation in Central America in 2010, which is still a pilot project in El Salvador.

Table A2-1. Summary Statistics for Multinomial Logit Regression

Variables	All	Inactive	Unemployment	Wage employment	Self-employment in non-agriculture	Self-employment in agriculture
	Mean	Mean	Mean	Mean	Mean	Mean
<i>age</i>	41.27 (12.02)	41.97 (14.01)	37.37 (12.08)	36.20 (9.88)	41.25 (11.04)	43.76 (11.30)
<i>squared age</i>	1847.93 (1019.27)	1957.73 (1185.51)	1541.92 (974.54)	1407.89 (782.92)	1823.27 (943.85)	2042.44 (987.19)
<i>female</i> ^a	0.46 (0.50)	0.65 (0.48)	0.54 (0.50)	0.26 (0.44)	0.69 (0.46)	0.20 (0.40)
<i>married</i> ^a	0.65 (0.48)	0.62 (0.49)	0.59 (0.49)	0.58 (0.49)	0.64 (0.48)	0.73 (0.45)
<i>rural</i> ^a	0.64 (0.48)	0.67 (0.47)	0.51 (0.50)	0.37 (0.48)	0.57 (0.50)	0.83 (0.38)
<i>born in Ouest</i> ^a	0.18 (0.39)	0.17 (0.37)	0.28 (0.45)	0.26 (0.44)	0.18 (0.39)	0.13 (0.33)
<i>primary</i> ^a	0.28 (0.45)	0.28 (0.45)	0.27 (0.45)	0.24 (0.43)	0.32 (0.47)	0.26 (0.44)
<i>secondary (and higher)</i> ^a	0.21 (0.41)	0.17 (0.37)	0.32 (0.47)	0.63 (0.48)	0.21 (0.41)	0.06 (0.23)
<i>(tertiary)</i> ^a	0.01 (0.11)	0.01 (0.08)	0.02 (0.13)	0.07 (0.26)	0.01 (0.08)	0.00 (0.00)
<i>remittance</i> ^a (dummy)	0.24 (0.43)	0.31 (0.46)	0.32 (0.47)	0.31 (0.46)	0.28 (0.45)	0.13 (0.34)
<i>remittance (share)</i>	0.10 (0.23)	0.17 (0.32)	0.17 (0.32)	0.08 (0.16)	0.10 (0.21)	0.03 (0.12)
Observations	5703	1113	576	605	1564	1845

Notes:

1) Standard errors are in parentheses.

2) a: dummy variable

APPENDIX

Chapter 3

The Impacts of the CCT and Rising Food Prices on the Consumption of Rural Poor in Mexico

3-1. Introduction

It has been more than 15 years since Mexico's Conditional Cash Transfer (CCT) Program: Education, Health and Nutrition Program (*Programa de Educación, Salud e Alimentación: PROGRESA*) was started in 1997 to replace all existing poverty programs. Targeting its benefits directly to the population in extreme poverty in rural areas, the program was intended (1) to alleviate *current* poverty through monetary and in-kind benefits, and (2) to reduce *future* levels of poverty by encouraging investment in education, health and nutrition (Skoufias, 2007). The program, which was renamed "Oportunidades" after the change of government in 2000, has finally achieved including over 5 million families in all Mexican states (Wood et al., 2009). In this chapter, the program will be designated as PROGRESA-Oportunidades.

In this chapter, the discussion will center upon how much PROGRESA-Oportunidades was able to reduce current poverty, measured by food consumption, through cash transfers. Levy (2006), the key figure in charge of designing and introducing PROGRESA-Oportunidades under the Zedillo administration, considers one of the major objectives of PROGRESA-Oportunidades to be the redistribution of income to families in extreme poverty by increasing their certainty of having a minimum level of consumption, together with the improvement of child schooling and poor families' health and nutrition status.

Greater attention, however, has been devoted to aspects of reducing future poverty by

intervening children's education and health and nutrition. Moreover, with respect to consumption aspects of PROGRESA-Oportunidades, almost all studies used data before 2003 and have confirmed poverty improvement. Few studies have examined the issue of the poverty trend and the effects of PROGRESA-Oportunidades after 2003.

The Mexican economy, in fact, enjoyed stability and positive growth during the 7 years from 2001 until the economic crisis caused by the Lehman shock in 2008. Poverty indices were also in a decreasing trend on a national level at least until 2006¹ despite the gradual increase of food prices. Did the poorest of the poor in marginal rural areas covered by PROGRESA-Oportunidades enjoy the same economic and social benefits as the reminder of the nation? The answer is no. The analyses of poverty trends of rural areas eligible for PROGRESA-Oportunidades during 2003–2007 in this chapter reveal the poverty degradation that occurred, as measured by food consumption, possibly because of food price increases. In addition, the regression results showed that the CCT cash transfers served only as a partial buffer against the drop of poor households' consumption level. This would imply that CCTs alone would be insufficient to help poor people escape completely from poverty trap once they face any kind of unexpected shocks such as sudden food price increases.

In the next section, characteristics of PROGRESA-Oportunidades and its panel data created for the external evaluations will be explained briefly. Section 3-3 presents a literature review focusing on consumption effects of the CCT. In Section 3-4, the poverty trend in marginal rural areas during 2003–2007 is described. The section then specifically examines the impacts of food price increases on rural poverty and presents the degree to which the CCT program contributed as a buffer against price shocks. Next, an empirical analysis using panel data is conducted in Section 3-5 to confirm the impact

¹ Data from World Development Indicators online and CONEVAL (<http://www.coneval.gob.mx>). However, it is difficult to determine exactly when the poverty trend reversed due to the absence of national household survey data for 2007.

of food price increases and the effects of CCT on poverty degradation during 2003 — 2007. Section 3-6 concludes.

3-2. Characteristics of PROGRESA-Oportunidades and its Panel Data

As described above, CCT programs were generally undertaken with two clear objectives. First, they provide poor households with a minimum consumption floor (to reduce “current” poverty). Second, in making transfers conditional, they encourage the accumulation of human capital to break a vicious cycle whereby poverty is transmitted across generations (to reduce *future* poverty) (Fiszbein and Schady, 2009). With respect to the Mexican PROGRESA-Oportunidades, the education component is designed to increase school enrollment among youth in Mexico’s poor rural communities by making educational grants available to the pupils’ mothers, with the requirement that greater than 85 percent attendance be achieved. In the area of health and nutrition, PROGRESA-Oportunidades includes distribution of nutritional supplements, education related to hygiene and nutrition, and monetary transfers for the purchase of food. Receipt of monetary transfers and nutritional supplements is tied to mandatory visits to public clinics for health care². The average monthly payment (received every two months) by a beneficiary family amounts to 20 percent of the value of monthly consumption expenditures prior to the initiation of the program. One additional requirement of PROGRESA-Oportunidades is that households benefiting from the program were obligated to stop receiving benefits from other programs (Skoufias, 2005).

The series of household panel data for the evaluation of PROGRESA-Oportunidades is called *Encuestas de Evaluación de los Hogares (ENCEL)*, which is designed and conducted periodically by the Social Development Secretary (*Secretaría de Desarrollo*

² This aspect of the program emphasizes targeting benefits to children under five, and pregnant and lactating women (Skoufias, 2005).

Social: SEDESOL) with the assistance of the International Food Policy Research Institute (IFPRI) for the purpose of the external evaluation of the program. A 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 full sample of ENCEL consists of repeated observations collected for 24,000 households from 506 localities (villages) in the 7 states of Guerrero, Hidalgo, Michoacán, Puebla, Querétaro, San Luis Potosí and Veracruz. Of those 506 localities, 320 localities were assigned to the treatment group (denominated as “Treatment 1998” herein), and 186 localities were assigned as controls (denominated as “Treatment 2000” herein). The eligible households of the control localities could not receive benefits of PROGRESA-Oportunidades until 2000 (Skoufias, 2007).

An additional comparison group of 151 localities not yet incorporated into the program was selected as a new control group using the propensity score matching (PSM) for the seventh round of the survey in 2003 (denominated as “Control 2003” herein) (Todd, 2004). This group became entitled to receive benefits starting by 2004. In total, eight rounds of surveys were conducted in the most marginal rural areas by 2007, enabling researchers to make use of a long period of micro-panel data.

As described in this chapter, we use rural samples of the two most recent rounds available, the years 2003 and 2007.

3-3. Literature Review: Impacts of CCT and Food Price Increases on Poverty in Mexico

The literature that specifically describes the short-term purpose of alleviating present poverty—in other words, consumption—will be surveyed in this section. First, Hoddinott and Skoufias (2004) and Hoddinott and Wiesmann (2008) studied whether PROGRESA-Oportunidades could have improved the diet of the rural poor in Mexico

or not using the first three rounds of ENCEL panel data in October 1998 (ENCEL98O), May-June 1999 (ENCEL99M) and November 1999 (ENCEL99N). Both studies revealed that the program beneficiaries increased caloric intake compared to their counterparts in the control villages. They also showed that the impact of PROGRESA-Oportunidades was greater on the improvement of dietary quality: the acquisition of calories from fruits, vegetables, and meats.

Skoufias and di Maro (2008) and Fiszbein and Schady (2009) analyzed the impact of PROGRESA-Oportunidades on poverty reduction using ENCEL98O, ENCEL99M and ENCEL99N. Both analyses showed a substantial reduction in poverty as measured by The Foster–Greer–Thorbecke (FGT) indices (Foster et al., 1984) for those participating in the program. Skoufias and di Maro (2008) reported that the poverty reduction effects were stronger for the poverty gap and the severity of poverty measures³.

Skoufias (2007) conducted an empirical analysis of the risk insurance model using three rounds of ENCEL panel data of 1998–1999. The effect of PROGRESA-Oportunidades on the improvement of the pre-existing risk sharing within villages was not statistically significant, but the analysis results revealed that receiving benefits of PROGRESA-Oportunidades enables households to insulate their consumption from idiosyncratic income shocks better than their counterparts. In addition, Angelucci and De Giorgi (2006; 2009) confirmed the indirect effect, or “spillover effect” of PROGRESA-Oportunidades cash transfers to increase the consumption of ineligible households living in the same treatment village.

Gertler et al. (2012) discussed the investment effect on welfare using ENCEL data for 1998–2003 and results of a baseline survey (ENCASEH) of 1997. Their estimates show that households consume about three-quarters of the transfer and invest the rest. Some

³ Skoufias and di Maro (2008) also studied the relation between PROGRESA-Oportunidades and adult work incentives, concluding that no evidence exists to show that the program affected adult participation in the labor market and overall adult leisure time.

studies, such as Angelucci and Attanasio (2009) and Krishnakumar and Chávez Juárez (2010), show that PROGRESA-Oportunidades has reduced poverty in urban areas.

All literature on consumption by 2003 has revealed a significant positive effect of PROGRESA-Oportunidades on poverty. It is notable that the data used in the literature are mostly those for 1998–1999, when the ideal randomized experiment to compare the program effects had been conducted. Some of the literature specifically describes a longer period extending to 2003, but only two reports (Arroyo et al., 2008; Attanasio et al., 2009) use data extending to 2007, the latest data available today.

Arroyo et al. (2008) analyzed the long-term effects of PROGRESA-Oportunidades on the consumption of the benefited households as well as on their decision-making for investment and saving using ENCEL 2007. They concluded, with respect to consumption, that households with longer exposure to the program tend to have greater per-capita consumption level than those with shorter exposure. However, they use only one year data for 2007 and did not take into account the price effects that stated to affect poor households in this period.

Attanasio et al. (2009) simulated the welfare consequences of the recent increases in food prices in Mexico and Colombia using CCT panel data. They showed that CCT programs provide better means of alleviating the problem of increasing staple prices than other indirect policies, computing the effects of 50 peso transfer and 5 percent price subsidy. This is the only analysis of Mexican food price increases and poverty that has used ENCEL data to date. They, however, completely dropped the “Control 2003” samples. Moreover, it would be necessary to examine the validity of their assumption by other estimation methods.

Several other studies, Valero-Gil and Valero (2008) and Wood et al. (2009) have examined the impacts of the food price increases on poverty in Mexico using the National Income and Expenditure Survey of Households (ENIGH) for 2006. Both of

them found a negative impact of the price change on the welfare of poor households. These studies also refer to CCT, but only in a complementary manner⁴.

As described above, few studies have examined the longer-term effects of PROGRESA-Oportunidades despite the availability of the updated data after 2000. More studies must particularly address the recent effects of the CCT on consumption and poverty by using data for 2007, which can also account for the important macro shock caused by commodity price increases.

3-4. Poverty Trend in Rural Mexico and Food Price Increases: 2003-2007

3-4-1. Poverty Trend in Rural Mexico

In this section, we examine the poverty trend of the most marginal areas of rural Mexico during 2003–2007 using household samples of the ENCEL data described above. The FGT poverty indices (Foster et al., 1984)—the most popular indices in measuring poverty—are used. The FGT indices are defined as

$$P_{\alpha} = \frac{1}{n} \sum_{i=1}^q \left(1 - \frac{c_{it}}{z} \right)^{\alpha}, \quad (3.1)$$

where q represents the number of individuals i whose consumption at time t , denoted by c_{it} , is below a certain level of poverty line z . Also, n represents the total population. When $\alpha = 0, 1$, or 2 , P_0, P_1 , or P_2 respectively represents “Poverty head count ratio”, “Poverty gap ratio” and “Squared poverty gap ratio”.

In this paper, per-capita weekly food consumption of each household, which is the sum of monetary expenditures and self-consumption, will be used to estimate the FGT indices⁵. The official rural food basket (*canasta básica alimentaria rural*) published by

⁴ Wood et al. (2009) only use the information to distinguish the poor from the non-poor. Valero-Gil and Valero (2008), in contrast, consider the buffer effect of PROGRESA-Oportunidades to the price shocks with another public policy for prices. However, their argument addresses neither the consumption of each household nor that of rural poor, but only focuses on the aggregated poverty ratio.

⁵ To calculate per-capita consumption, we first construct each household’s weekly food consumption by summing up the reported amount of weekly food consumption and the

the National Council for the Evaluation of Social Development Policy (*Consejo Nacional de Evaluación de la Política de Desarrollo Social: CONEVAL*) is used as the poverty line. Both the per-capita food consumption and the poverty line are deflated by the state-level food CPI⁶.

Table 3-1 presents the changes in the three types of FGT indices during 2003–2007. Indices were calculated using the overall sample as well as using three sub-samples: the original treatment groups (villages) in which the eligible households started receiving benefits in 1998, denominated as “Treatment 1998”, the original control villages receiving benefits since 2000 (Treatment 2000), and the new control villages, which were integrated in the ENCEL in 2003 and which started receiving benefits by 2004 (Control 2003).

The striking result of Table 1 presents that poverty worsened (rose) in all three different types of indices as well as in all three sub-samples with different periods of program exposure. The poverty head count ratio increased 2 percentage points in overall (from 94 percent to 96 percent), in “Treatment 2000” (from 95 percent to 97 percent), and in “Control 2003” (from 91 percent to 93 percent), and 3 percentage points in “Treatment 1998” (from 94 percent to 97 percent)⁷. The poverty gap ratio, which indicates the *depth* of poverty, also worsened by 7 percentage points (from 0.55 to 0.62) in overall and by 5–8 percentage points in the sub-samples. The squared poverty gap ratio, which represents the *severity* of poverty, rose markedly. Aggravation of the poverty gap ratio and the squared poverty gap ratio confirms that the distribution among

estimated weekly self-consumption. Then we divide the household’s weekly food consumption by the number of household members to ascertain the per-capita weekly food consumption. In estimating the amount of self-consumption, we first calculate the median state price of each item using each household’s reported amounts of weekly purchase and the expenditure on the item. Then we multiply the amount of reported self-consumption by the estimated unit median price of the state.

⁶ Banco de México Estadísticas: <http://www.banxico.org.mx/estadisticas/index.html>

⁷ The high percentage of poverty head count ratio depends on the fact that the ENCEL sample villages are chosen from the most marginal rural areas throughout the country.

the poor also worsened, which means that the poorest of the poor became much poorer than the rest.

Table 3-1. Changes in FGT Indices (Per-Capita Food Consumption), 2003–2007

Poverty Indices	Overall Sample		Treatment 1998		Treatment 2000		Control 2003	
	2003	2007	2003	2007	2003	2007	2003	2007
Headcount ratio	0.94	0.96	0.94	0.97	0.95	0.97	0.91	0.93
Poverty gap ratio	0.55	0.62	0.56	0.64	0.57	0.64	0.49	0.54
Squared poverty gap ratio	0.37	0.44	0.38	0.46	0.38	0.46	0.31	0.36
Number of obs	18,924	18,924	9,012	9,012	6,285	6,285	3,627	3,627

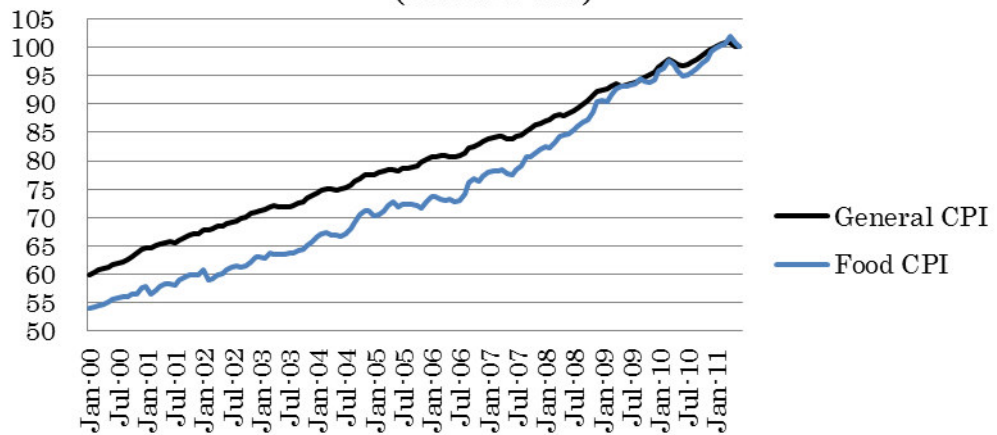
Source: Author's calculation based on ENCEL2003 and 2007.

The level of poverty indices of “Control 2003” is modest compared to the other two treatment groups in 2003 and 2007, which suggests that the profile of the “Control 2003” should be different (less poor) even though this group was added to serve as a new *control* for the original samples. Furthermore, the magnitude of changes in FGT indices is less in the poverty gap and squared poverty gap ratios in the case of “Control 2003”, which confirms again the hypothesis that the most vulnerable households, which are most easily affected by unexpected shocks, should be the poorest of the poor.

3-4-2. Food Price Increases in Mexico

A continuous rise in food prices has been observed during 2003–2007 in Mexico. Figure 3-1 presents the trends of general and food CPIs at the national level. It is apparent that the food CPI growth has been larger than the general CPI. In fact, the proportion of the food CPI relative to the general CPI rises from 0.88 as of January 2003 to 0.94 as of December 2007.

**Figure 3-1. CPI Trends in Mexico (Monthly),
2000-2011**
(Jun 2011=100)



Source: Author's elaboration based on the data from Banco de México.

This phenomenon presumably occurred in correspondence to the food price increases in the international market, especially those of soy beans and cereals such as corn, wheat, and rice. Figure 3-2 shows the monthly international food and cereal price indices. It is clear that the international food price increase has been caused by the price rise in cereals. The main reason for this unusual price increase is the high demand for biofuels (Valero-Gil and Valero, 2008). Since Mexico has fully liberalized the import of maize, its principal grain, its domestic price is determined fundamentally by the same mechanism as that of the United States (Tani, 2012). In fact, Mexico imports one-third of its domestic consumption (Tani, 2012) ⁸, almost all of it from the United States.

⁸ Mexico imports only yellow maize for industrial processes and cattle feed. Domestic production of white maize for tortillas satisfies the national demand (Tani, 2012).

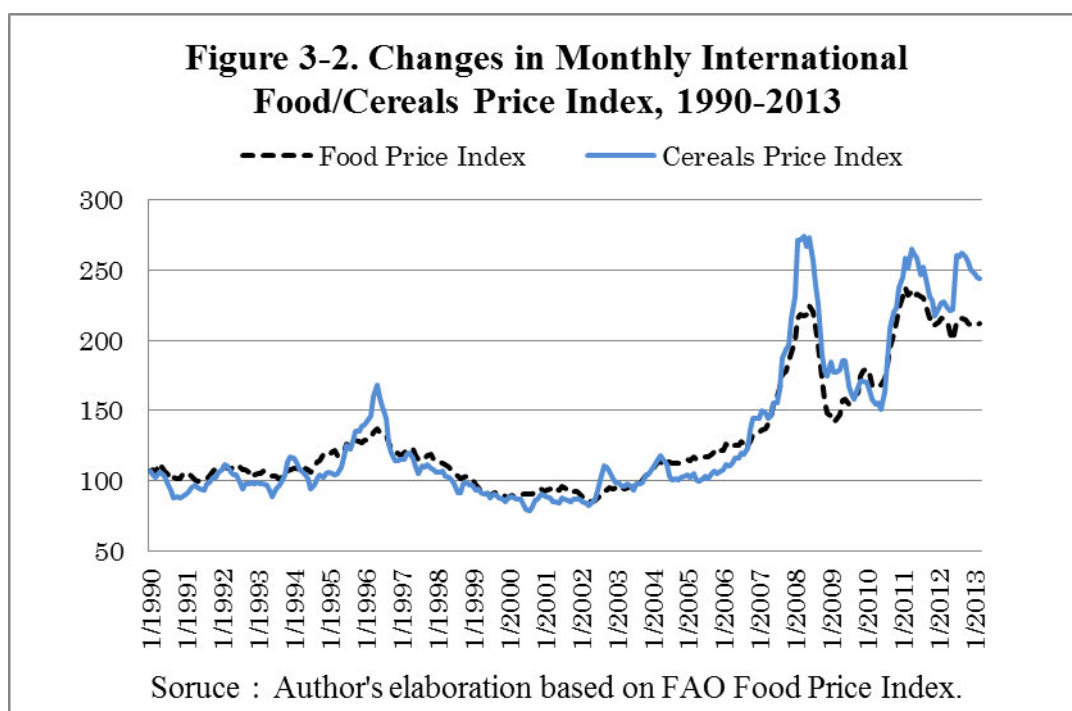


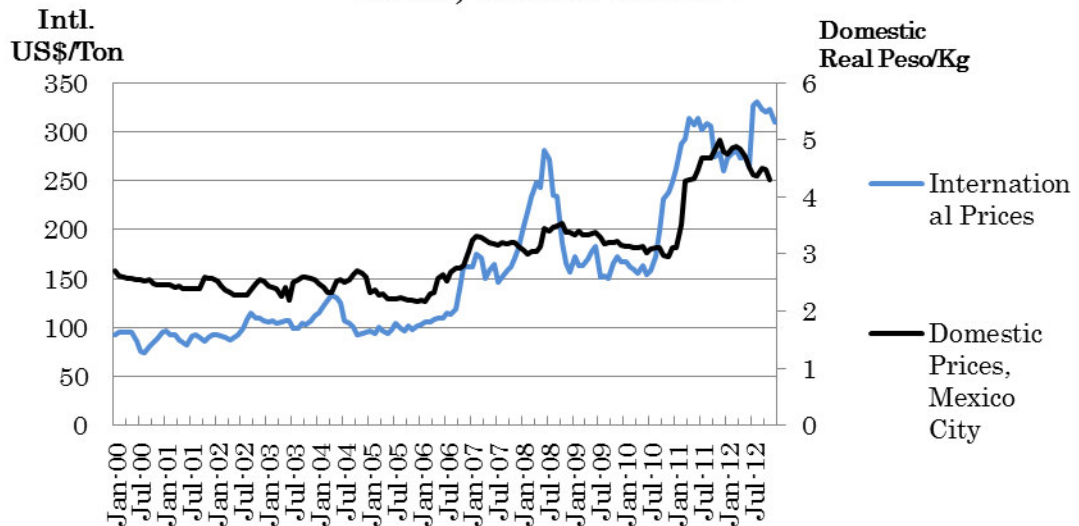
Figure 3-3 shows both the domestic wholesale price⁹ and the international price of maize. It is noteworthy that the domestic price follows the international price trend. The wholesale price of maize in Mexico City rose by 1.3 times during 2003–2007 from 2.46 pesos per kilo to 3.21 pesos (annual average) while its international price increased by more than 1.5 times during the same period¹⁰.

The impacts of food price increases on the rural poverty in Mexico and the CCT effects will be discussed in detail in the next sub-sections.

⁹ Wholesale prices of Mexico City are used because of the limit of data availability. Only prices in Mexico City, Guadalajara (second biggest city) and Puebla (one of the ENCEL pilot state near Mexico City) are available. We should note that the price trends of these three cities turned out to be very similar throughout the period. Wood et al. (2009) also conclude that there is little regional variation in the change in tortilla prices.

¹⁰ With respect to other major Mexican staples, rice prices also increased during the same period, but black bean prices were maintained until 2008.

**Figure 3-3. Mexican Domestic and International Prices:
Maize, 01/2000-12/2012**



Source: Author's elaboration based on FAO GIEWS and
FAO International commodity prices.

3-4-3. Impacts of Food Price Increases on Rural Poverty and the Effects of CCT

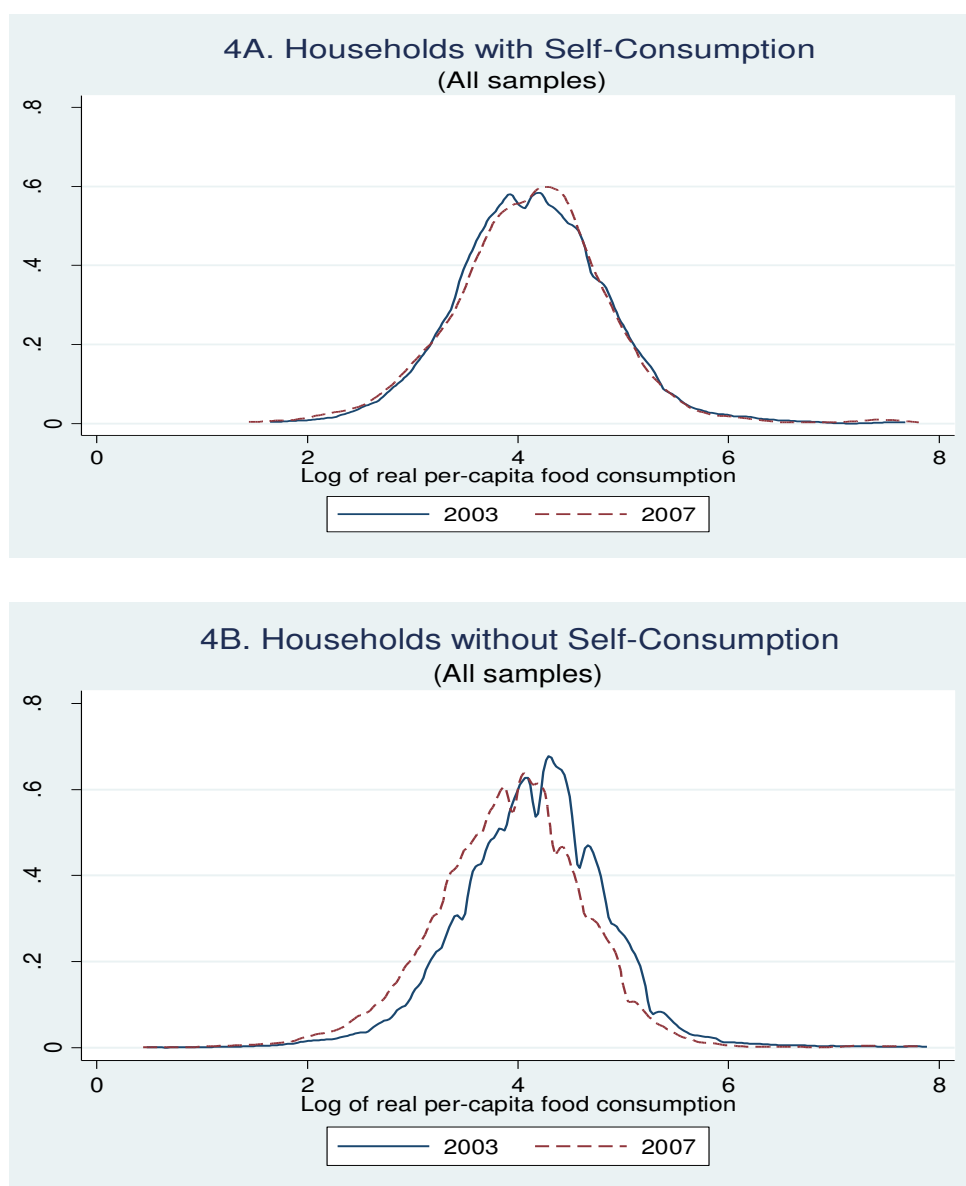
3-4-3-1. Impacts of Food Price Increases on Rural Poverty

Figure 3-4 shows the kernel densities of per-capita real food consumption in 2003 and 2007. To ascertain the different impacts of the food price increases in this period, the sample is divided into two groups: households with self-consumption in 2007 (Fig. 4A) and those without self-consumption (Fig. 4B). Having self-consumption or not is used as an indicator of the impact of food price increases because: (i) farmers are widely known, if they rationally respond to the market signals, to increase their agricultural production when the food price rises; (ii) poor farmers, who are the principal target of PROGRESA-Oportunidades, are mostly engaged in maize cultivation for their daily consumption of tortillas¹¹; and (iii) the estimates of the per-capita consumption used for this study have taken into account the level of self-consumption as a part of each

¹¹ About 60 percent of the sample households cultivated lands whose median surface is 2 ha. and 90 percent of them are rain-fed in 2003.

household's food consumption. Consequently, having self-consumption or not is expected to directly reflect the influence of food price increases, especially that of maize. The self-consumption dummy will be utilized hereafter as a proxy for the food price increase to measure its impact.

Figure 3-4. Kernel Density of per-capita Food Consumption



Source: Author's elaboration based on ENCEL 2003, 2007.

The figure shows that the overall food consumption level of households without self-consumption decreased in 2007 compared to that of 2003 (the distribution shifts to the left in Fig. 4B), whereas households having self-consumption in 2007 maintain their food consumption level despite the food price increases in Fig. 4A. When comparing the averages of real per-capita food consumption, households having self-consumption in 2007 increased their weekly per-capita food consumption by 7.7 percent from 87.5 pesos (on average) in 2003 to 94.2 pesos (on average) in 2007. The weekly per-capita consumption of those without self-consumption in 2007 reduced by 25.5 percent from 95.7 pesos (on average) to 71.3 pesos (on average).

In the next subsection, the discussion is focused on whether the cash transfers by PROGRESA-Oportunidades can prevent households from falling into a poorer situation by lowering their consumption level.

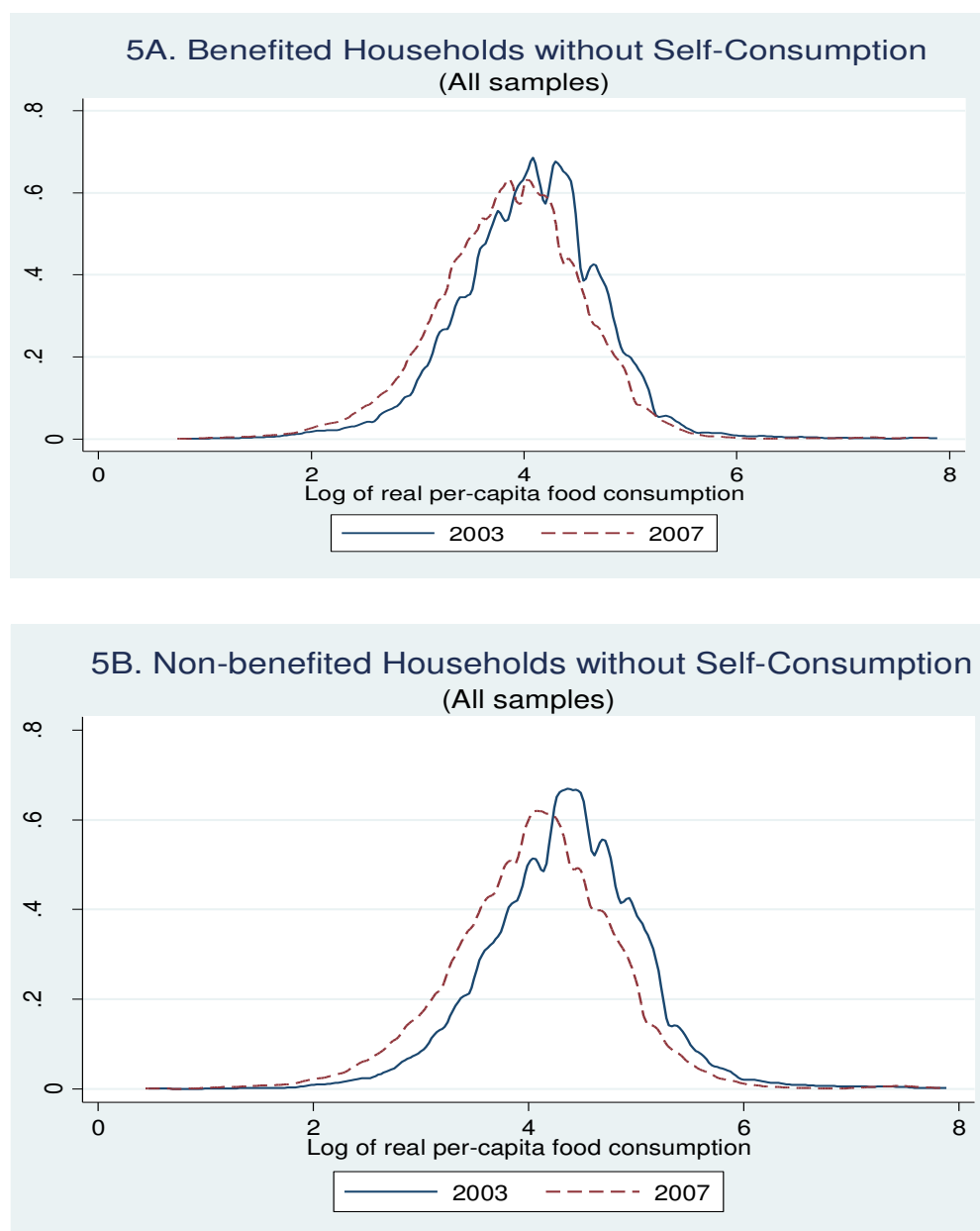
3-4-3-2. *Buffer Effects of the CCT on Poverty Degradation*

In Figure 3-5, only households without self-consumption in 2007, who are supposed to have been affected by price increases, are selected to divide them into two groups: those receiving cash transfers from PROGRESA-Oportunidades in 2007 (Fig. 5A) and those without benefits (Fig. 5B). As the figure shows, the shift of distribution to the left is smaller for the benefitted households, which means that the consumption level of benefitted households falls less. When comparing the average weekly per-capita consumption of each group, that of benefitted households fell by 11.3 percent from 84.0 pesos (on average) in 2003 to 66.3 pesos (on average) in 2007. In contrast, the average consumption of households not receiving benefits fell by as many as 32.2 percent from 121.8 pesos in 2003 to 82.4 pesos in 2007.

In sum, one can infer that cash transfers by PROGRESA-Oportunidades had partial

(not complete) consumption smoothing effects when facing the unexpected food price increases. Empirical analyses will be conducted in the next sub-section to confirm statistically the robustness of this inference.

Figure 3-5. Kernel Density of per-capita Food Consumption



Source: Author's elaboration based on ENCEL 2003, 2007.

3-5. Empirical Analysis

3-5-1. Methods

The model for the panel to be estimated is the following:

$$c_{it} = \alpha + \beta Year_{07} + \gamma Benefit_{07} + \delta Self_{07} + v_i + \epsilon_{it},$$
$$i = 1, \dots, N, t = 1, \dots, T, \epsilon_{it} \sim iid(0, \sigma^2) \quad (3.2)$$

$$c_{it} = \alpha + \beta_1 Year_{07} + \beta_2 D_{2000} \cdot Year_{07} + \beta_3 D_{2003} \cdot Year_{07}$$
$$+ \gamma Benefit_{07} + \delta Self_{07} + v_i + \epsilon_{it}, \quad (3.2)'$$

$$c_{it} = \alpha + \beta Year_{07} + \gamma Benefit_{07} + \delta Self_{07}$$
$$+ \theta D_{2003}(\beta Year_{07} + \gamma Benefit_{07} + \delta Self_{07}) + v_i + \epsilon_{it}, \quad (3.2)''$$

where c_{it} represents real per-capita food consumption of household i in time t . The reminder of the independent variables are all dummies that take 1 if $t = 2$ ($Year_{07}$), if household i receives a cash transfer from PROGRESA-Oportunidades in 2007 ($Benefit_{07}$) and if household i has self-consumption in 2007 ($Self_{07}$). v_i is a time-invariant idiosyncratic (household specific) error term and ϵ_{it} , the reminder disturbance of mean zero and independent and identically distributed (i.i.d.). In addition, interaction terms of different treatment/control groups (“Treatment 2000” and “Control 2003”), D , with $Year_{07}$, $Benefit_{07}$ or $Self_{07}$ are used to control the group-specific effects that must be attributed to the difference of the years receiving benefits and their profiles as indicated in equations (3.2)' and (3.2)'' .

The parameters of this model can provide *average* effects of the price shock and of the CCT to the households' consumption level. The price shock is explained by the $Year_{07}$ dummy as a macro shock to all households that happened during 2003–2007, and by the $Self_{07}$ dummy for the reasons discussed above. Furthermore, the merit of this model is that we can control the time-invariant idiosyncratic characteristics of the households to extract *common* effects of food price increases and of CCT cash transfers.

3-5-2. Results

Table 3-2 presents the summary statistics of the variables to be used in the analysis. Only 8 percent of the households practice self-consumption. 69 percent of the sample received cash transfer of PROGRESA-Oportunidades, which is consistent with the other reports of the literature. “Treatment 1998”, “Treatment 2000” and “Control 2003” respectively account for 47 percent, 33 percent and 19 percent¹².

Table 3-2. Summary Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
<i>log of weekly real per-capita food consumption</i>	overall	4.04	0.74	-2.08	9.68	N = 37515
	between		0.60	0.62	7.71	n = 18774
	within		0.44	0.94	7.14	T-bar = 1.99824
<i>year dummy (2007=1)</i>	overall	0.50	0.50	0	1	N = 37530
	between		0.02	0	1	n = 18781
	within		0.50	0.00	1.00	T-bar = 1.9983
<i>self-consumption in 2007 (dummy)</i>	overall	0.08	0.27	0	1	N = 37530
	between		0.27	0	1	n = 18781
	within		0.00	0.08	0.08	T-bar = 1.9983
<i>receiving cash transfer from PROGRESA in 2007</i>	overall	0.69	0.46	0	1	N = 37530
	between		0.46	0	1	n = 18781
	within		0.01	0.19	1.19	T-bar = 1.9983
<i>Treatment 1998 (dummy)</i>	overall	0.47	0.50	0	1	N = 37530
	between		0.50	0	1	n = 18781
	within		0.00	0.47	0.47	T-bar = 1.9983
<i>Treatment 2000 (dummy)</i>	overall	0.33	0.47	0	1	N = 37530
	between		0.47	0	1	n = 18781
	within		0.00	0.33	0.33	T-bar = 1.9983
<i>Control 2003 (dummy)</i>	overall	0.19	0.39	0	1	N = 37530
	between		0.39	0	1	n = 18781
	within		0.00	0.19	0.19	T-bar = 1.9983

Source: ENCEL 2003, 2007.

¹² Only the households of which the ID matched in both years were selected. Households that did not report their expenditures were also dropped from the sample.

Table 3-3 presents the regression results. Model 1 shows that the consumption dropped by about 21 percent on average in 2007 compared to the 2003 level. Receiving benefits in 2007 increases consumption level by about 10–11 percent on average (Models 2, 4, 6, 7), whereas having self-consumption in 2007 increases consumption by about 22–23 percent (Models 3, 4, 6, 7). When controlling *Benefit*₀₇, the magnitude of coefficients of *Year*₀₇ rises by about 10 percentage points, which means that the consumption level would drop by about 30 percent on average if a household received no benefits nor practiced self-consumption in 2007 (Models 4, 6, 7).

With respect to the group dummies, only “Control 2003” interacted with *Year*₀₇ is statistically significant (Models 5 and 6), which implies that “Control 2003” has a different profile from the other two groups as discussed in the preceding section. It is particularly interesting, however, that neither of the interaction terms of the “Control 2003” dummy and *Benefit*₀₇ or *Self*₀₇ become statistically significant (Model 7), which implies that the effects of cash transfers or of self-consumption are independent of the factors inherent in any of the treatment/control groups.

Table 3-4 presents regression results of household samples without self-consumption to illustrate the buffer effects of cash transfers of PROGRESA-Oportunidades more accurately. Model 1, with only the year dummy, shows that the households without self-consumption in 2007 decreased their consumption level by about 23 percent on average. The decrease, however, worsens to 30–32 percent when the *Benefit*₀₇ dummy is included (Models 2 and 4), which implies that the consumption level will drop by more than 30 percent if the households have neither self-consumption nor PROGRESA-Oportunidades benefits. Cash transfers of PROGRESA-Oportunidades offset one-third of the total drop in eligible households’ food consumption on average (-0.3+0.1 in Model 2).

Table 3-3. Regression Results of Panel data

Dependent Variable: Log of weekly real per-capita food consumption														
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Fixed	Random ^a	Fixed	Fixed	Random ^a	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	
year 2007	-0.209 (-33.60)***	-0.209 (-33.60)***	-0.280 (-25.11)***	-0.227 (-35.05)***	-0.227 (-35.44)***	-0.299 (-26.44)***	-0.223 (-24.73)***	-0.326 (-24.34)***	-0.325 (-24.53)***					
year 2007 * Treatment 2000							-0.005 (-0.36)	-0.004 (-0.32)						
year 2007 * Control 2003							0.081 (4.84)***	0.102 (6.06)***	0.094 (3.71)***					
benefit in 2007			0.103 (7.65)***			0.104 (7.72)***		0.116 (8.58)***	0.112 (7.28)***					
self-consumption in 2007				0.223 (9.69)***	0.216 (11.53)***	0.224 (9.75)***		0.225 (9.83)***	0.226 (8.93)***					
benefit 2007 * Control 2003										0.017 (0.53)				
self-consumption 2007 * Control 2003										-0.003 (-0.04)				
Constant	4.145 (941.21)***	4.145 (770.13)***	4.145 (942.66)***	4.145 (943.54)***	4.145 (771.30)***	4.145 (945.02)***	4.145 (941.87)***	4.145 (946.06)***	4.145 (946.04)***					
Number of obs	37515	37515	37515	37515	37515	37515	37515	37515	37515					
R-sq: within	0.0568	0.0568	0.0598	0.0615	0.0615	0.0645	0.0582	0.0667	0.0667					
between	0.0000	0.0000	0.0327	0.0021	0.0021	0.0061	0.0224	0.0001	0.0001					
overall	0.0197	0.0197	0.0118	0.0227	0.0227	0.0146	0.0255	0.0195	0.0194					
F test	F=2.05	-	F=1.98	F=2.06	-	F=1.99	F=2.02	F=1.97	F=1.98					
Prob>F	0.000	-	0.000	0.000	-	0.000	0.000	0.000	0.000					
Breusch and Pagan test	-	chi2(1)=2053.41	-	-	chi2(1)=2069.57	-	-	-	-					
Prob>chi2	-	0.0000	-	-	0.0000	-	-	-	-					
Hausman test	chi2(1)=0.58		chi2(2)=661.84		chi2(2)=0.76	chi2(3)=664.48	chi2(3)=209.57	chi2(5)=805.54	chi2(6)=823.39					
Prob>chi2	0.4453		0.0000		0.6828	0.0000	0.0000	0.0000	0.0000					

Note: t statistics (for fixed effects model) or z statistics (for random effects model) are in parentheses. ***, **, * are significant at 1, 5, and 10 percent.

a: Random effects model is also shown when Hausman specification test adopts the model.

Source: ENGEL 2003, 2007.

**Table 3-4. Regression Results of Panel data
(Households without self-consumption in 2007)**

Dependent Variable: Log of weekly real per-capita food consumption					
	Model 1		Model 2	Model 3	Model 4
	Fixed	Random ^a	Fixed	Fixed	Fixed
<i>year 2007</i>	-0.227 (-35.15)***	-0.227 (-35.14)***	-0.301 (-25.99)***	-0.245 (-26.07)***	-0.330 (-18.82)***
<i>year 2007 *</i> <i>Treatment 2000</i>				0.003 (0.18)	0.007 (0.25)
<i>year 2007 *</i> <i>Control 2003</i>				0.087 (4.99)***	0.098 (3.49)***
<i>benefit in 2007</i>			0.107 (7.69)***		0.120 (5.76)***
<i>benefit 2007 *</i> <i>Treatment 2000</i>					-0.009 (-0.26)
<i>benefit 2007 *</i> <i>Control 2003</i>					0.012 (0.34)
<i>Constant</i>	4.146 (907.97)***	4.146 (740.50)***	4.146 (909.50)***	4.146 (908.65)***	4.146 (910.48)***
Number of obs	34527	34527	34527	34527	34527
R-sq: within	0.0669	0.0669	0.0700	0.0684	0.0723
between	0.0000	0.0000	0.0321	0.0223	0.003
overall	0.0232	0.0232	0.0148	0.0292	0.020
F test	F=2.08	-	F=2.00	F=2.05	F=1.99
Prob>F	0.000	-	0.000	0.000	0.000
Breusch and Pagan test	-	chi2(1)=1939.25	-	-	-
Prob>chi2	-	0.000	-	-	-
Hausman test	chi2(1)=0.83		chi2(2)=608.94	chi2(3)=190.93	chi2(6)=756.80
Prob>chi2	0.3632		0.0000	0.0000	0.0000

Note: t statistics (for fixed effects model) or z statistics (for random effects model) are in parentheses.

***, **, * are significant at 1, 5, and 10 percent.

a: Random effects model is also shown when Hausman specification test adopts the model.

Source: ENCEL 2003, 2007.

The interaction terms of treatment/control group dummies with $Year_{07}$ or $Benefit_{07}$ are included in models 3 and 4, respectively, to control the length of exposure to the program and the different profiles of respective groups. As in Table 3, only the interaction term of $Year_{07}$ and “Control 2003” is positive and significant, which implies that no significant difference of length or profiles exists between “Treatment 1998” and “Treatment 2000”, but the “Control 2003” households’ decrease in consumption is slightly smaller than the original two groups because of their different profiles (not so poor as their counterparts). The statistical insignificance of the interaction terms of treatment/control groups dummies and $Benefit_{07}$ for both “Treatment 2000” and “Control 2003” indicates that the buffer effects of PROGRESA-Oportunidades against the food price increases is the same among all groups (Model 4).

3-6. Concluding Remarks

As described in this chapter, the discussion emphasized the impacts of the food price increases on the poverty degradation in rural Mexico prevailing during 2003–2007, particularly addressing the buffer effects of CCT against the macro shock. Results present strong evidence that the substantial drop of food consumption level during 2003–2007 should be attributed to the domestic food price increases caused by international price changes (especially for maize). In addition, the empirical analysis confirmed the positive effects of PROGRESA-Oportunidades (especially through cash transfers) but the effects were insufficient to compensate the entire loss of consumption, compared to the roles played by self-consumption.

Finally, the empirical results of this study imply that CCTs should not be overvalued, given that the program cannot fully cope with poverty degradation, particularly in case of external shocks. Kurosaki (2009) argues that poor households are vulnerable to risk

in the sense that they fall into a severer poverty trap once they encounter any unexpected external shocks, which might cancel out the longer-term effects of the program that have been promoted by the investment in education and health. Additional policy measures, including flexible in-kind benefits¹³, should be strongly required to compensate these plausible losses whenever an unexpected event occurs.

The shortcoming of this chapter, however, is that variables such as income and price, which are other important factors in determining the consumption level, were not considered directly in the regression models because of the complexity of the data. This remains for a future study. Furthermore, it is noteworthy that this analysis cannot incorporate consideration of the recent economic crisis caused by the Lehman shock because of limited data availability. In addition, the steep rise of food prices had just begun in this period. Peaks were found in 2008 and in 2011. It is likely that the poverty circumstances of these households would have worsened even more severely after 2007. We must continue to observe, using new data, the poverty trends and the roles of PROGRESA-Oportunidades amid the severe economic situation.

¹³ In 2007, PROGRESA-Oportunidades added to their grant 50 pesos per month which were labeled as a subsidy for energy consumption. (Attanasio et al., 2009)

Chapter 4

Consumption Smoothing and Vulnerability in Rural Mexico

4-1. Introduction

It is widely known that people living in the rural areas of poor countries must often cope not only with severe poverty but also with extremely variable incomes. They face many risks that fluctuate their incomes, such as natural disasters, illness, injury, involuntary unemployment and market price changes, and they are often hardly insured against these risks. Income fluctuations can present an acute threat to people's livelihoods even if, on average, incomes are high enough to maintain a minimal standard of living (Bardhan and Udry, 1999).

The term *vulnerability* is used rather loosely in economics and other disciplines (Dercon, 2005). One could define *vulnerable households* as those likely to fall below an agreed upon poverty line in the future with a particular probability. Some non-poor household could be classified as vulnerable to poverty, whereas some poor households could be classified as not vulnerable to poverty in the future. These measures can be referred to as *expected poverty* measures. An alternative way of expressing vulnerability is closely linked to standard expected utility approaches. Vulnerability is then the welfare cost related to the sum of the welfare loss from deviations of mean consumption relative to an agreed level (*the cost of poverty*) plus a measure of *the cost of risk*—the difference of expected utility from the utility related to expected consumption. Its key advantage is its direct link of expected poverty with standard economic theory related to the behavior toward risk (Dercon, 2005).

The theory of expected utility tells us that the expected utility of risk-averse individuals falls as the variability of consumption rises. If we knew the utility functions and expected consumption patterns of all individuals, we could then analyze poverty in terms of certainty-equivalent consumption (the consumption which, if unvarying, would yield an equivalent level of expected utility as a household's actual—higher mean but more variable—consumption levels) (Kamanou and Morduch, 2005).

Kamanou and Morduch (2005) argued that the vulnerability of a population is the product of three elements: (1) the pattern of possible *shocks*, or losses, because of the loss of a job or a bad harvest; (2) the strength of *coping mechanisms*, or the degree to which provisions are not in place to fully address shocks; and (3) structural and behavioral ramifications of consumption declines: whether such declines would just cause temporally shortfalls for households or lead them to fall into poverty traps?

The main obstacles to consumption smoothing are the liquidity constraints caused by the market imperfection in rural areas. Bardhan and Udry (1999) argue that liquidity constraints are more likely to be binding particularly among poor farmers, so that (agricultural) production and consumption cannot be financed from savings, and the costs (in terms of utility, health and even survival) of fluctuations in an already low level of consumption are extreme. The poor farmers need to consume before harvest, which depends on climate and many other external factors. Thus, when production is risky and insurance markets are incomplete, credit transactions play a valuable role by permitting people to smooth consumption in the face of a randomly fluctuating stream of income.

The inexistence or poor functioning of formal credit and/or insurance markets in rural areas are supplemented by a variety of informal mechanisms. Dercon (2005) describes two strategies such households exposed to income fluctuations use to reduce the impacts of shocks: *risk-management* strategies and *risk-coping* strategies.

Risk-management strategies attempt to reduce the riskiness of the income process *ex ante* (*income smoothing*) through, in most cases, diversification of income sources by combining different income generating activities, including cultivation of various crops to reduce the harvest risk, even if the crops have a lower average yield. On the other hand, Risk-coping strategies include self-insurance (through precautionary savings) and informal group-based risk sharing. They deal with the consequences of income risk (*consumption smoothing*). Households can insure themselves by building up assets in good years, which they can deplete in bad years. Also, informal arrangements can be made among members of a group or village to support each other in case of hardship, for example, among extended families, ethnic groups or neighborhoods (Dercon, 2005).

There is growing interest in the empirical analysis of informal risk sharing and in modeling the sustainability and consequences of the arrangements listed above. The most frequently cited study on risk sharing is by Townsend (1994) who uses ten-year panel data on three high-risk villages in the semi-arid tropics of southern India¹. Townsend (1994) states that the aim of his study is to pose a simple question: How good or how bad are the institutions that might insure people in villages in southern India against the risks they face, such as erratic rainfall, crop and human diseases, and severe income fluctuations? He points out that there were many studies examining the possible risk-management/coping mechanisms one by one, such as crop/land diversifications, grain storage, purchases or sales of land or livestock, informal borrowing, or gifts and transfers in family networks. However, in studying only one market or institution, the researcher might miss smoothing possibilities provided by another. His study presents a general equilibrium framework that overcomes the problem of looking at risk sharing markets or institutions one at a time. Specifically, using the general equilibrium model inevitably leads the researcher to focus on outcomes, namely, consumption and labor

¹ The Indian panel data, known as ICRISAT data, is named after the institution that conducted the survey: the International Crops Research Institute for Semi-Arid Tropics.

supply², so that all actual institutions of any kind are jointly evaluated.

In this study, an empirical analysis of risk-sharing mechanisms in rural Mexico is conducted to discuss the vulnerability of the rural poor using the most recent two periods of Mexican rural household panel data, in 2003 and 2007. In this study, *vulnerability* is considered the inability to smooth consumption because of liquidity constraints. First, we estimate a basic risk-sharing model defined by Townsend (1994) to examine how the risk-sharing mechanism works in rural Mexico. Then, we extend the model to focus on the welfare loss caused by negative shocks. We consider the effects of Mexico's widely known poverty reduction program: the Conditional Cash Transfer (CCT) program, continuously within the risk-sharing framework. CCT programs, which are implemented in many developing countries in the world as a new targeting poverty reduction strategy, were generally undertaken with two clear objectives. First, they provide poor households with a minimum consumption floor (to reduce *current* poverty). Second, in making transfers conditional, they encourage the accumulation of human capital to break a vicious cycle whereby poverty is transmitted across generations (to reduce *future* poverty) (Fiszbein and Schady, 2009). Whether CCT can enhance the risk-sharing mechanism corresponds to the first objective (to reduce current poverty).

The structure of the chapter is as follows: The next section describes the rural households in the sample. A standard risk-sharing model is presented in Section 4-3. Empirical analyses are conducted in Section 4-4 with three different specifications: a basic risk-sharing model, a model that focuses specifically on negative income shocks to measure vulnerability more accurately; and a model that includes the effects of CCT. Section 4-5 concludes.

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² We assume the separability of consumption and labor supply in this study, and do not deal with labor supply.

4-2. Description of Panel Data

The series of household panel data used in this study is called *Encuestas de Evaluación de los Hogares (ENCEL)*, or *Household Evaluation Surveys*, which is designed and conducted periodically by the Social Development Secretary (*Secretaría de Desarrollo Social: SEDESOL*) assisted by the International Food Policy Research Institute (IFPRI) for the purpose of the external evaluation of the CCT program. Nine rounds of rural household panel data are available to date from 1997 to 2007, including a baseline survey in 1997. A 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 full sample of ENCEL consists of repeated observations collected for 24,000 households from 506 localities (villages) in the 7 states of Guerrero, Hidalgo, Michoacán, Puebla, Querétaro, San Luis Potosí and Veracruz. Of those 506 localities, 320 localities were assigned to the treatment group (denominated as “Treatment 1998” herein), and 186 localities were assigned as controls (denominated as “Treatment 2000” herein). The eligible households of the control localities could not receive PROGRESA-Oportunidades benefits until 2000 (Skoufias, 2007).

An additional comparison group of 151 localities not yet incorporated into the program was selected as a new control group using propensity score matching (PSM) for the seventh round of the survey in 2003 (denominated as “Control 2003” herein) (Todd, 2004). They became entitled to receive benefits through 2004. In total, eight rounds of surveys were conducted in the most marginal rural areas by 2007, which enables researchers to make use of a long period of micro-panel data.

We use rural samples of the two most recent rounds available: the years 2003 and 2007. ENCEL 2003 consists of 33,887 households and 205,306 individuals. ENCEL 2007 consists of 25,899 households and 176,809 individuals living in the seven sample

states³. When we drop households whose consumption is unreported or reported as nil, 18,942 households remain as a complete panel dataset in the case of food consumption, and 17,603 households in the case of total consumption.

4-3. Risk-Sharing Model⁴

4-3-1. General Model

We first examine a village economy in which the Pareto-efficient allocation of risk is achieved, but in which there is no access to credit markets or even to storage. Let $i = 1, \dots, N$ index the households that live in the village. There are T periods, indexed by t . Also s indexes the S states of nature, each with the objective and commonly known probability of occurrence π_s . In state s , each household i receives an income of $y_{is} > 0$ ⁵. Let c_{ist} represent household i 's consumption if state s occurs in period t . Suppose that each household has a separable utility function of the form:

$$U_i = \sum_{t=1}^T \rho^t \sum_{s=1}^S \pi_s u_i(c_{ist}), \quad (4.1)$$

where ρ^t is a discount factor. $u(\cdot)$ is twice continuously differentiable with $u' > 0$, $u'' < 0$ and $\lim_{x \rightarrow 0} u'(x) = +\infty$. A Pareto-efficient allocation of risk within the village can be found by maximizing the weighted sum of utilities of each of the N households, where the weight of household i in the Pareto program is λ_i , $0 < \lambda_i < 1$, $\sum \lambda_i = 1$:

$$\max_{c_{ist}} \sum_{i=1}^N \lambda_i U_i, \quad (4.2)$$

subject to the resources available in the village at each point in time in each state of nature:

³ ENCEL 2007 also includes new samples of 18,052 households and 77,768 individuals extracted from the original 7 states as well as from some other poor states. They are excluded from the panel data because they are cross-sectional and their profiles are very different from those of ENCEL 2003.

⁴ This section mainly relies on Bardhan and Udry (1999: Ch.8) and Kurosaki (2001: Ch.8; 2006a; 2009: Ch.9).

⁵ Here we assume that income is exogenous.

$$\sum_{i=1}^N c_{ist} \leq \sum_{i=1}^N y_{ist} \quad \forall s, t. \quad (4.3)$$

$$c_{ist} \geq 0. \quad \forall s, t \quad (4.4)$$

Equation (4.3) is the set of village resource constraints. Equation (4.4) contains the non-negativity constraints, which do not bind if the village has any resources in each period along each possible history.

The first-order conditions corresponding to c_{ist} and c_{jst} imply

$$\frac{u'_i(c_{ist})}{u'_j(c_{jst})} = \frac{\lambda_j}{\lambda_i} \quad \forall i, j, s, t. \quad (4.5)$$

This equality extends across all N households in the village in any state at any point in time. The marginal utilities and, therefore, consumption levels of all households in the village move together. This implies that the consumption of any household is a monotonically increasing function of average village consumption. In a Pareto-efficient allocation, then, transient changes in income are fully pooled at the community level. The only risk faced by the household is that faced by the community as a whole.

To see this result in its stark form, suppose that everyone in the village has an identical constant absolute risk aversion utility function, so that $u_i(c_i) = -(1/\sigma)e^{-\sigma c_i}$. Applying this utility function to the first-order condition (5) and taking logs, we find

$$c_{ist} = c_{jst} + (1/\sigma)(\ln(\lambda_i) - \ln(\lambda_j)), \quad (4.6)$$

As before, this equality holds across all N households in the village at any point in time. If we sum across these N equalities,

$$c_{ist} = \bar{c}_{st} + \frac{1}{\sigma} \left(\ln(\lambda_i) - \frac{1}{N} \sum_{j=1}^N \ln(\lambda_j) \right), \quad (4.7)$$

where

$$\bar{c}_{st} = \frac{1}{N} \sum_{j=1}^N c_{jst}$$

Therefore, household consumption is equal to the average level of consumption in the village plus a time-invariant household fixed effect that depends on the relative weight of the household in the Pareto program. Equation (4.7) implies that the change in a

household's consumption between any two periods is equal to the change in average community consumption between the two periods. After controlling for average consumption, a household's consumption is unaffected by its own income. In a Pareto-efficient allocation of risk within a community, households face only aggregate risk. Idiosyncratic income shocks are completely insured within the community.

From the second welfare theorem, we know that the Pareto-efficient allocation of risk can be supported by a competitive equilibrium with complete contingent markets. However, it is implausible that such a rich set of competitive markets exists. Any risk-pooling mechanism must overcome the information and enforcement problems associated with insurance contracts. In the presence of these problems, a complete set of markets will not exist and the competitive equilibrium will not be Pareto-efficient. However, efficient (or nearly efficient) risk-pooling could be supported by a variety of other mechanisms such as interlinkages and repeated personalized transactions between households, which are usually observed at community levels in developing countries, as many studies have pointed out.

The existence of *ex post* risk-pooling mechanisms within a variety of communities in less developed countries suggests that some communities may have developed insurance systems that allocate risk to approach Pareto efficiency. This line of reasoning has motivated a number of quantitative studies of risk sharing. For example, Townsend (1994) and Ravallion and Chaudhuri (1997) examine consumption outcomes rather than specific risk-pooling mechanisms in the ICRISAT Indian study villages⁶. There is a high degree of co-movement in consumption across households within this set of villages, despite the fact that there is a substantial amount of idiosyncratic income variation.

⁶ Other representative empirical studies on risk sharing are Deaton (1992) and Grimard (1997) in Côte d'Ivoire, Udry (1994) on rural credit market in Nigeria, and Amin et al. (2003) on microfinance in Bangladesh. All of them rejected the full risk sharing hypothesis. See also Bardhan and Udry (1999: Ch.8) and Kamanou and Morduch (2005) for a detailed literature review on empirical studies of risk sharing.

Nevertheless, a fully Pareto-efficient allocation of risk is not achieved in these villages.

4-3-2. Empirical Model

A reduced form of Equation (4.7) based on Townsend (1994) is

$$c_{it} = b_i + a_i \bar{c}_t + \beta_i y_{it} + v_{it} , \quad (4.8)$$

where $\bar{c}_t$ is average consumption in the village, y_{it} represents a household's idiosyncratic variables, in this case, income, and v_{it} is an i.i.d. error term with mean zero.

We assume measurement errors in y_{it} :

$$y_{it} = y_{it}^* + \epsilon_{it} , \quad (4.9)$$

Then, Equation (4.8) will become

$$c_{it} = b_i + a_i \bar{c}_t + \beta_i y_{it} + v_{it} - \beta_i \epsilon_{it} , \quad (4.10)$$

By taking first differences, we obtain

$$\Delta c_{it} = b_i + a_i \Delta \bar{c}_t + \beta_i \Delta y_{it} + u_{it} , \quad (4.11)$$

$$u_{it} = \Delta v_{it} - \beta_i \Delta \epsilon_{it} , \quad (4.12)$$

where Δy_{it} represents household's idiosyncratic income shocks.

A full risk sharing can be achieved when the null hypothesis of $\beta_i = 0$ is accepted across all households within the village⁷. In other words, if the economy (say a village) achieves Pareto optimal risk sharing among villages, Δc_{it} should respond only to the village level shocks $\Delta \bar{c}_t$ so that the size of β_i shows excess sensibility of consumption to idiosyncratic income shocks. A relatively large positive value of β_i indicates that individual i is less able to cope with such shocks.

Ravallion and Chaudhuri (1997) examined thoroughly the Townsend (1994) model to prove that his estimates of β_i had a downward bias. They insisted that the second term of Equation (4.11)— $a_i \Delta \bar{c}_t$ —should be replaced by time-village dummies $\sum_t \delta_t D_t$, in

⁷ An alternative hypothesis ($\beta_i = 1$) implies a complete autarky or the complete lack of risk-sharing mechanisms.

case of assuming the uniform time preference and risk aversion across households in the village. The parameter β can more accurately reflect the effects of idiosyncratic income shocks Δy_{it} , because the time-village dummies absorb all the aggregate shocks that occur within the village economy. In addition, restrictions on the parameters, $b_i = b$, $a_i = a$, $\beta_i = \beta \quad \forall i$, are usually imposed by assuming uniform time preferences and risk aversion across households in using developing countries' panel data because the available period is typically short.

$$\Delta c_{it} = b + \sum_t \delta_t D_t + \beta \Delta y_{it} + u_{it} , \quad (4.13)$$

Parameter β is also called the *excess sensitivity* parameter because it becomes positive when any kind of liquidity constraints and imperfect credit and/or insurance market mechanisms are observed.

Since the panel data used in this study is of two periods (2003 and 2007), the model to be estimated takes the form of a cross-section.

$$\Delta c_i = \alpha_v + \beta \Delta y_i + \gamma X_i + u_i , \quad (4.14)$$

where α_v are village dummies, X_i is a vector of household-specific factors that will affect the consumption change, and u_i is an i.i.d. error term with mean zero.

4-3-3. Model with Emphasis on Welfare Loss

According to Kurosaki (2006a, 2009: Ch. 9), one of the problems in using a specification such as Equation (4.13) for a vulnerability analysis is that parameter β does not distinguish whether Δy_{it} is positive or negative. Parameter β in this case shows the extent to which a household needs to decrease its consumption level when hit by a negative income shock, as well as the extent to which it can afford to increase its consumption level when it enjoys a certain income increase. Therefore, it is necessary to separate the marginal effect of negative income shocks from that of positive income shocks to consumption. Only the degree to which a household is forced to decrease

consumption in response to negative income shocks should be regarded as vulnerability. Following Kurosaki (2006a, 2009: Ch. 9), a modified version of the model in Equation (4.14) is estimated in this study⁸.

$$\Delta c_i = \alpha_v + \beta_1(1 - d_i)\Delta y_i + \beta_2 d_i \Delta y_i + \gamma X_i + u_i, \quad (4.15)$$

where $d_i = 1$ if $\Delta y_i < 0$, u_i is an i.i.d. error term with mean zero. Parameter β_1 shows the extent to which consumption increases when income increases marginally for a household, after controlling for aggregate village shocks and household-specific factors X_i , and β_2 shows the extent to which consumption decreases when income decreases marginally for a similar household.

4-4. Empirical Analyses and Results

4-4-1. Summary Statistics

Table 4-1 presents summary statistics of variables used in the regression in this study⁹. The manner in which the variables are created is summarized in Appendix I. A significant drop in consumption and income was observed in 2003–2007. Weekly per-capita real consumption decreased, on average, by 8.8 Mexican pesos for food alone, and by 10.8 pesos in total. Furthermore, per-capita real income decreased by 6.3 pesos on average in the same period. In contrast, per-capita income between 2001 and 2002 increased. This phenomenon is attributed to the poor households' welfare loss caused by international and domestic food price increases during the period (Uchiyama, 2013; Attanasio et al., 2009; Wood et al., 2009; Valero-Gil and Valero, 2008). The table shows that half of the sampled households experienced income decline.

⁸ Kochar (1995) estimated the effects of shocks on wage income and informal borrowings by considering the asymmetrical effects of positive and negative crop income shocks. Also, Jacoby and Skoufias (1997) examined the effects of seasonal income fluctuation on the child school attendances by applying the same method.

⁹ Finally 12,243 households remain as a complete panel 2003-2007 after dropping zero or unreported income and upper and lower 1 percent of the sample as outliers.

With respect to the household characteristics in the base year (2003), 24 percent of the household heads have never received education. Those who ended up in primary school account for 65 percent, while about 9.5 percent had some secondary school and only 2 percent had high school education or higher. The dropout rate is high: the author's calculation based on the data shows that more than half of the household heads who had entered primary school did not graduate. Female-headed households account for 10 percent. The average age of the household heads is 46 years old, and 88 percent are married and 10 percent are divorced or separated. The average household size is 5.3 people and the dependency ratio is 42.7. About 31 percent of the households are indigenous (that is, household heads speak indigenous languages). About 60 percent are beneficiary households of the CCT program in 2003. This percentage increases to 78.5 percent because the "Control 2003" households start to receive benefits in 2004. Households that had self-consumption in the week they were interviewed account for 6.3 percent. Households that own or cultivate lands account for about 63 percent. These households own or cultivate 4.8 hectares on average, but the median farming household only owns or cultivates 2 hectares, implying that there are large numbers of small poor farmers and small numbers of large farmers. Land with full or partial irrigation accounts for 9.3 percent, which indicates that the most of land is rain-fed and, thus, the productivity must be low. About 26 percent of the households receive some kind of personal transfers (remittances) in cash or in kind. In addition, 32 percent of the households have members over 15 years old living away from home (migrants).

There are seven highly marginal pilot states selected from different parts of Mexico: four from Central Mexico (Hidalgo, Michoacán, Puebla, and Querétaro), one from North (San Luis Potosí), one from Gulf of Mexico (Veracruz), and one from Southern Pacific (Guerrero). The three treatment/control groups in the table correspond to the aforementioned village categories.

Table 4-1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ΔC_i : Food	12243	-8.819	47.257	-338.668	267.406
ΔC_i : Total	11483	-10.787	61.177	-391.588	487.897
ΔY_i	12243	-6.259	47.072	-378.942	137.707
d	12243	0.503	0.500	0	1
$(1-d)$	12243	0.497	0.500	0	1
$d\Delta Y_i$	12243	-15.857	39.953	-378.942	0.000
$(1-d)\Delta Y_i$	12243	9.598	17.753	0.000	137.707
ΔY_i : 2001-02	12243	1.223	21.480	-604.357	831.271
Food Consumption03	12243	71.116	43.968	10.435	391.298
Food Consumption07	12243	62.297	39.791	8.421	294.724
Total Consumption03	12243	90.736	56.469	9.885	415.187
Total Consumption07	11483	80.245	54.386	10.892	505.691
Income03	12243	28.946	43.764	0.607	392.972
Income07	12243	22.687	21.473	0.964	146.838
noedu03	12218	0.236	0.424	0	1
primary03	12218	0.649	0.477	0	1
secondary03	12218	0.095	0.293	0	1
highschool03	12218	0.011	0.105	0	1
technical03	12218	0.007	0.082	0	1
univ03	12218	0.002	0.048	0	1
female03	12240	0.100	0.300	0	1
age03	12236	46.268	14.620	3	98
married03	12242	0.877	0.329	0	1
divorced03	12242	0.099	0.299	0	1
total_member03	12243	5.246	2.315	1	19
depratio03	12243	42.678	23.848	0	100
indigenous03	12234	0.308	0.462	0	1
CCT_dum03	12243	0.592	0.492	0	1
selfcons_dum03	12243	0.063	0.244	0	1
land_dum03	12243	0.627	0.484	0	1
total_land_ha03	8119	4.776	10.048	1	200
irrigation03	7774	0.093	0.290	0	1
hhremitt03	12243	0.256	0.437	0	1
hmmig_over15_dum03	12243	0.324	0.468	0	1
State12: Guerrero	12243	0.079	0.270	0	1
State13: Hidalgo	12243	0.104	0.306	0	1
State 16: Michoacán	12243	0.168	0.373	0	1
State 21: Puebla	12243	0.146	0.353	0	1
State 22: Querétaro	12243	0.077	0.267	0	1
State 24: San Luis Potosí	12243	0.162	0.369	0	1
State 30: Veracruz	12243	0.263	0.440	0	1
"Treatment 1998"	12243	0.477	0.499	0	1
"Treatment 2000"	12243	0.335	0.472	0	1
"Control 2003"	12243	0.188	0.390	0	1

Notes:

1) Consumptions and Incomes are shown in local currency in real terms (June 2011=100)

2) ΔC_i stands for changes in consumption 2003–2007, and ΔY_i stands for changes in income 2003–2007.

3) d takes 1 if $\Delta Y_i < 0$

Source: Author's elaboration based on ENCEL 2003, 2007.

4-4-2. Basic Model

We assume endogeneity of observed changes in income in estimating Equation (4.14). Thus, the explanatory variables are replaced by fitted values using instrumental variables. The instruments include X_i (household-specific factors that are likely to affect the households' income changes and the degree of consumption smoothing to which they can achieve) and the changes in lagged income between 2001 and 2002¹⁰ that should be correlated with the income changes in 2003–2007. Food consumption and total consumption are used as explained variables (Δc_i) in all models herein.

Table 4-2 presents the results of both ordinary least squares (OLS) and two-stage least squares (2SLS) regressions on food consumption and on total consumption. X_i consists of household size; the dependency ratio; the age, sex, marital status, ethnicity, and the education level of the household head, and the total hectares of land owned or cultivated by the household. Instruments include per-capita wage income changes in 2001–2002, a land dummy (1 if a household owns or cultivates a land, 0 otherwise), and a migrant dummy (1 if a household has any member aged 15 years and older that has migrated to another place, 0 otherwise). Different specifications are applied by using irrigation (1 if a household has any irrigated land), CCT (1 if a household receives money benefit of CCT), self-consumption (1 if a household has self-consumption), and remittance (1 if a household receives personal transfers) dummies as X_i (Model 1) or as instruments (Model 2) to check for robustness. Table 4-2 is limited to present estimated β coefficients. Complete results are shown in Appendix II (Table A4-2 and A4-3).

¹⁰ The details of the income change in 2001–2002 are explained in Appendix I. The sum of retrospective wage earnings of household heads and spouses are used as a proxy of lagged household income changes because data for the newly added control group (Control 2003) is not available before 2003.

Table 4-2. Regression Results of Equation (4.14)

	Food Consumption		Total Consumption	
	Model 1	Model 2	Model 1	Model 2
β (OLS)	0.1402*** (0.0131)	0.1438*** (0.0130)	0.1816*** (0.0162)	0.1837*** (0.0162)
β (2SLS)	0.6423*** (0.0834)	0.5898*** (0.0644)	0.7509*** (0.1048)	0.6141*** (0.0807)
<i>village dummies</i>	yes	yes	yes	yes
No. of Obs	12349	12349	11442	11442
R-squared (OLS)	0.1376	0.1335	0.1613	0.1592
Chi2 (2SLS)	216028.91	128128.105	279507.618	41600701.430

Notes:

1) Huber-White heteroscedasticity consistent standard errors are in parentheses.

2) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

The OLS estimation coefficients of β are about 0.14 for food consumption and about 0.18 for total consumption in both models, which is consistent with previous studies in terms of significance and magnitude. This implies that real food and total consumption rises (declines) by 0.14 and 0.18 Mexican pesos respectively when the real income rises (declines) 1 Mexican peso. The null hypothesis of full risk sharing is rejected at the 1 percent level. It is noteworthy that the coefficients for food consumption are smaller than the coefficients for total consumption, which implies that food consumption is better insured than total consumption. This result is consistent with most of the previous studies conducted in other developing countries¹¹. Skoufias (2007) explains, in this respect, that an increase in household income increases the demand of

¹¹ IV estimates of three ICRISAT villages conducted by Ravallion and Chaudhuri (1997) range from 0.209 to 0.462 when using ‘flow accounting: FA’ income data, and from 0.120 to 0.336 when using ‘observable transaction: OT’ income data (Table IV). Kurosaki (2001: Table 8-6) also has similar results to those of Ravallion and Chaudhuri (1997) with the same Indian data. In the case of Côte d’Ivoire, the estimated ‘excess sensitivity’ parameters range from negative (essentially zero) to 0.54. (Deaton, 1993: Table 3) In addition, the estimation results of Grimard (1997) using the Côte d’Ivoire data are quite robust with coefficients all around 0.2 for different specifications and regression methods.

luxury goods (non-food) more than that of necessities (such as food), and the opposite is true in case of a decrease in household income. The 2SLS coefficients are much larger than the OLS coefficients for both food and total consumptions, which confirms the downward bias in β owing to endogeneity as the theory predicts¹².

4-4-3. Model with Emphasis on Welfare Loss

Table 4-3 presents the OLS¹³ regression results of Equation (4.15), in which we distinguish the risk-sharing effects against negative income changes (β_2) from those against positive income changes (β_1). The results are quite robust regardless of the specifications. Two models are shown in the table, whose specifications are the same as those in Table 4-2.

Table 4-3. OLS Regression Results of Equation (4.15)

	Food Consumption		Total Consumption	
	Model 1	Model 2	Model 1	Model 2
β_1	0.3482*** (0.0299)	0.3566*** (0.0299)	0.4367*** (0.0413)	0.4416*** (0.0412)
β_2	0.0857*** (0.0144)	0.0879*** (0.0144)	0.1146*** (0.0187)	0.1158*** (0.0187)
<i>village dummies</i>	yes	yes	yes	yes
No. of Obs	12199	12199	11442	11442
R-squared	0.1535	0.1487	0.1667	0.1647

Notes:

1) Huber-White heteroscedasticity consistent standard errors are in parentheses.

2) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

¹² One can infer from the 2SLS regression results that a downward bias caused by measurement errors is greater than other possible biases attributed to specification errors or omitted variables.

¹³ Only the OLS regression results are shown here, because IV regression results by using the same instruments as in the basic model were not robust, possibly because of weak instruments. This will remain for a future study.

The results show that β_1 (for positive income changes) is 0.35-0.36 for food consumption and 0.44 for total consumption, while β_2 (for negative income changes) is 0.09 for food consumption and 0.12 for total consumption. There are two interesting facts to discuss. First, it is noteworthy that the coefficients on positive income shocks (β_1) are much larger than the coefficients on negative income shocks (β_2) for both food and total consumptions (0.35 (β_1) versus 0.08 (β_2) in food consumption, and 0.44 (β_1) versus 0.12 (β_2) in total consumption, respectively)¹⁴. One can infer that risk-sharing mechanisms are well developed to deal with negative shocks (in other words, vulnerability) at the village level in rural Mexico. Another possible explanation could be the downward rigidity of food demand: the households that suffered from negative income changes are poorer households living far below the subsistence level, and thus, these cannot decrease their consumption level despite the negative shocks.

Second, β values are larger in total consumption than in food consumption regardless of the positive or negative shocks, which confirms the implications of the basic model of Equation (4.14). However, the discrepancies of β between food and total consumptions are much larger in the case of positive income shocks (β_1): $(\beta_{1Total} - \beta_{1Food}) > (\beta_{2Total} - \beta_{2Food})$. Differences of coefficients are 0.09 (0.44-0.35) in the case of β_1 and 0.03 (0.12-0.09) in the case of β_2 . This fact implies that the consumption elasticity to positive income shocks is higher and that households tend to increase expenditure on non-food (luxury) goods when income increases.

4-4-4. Model with CCT Effects

4-4-4-1. Outline of Mexico's CCT Program: PROGRESA-Oportunidades

It has been more than 15 years since Mexico's CCT program: Education, Health and

¹⁴ The 2 SLS estimates of β for negative income shocks presented by Kurosaki (2006a; 2009: Ch.9) varied depending on specifications. The OLS results of this study could be more consistent with the prediction of the theory on vulnerability.

Nutrition Program (*Programa de Educación, Salud e Alimentación: PROGRESA*) was started in 1997 to replace all existing poverty programs. Targeting its benefits directly to the population in extreme poverty in rural areas, the program was intended (1) to alleviate current poverty through monetary and in-kind benefits and (2) to reduce future levels of poverty by encouraging investment in education, health and nutrition (Skoufias, 2007). The program, which was renamed “Oportunidades” after the change of government in 2000, has finally achieved including over 5 million families in all Mexican states (Wood et al., 2009). In this study, the program is designated as PROGRESA-Oportunidades.

The education component of PROGRESA-Oportunidades is designed to increase school enrollment among youth in Mexico’s poor rural communities by making educational grants available to pupil’s mothers, with the requirement that greater than 85 percent attendance be achieved. In the area of health and nutrition, PROGRESA-Oportunidades includes distribution of nutritional supplements, education related to hygiene and nutrition, and monetary transfers for the purchase of food. Receipt of monetary transfers and nutritional supplements is tied to mandatory visits to public clinics for health care¹⁵. The average monthly payment (received every two months) by a beneficiary family amounts to 20 percent of the value of monthly consumption expenditures prior to the initiation of the program. One additional requirement of the PROGRESA-Oportunidades program is that households benefiting from PROGRESA-Oportunidades were obligated to stop receiving benefits from other programs (Skoufias, 2005).

Levy (2006), the key person of designing and introducing PROGRESA-Oportunidades under the Zedillo administration, regards the redistribution of income to families in extreme poverty by increasing their certainty of having a

¹⁵ This aspect of the program emphasizes targeting benefits to children under five, and pregnant and lactating women (Skoufias, 2005).

minimum level of consumption as one of the major objectives of PROGRESA-Oportunidades, in addition to the improvement of child schooling and poor families' health and nutrition status. In this section, the discussion centers on whether PROGRESA-Oportunidades has contributed to reduce current poverty or vulnerability of the eligible households by reinforcing the existing risk-sharing mechanisms through cash transfers¹⁶.

4-4-4-2. Regression Results

Table 4-4 presents OLS regression results of Equations (4.14) and (4.15) with three subsamples, "Treatment 1998," "Treatment 2000," and "Control 2003" to examine the CCT's effects on risk sharing. Each model's specifications are the same as those in the previous sections.

Table 4-4-1, with the basic model, shows that coefficient β is smallest in "Treatment 1998" groups, second smallest in "Treatment 2000" and largest in "Control 2003" groups for both food (0.11, 0.15, and 0.20, respectively) and total consumptions (0.17, 0.19, and 0.21-0.22, respectively). The result suggests that the longer the exposure to the CCT program, the better insured the household, which supports the hypothesis that CCT influences poverty reduction and mitigating vulnerability by securing a minimum income level. Moreover, the results imply that risk-sharing mechanisms are functioning

¹⁶ There are several previous studies on consumption smoothing effects of CCT in Mexico. Angelucci and De Giorgi (2006; 2009) confirm the indirect effect, or *spillover effect*, of PROGRESA-Oportunidades cash transfers to increase the consumption of ineligible households living in the same treatment village. They argue that the availability of additional liquidity in the network (through CCT cash transfers) causes changes in the local credit and insurance markets, which enables not only treated households but also non-treated households to reduce their savings and increase consumption. Skoufias (2007) conducted an empirical analysis of the risk insurance model using three rounds of ENCEL panel data of 1998–1999. The effect of PROGRESA-Oportunidades on the improvement of the pre-existing risk sharing within villages was not statistically significant. He attributed this result to the short period of time (1.5 years) after the program implementation.

better for food consumption than for total consumption in “Treatment 1998” and “Treatment 2000” villages (villages that have longer exposure to CCT since 1998 and 2000, respectively). In contrast, there is almost no difference in the magnitude of coefficients, β , between food consumption (0.20) and total consumption (0.21-0.22) in “Control 2003” group. This fact might imply that longer exposure to CCT is more effective in securing the basic needs, especially food consumption. Another explanation lies in omitted variable biases because of different profiles of the original sample groups (“Treatment 1998” and “Treatment 2000”) and the newly added control group (“Control 2003”), which may remain even after controlling for village-specific and observable household-specific characteristics in the regression.

Table 4-4-2 shows the OLS regression results of Equation (4.15), by distinguishing the negative income shocks from positive income shocks. All but one of the coefficients are significant and similar to the estimates in Table 4-3. However, it is difficult to confirm the CCT effects except in the coefficients of negative income shocks (β_2) in food consumption. The coefficients β_2 for food consumption are 0.5, 0.11, and 0.15 respectively for “Treatment 1998,” “Treatment 2000” and “Control 2003,” which clearly indicates that households are relatively well insured (β_2 are relatively close to zero, but the null hypothesis rejected.) and that longer exposure to CCT enhances the risk-sharing mechanisms in the village. This finding strongly supports the hypothesis that CCT transfers succeed in securing the basic needs of poor households.

Table 4-4-1. OLS Regression Results of Equation (4.14)

Variables	Model 1			Model 2		
	T1998	T2000	C2003	T1998	T2000	C2003
Food Consumption						
β	0.1118*** (0.0163)	0.1472*** (0.0214)	0.2027*** (0.0339)	0.1147*** (0.0164)	0.1518*** (0.0214)	0.2041*** (0.0340)
Total Consumption						
β	0.1653*** (0.0212)	0.1862*** (0.0277)	0.2111*** (0.0465)	0.1655*** (0.0213)	0.1905*** (0.0274)	0.2163*** (0.0460)
<i>village dummies</i>	yes	yes	yes	yes	yes	yes
No. of Obs (Food)	5819	4090	2290	5819	4090	2290
R-squared (Food)	0.1575	0.1389	0.1532	0.1516	0.1334	0.1494
No. of Obs (Total)	5450	3848	2144	5450	3848	2144
R-squared (Total)	0.1825	0.1455	0.1464	0.1788	0.1435	0.1456

Notes:

1) Huber-White heteroscedasticity consistent standard errors are in parentheses.

2) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 4-4-2. OLS Regression Results of Equation (4.15)

	Model 1			Model 2		
	T1998	T2000	C2003	T1998	T2000	C2003
Food Consumption						
β_1	0.3632*** (0.0437)	0.3197*** (0.0532)	0.3308*** (0.0637)	0.3732*** (0.0437)	0.3245*** (0.0530)	0.3396*** (0.0636)
β_2	0.0538*** (0.0183)	0.1055*** (0.0250)	0.1524*** (0.0447)	0.0551*** (0.0182)	0.1095*** (0.0251)	0.1514*** (0.0444)
Total Consumption						
β_1	0.4978*** (0.0641)	0.3495*** (0.0703)	0.4179*** (0.0827)	0.5057*** (0.0642)	0.3546*** (0.0696)	0.4233*** (0.0828)
β_2	0.0888*** (0.0230)	0.1450*** (0.0328)	0.1341** (0.0606)	0.0873*** (0.0229)	0.1486*** (0.0327)	0.1398** (0.0599)
<i>village dummies</i>	yes	yes	yes	yes	yes	yes
No. of Obs (Food)	5819	4090	2290	5819	4090	2290
R-squared (Food)	0.1655	0.1429	0.156	0.1601	0.1374	0.1526
No. of Obs (Total)	5450	3848	2144	5450	3848	2144
R-squared (Total)	0.1908	0.1477	0.1507	0.1876	0.1457	0.1498

Notes:

1) Huber-White heteroscedasticity consistent standard errors are in parentheses.

2) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

4-5. Concluding Remarks

Three models were estimated to examine the risk-sharing mechanisms in rural Mexico using household panel data. The first model, examining the general risk sharing at the village level, revealed that risk-sharing mechanisms are incomplete, but work better for food consumption than for total consumption, which is consistent with previous studies. The second model, by focusing on the welfare loss, revealed that households are much better insured from negative income shocks than from positive income shocks, which is favorable in the presence of vulnerability. The third model, which includes CCT effects on risk sharing, confirmed the hypothesis that CCT reinforces the risk-sharing mechanisms of the treatment villages. The CCT effects were more apparent in securing poor households' basic needs (negative income shocks to food consumption).

Overall, the results support the hypothesis that risk-sharing mechanisms in rural Mexico offer better insurance in securing basic needs such as food and thus play important roles when households suffer from negative income shocks. In addition, CCT enhances the existent risk-sharing mechanisms. The risk-sharing mechanisms, reinforced by CCT, in turn, serve to mitigate the liquidity constraints (vulnerability) of poor households. However, one should take into consideration the possibility of downward rigidity of food demand that vulnerable households living below subsistence levels cannot decrease their consumption further even when hit by negative income shocks. More disaggregated analyses, such as quintile regressions, would be necessary to draw a more precise conclusion in this respect, which will remain for a future study.

The analyses of this study were based on two-period cross-sectional panel data. However, as mentioned above, ENCEL data has nine rounds in total, and the tenth survey was conducted in 2011. Moreover, since 2003, food prices have constantly increased in tandem with the international food price crisis, which reached its peak in

2008 and 2011. This study considered the price shock only as a part of the village-level macro shocks in general. The sample would have to be expanded to more than three periods to more precisely account for the influence of price shocks (including the Lehman shock, when new data becomes available), and to enable further robustness checks of this study's conclusion.

APPENDIX I

Variables

Household real per-capita food consumption: First, we construct each household's weekly food consumption by summing up the reported amount of weekly food consumption and the estimated weekly self-consumption. Then we divide the household's weekly food consumption by the number of household members to ascertain the per-capita weekly food consumption. In estimating the amount of self-consumption, we first calculate the median state price of each item using each household's reported amounts of weekly purchase and the expenditure on the item. Then, we multiply the amount of reported self-consumption by the estimated unit median price of the state. Per-capita food consumption is deflated by the annual average food CPI¹⁷.

Household real per-capita total consumption: We construct the household real per-capita total consumption in the same way as the food consumption described above by using the reported amount of weekly total consumption of food and non-food items. Per-capita total consumption is deflated by the annual average general CPI.

Household real per-capita income in 2003 and 2007: This includes all household members' wages, pensions, bonuses, monetary institutional transfers (including CCT), agricultural sales, and non-agricultural sales. It excludes personal transfers (including remittances), non-labor or irregular incomes such as sales of assets (houses, cars, home electronics, etc.), inheritance, lottery, gifts, and donations. Personal transfers are

¹⁷ Banco de México Estadísticas.
<http://www.banxico.org.mx/estadisticas/index.html>
(June 2001=100)

excluded because they are more likely to reflect *ex-post* adjustments to shocks, as Skoufias (2007) argues. The reported units of each income sources vary from daily, weekly, monthly to annual. Thus, we estimate the weekly amount of each income source and sum these up to find weekly household income. Then, we divide the weekly total income by the number of household members and deflated it by the annual average general CPI. Households that have any kind of unreported income sources are dropped from the sample.

Household real per-capita income in 2001 and 2002: This consists of the sum of the household head and spouse's retrospective weekly wage income divided by the number of household members and deflated by the average annual general CPI.

Education dummies: *Primary/Secondary/Highschool* education refers to those who have enrolled in a primary/secondary school or high school regardless of whether they graduated. *Technical* education refers to those who have enrolled in any technical/vocational school (including teacher's college). *University* education refers to those who have enrolled in a university and higher (including those who graduated from university and who have entered into/graduated from the post-graduate level).

Household demographic variables: The total number of household members refers to the members who live in the same house regularly, and excludes household members who live separately for more than one year, who live in the same place, but only temporarily, and who have expired. The dependency ratio is the proportion of household members under 14 years and over 65 years of age (non-labor force) to the number of household members aged 15–64 (labor force).

APPENDIX II

Table A4-2. Regression Results of the First Stage of Equation (4.14)

Variables	Food Consumption		Total Consumption	
	Model 1	Model 2	Model 1	Model 2
<i>Instrumented: $\Delta y_{i,t}$ (2003-2007)</i>				
<i>X_i:</i>				
<i>primary03</i>	-3.021***	-3.021***	-3.263***	-3.263***
<i>secondary03</i>	-2.964*	-2.964*	-2.985*	-2.985*
<i>highschool03</i>	-15.311***	-15.311***	-14.798***	-14.798***
<i>technical03</i>	-10.714	-10.714	-11.192	-11.192
<i>univ03</i>	-17.271	-17.271	-15.144	-15.144
<i>total_member03</i>	1.184***	1.184***	1.248***	1.248***
<i>depratio03</i>	0.172***	0.172***	0.166***	0.166***
<i>female03</i>	2.756	2.756	2.670	2.670
<i>age03</i>	-0.436***	-0.436***	-0.436***	-0.436***
<i>married03</i>	3.147	3.147	4.631	4.631
<i>divorced03</i>	1.400	1.400	2.868	2.868
<i>indigenous03</i>	4.456**	4.456**	4.269**	4.269***
<i>total_land_ha03</i>	-0.368***	-0.368***	-0.334***	-0.334
<i>irrigation03</i>	-9.623***		-10.078***	
<i>CCT_dum03</i>	-0.196		-0.049	
<i>selfcons_dum03</i>	-4.630***		-4.490***	
<i>hhremit03</i>	-9.907***		-9.781***	
<i>Instruments:</i>				
<i>$\Delta y_{i,t-1}$ (2001-2002)</i>	-0.077**	-0.077**	-0.075**	-0.075**
<i>land_dum03</i>	-11.477***	-11.477***	-12.242***	-12.242***
<i>hhmig_over15_dum03</i>	-6.177***	-6.177***	-5.833***	-5.833***
<i>hhremit03</i>		-0.196		-0.049
<i>selfcons_dum03</i>		-9.907***		-9.781***
<i>CCT03_dum</i>		-4.630***		-4.490***
<i>irrigation03</i>		-9.623***		-10.078***
<i>_cons</i>	33.5538	33.554***	34.506***	34.506***
<i>village dummies</i>	yes	yes	yes	yes
No. of Obs	12349	12349	11442	11442
R-squared	0.1628	0.163	0.170	0.170
F statistics	599.11	599.110	165.840	165.840

Notes:

1) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

2) $\Delta y_{i,t}$ stands for changes in income.

Table A4-3. Regression Results of Equation (4.14)

Variables	Food Consumption				Total Consumption			
	Model 1		Model 2		Model 1		Model 2	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
β	0.1402***	0.6423***	0.1438***	0.5898***	0.1816***	0.7509***	0.1837***	0.6141***
<i>primary03</i>	-1.1055	0.6891	-1.2637	0.4325	-3.1118**	-0.9731	-3.2256**	-1.5299
<i>secondary03</i>	-2.4718	-1.1952	-2.6685	-1.5641	-3.897	-2.2347	-4.0774*	-2.893
<i>highschool03</i>	-1.0253	6.6416	-1.1275	5.4881	0.5759	8.8971	0.3853	6.4868
<i>technical03</i>	-11.4713*	-6.2134	-11.2992*	-7.2298	9.4061	15.3861*	9.4212	13.3714
<i>univ03</i>	-19.8707	-12.0768	-20.2393	-13.371	-2.3921	5.2763	-2.9251	2.863
<i>total_member03</i>	1.3817***	0.8856***	1.4000***	1.0409***	2.1321***	1.5756***	2.1950***	1.8504***
<i>depratio03</i>	0.1578***	0.0544*	0.1552***	0.0650**	0.2425***	0.1281***	0.2397***	0.1549***
<i>female03</i>	1.1467	-0.3617	0.2995	-0.9405	-3.7037	-5.7328*	-4.5211	-5.9605*
<i>age03</i>	-0.3079***	-0.0191	-0.3278***	-0.0568	-0.4049***	-0.0774	-0.4273***	-0.1656**
<i>married03</i>	-1.6523	-3.1846	-1.837	-3.005	6.3441	3.7895	6.3066	4.5834
<i>divorced03</i>	-10.0258**	-11.2943***	-9.9071**	-10.9608***	2.1675	0.1366	2.377	0.9387
<i>indigenous03</i>	-2.1373	-4.0437*	-2.1531	-3.8015*	1.1975	-0.8054	1.2078	-0.2767
<i>total_land_ha03</i>	0.0384	0.2931***	0.0326	0.2725***	0.0051	0.2801***	0.0003	0.2221***
<i>irrigation03</i>	0.4371	7.7785***			0.5867	9.3690***		
<i>CCT_dum03</i>	1.1779	3.7368***			2.1764	4.9942***		
<i>selfcons_dum03</i>	-12.9203***	-7.7668***			-9.0792***	-3.4248		
<i>hitemit03</i>	-3.4085***	-2.9343**			-4.1940***	-3.5689**		
<i>_cons</i>	1.4002	-15.6875	0.0378	-15.5731	28.3717**	9.2848	26.9945**	12.2189
<i>village dummies</i>	yes	yes	yes	yes	yes	yes	yes	yes
No. of Obs	12349	12349	12349	12349	11442	11442	11442	11442
R-squared	0.1376	-	0.1335	-	0.1613	-	0.1592	-
F statistics	-	599.11	-	599.110	-	165.840	-	165.840
Chi2	-	216028.91	-	128128.105	-	279507.618	-	41600701.430
Robust Durbin-Wu-Hausman test of endogeneity								
Chi2	-	43.8441	-	51.736	-	38.150	-	34.455
F statistics	-	40.8796	-	49.159	-	36.002	-	32.875
Weak instrument tests								
F statistics	-	61.5707	-	39.702	-	61.489	-	38.532
Test of overidentifying restrictions								
Chi2	-	142.941	-	186.167	-	139.746	-	171.240

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$ based on Huber-White heteroscedasticity consistent standard errors.

APPENDIX IV

Table A4-4. OLS Regression Results of Equation (4.15)

Variables	Food Consumption		Total Consumption	
	Model 1	Model 2	Model 1	Model 2
β_1	0.3482***	0.3566***	0.4367***	0.4416***
β_2	0.0857***	0.0879***	0.1146***	0.1158***
<i>primary03</i>	-1.2846	-1.449	-3.3487**	-3.4668**
<i>secondary03</i>	-2.9315*	-3.1465*	-4.4369*	-4.6321*
<i>highschool03</i>	-1.9444	-2.1003	-0.4884	-0.7297
<i>technical03</i>	-12.8771**	-12.7934**	7.6039	7.53
<i>univ03</i>	-21.2319*	-21.7382*	-4.1653	-4.8416
<i>total_member03</i>	1.5356***	1.5613***	2.3217***	2.3915***
<i>depratio03</i>	0.1399***	0.1374***	0.2200***	0.2176***
<i>female03</i>	1.0751	0.302	-3.725	-4.4647
<i>age03</i>	-0.3098***	-0.3287***	-0.4065***	-0.4277***
<i>married03</i>	-1.638	-1.8057	6.2803	6.2629
<i>divorced03</i>	-9.7769**	-9.6806**	2.3343	2.5161
<i>indigenous03</i>	-1.9628	-1.9701	1.4266	1.4434
<i>total_land_ha03</i>	0.0337	0.0274	-0.001	-0.0063
<i>irrigation03</i>	0.1038		0.2728	
<i>CCT_dum03</i>	1.3924		2.4364	
<i>selfcons_dum03</i>	-12.5587***		-8.6920***	
<i>hhremit03</i>	-3.2141***		-3.9936***	
<i>_cons</i>	-4.0236	-5.5269	21.7480*	20.2716
<i>village dummies</i>	yes	yes	yes	yes
No. of Obs	12199	12199	11442	11442
R-squared	0.1535	0.1487	0.1667	0.1647

Note: * p<0.1; ** p<0.05; *** p<0.01 based on Huber White heteroscedasticity consistent standard errors.

APPENDIX V

Table A4-5-1. OLS Regression Results of Equation (4.14)

Variables	Food Consumption			Total Consumption		
	T1998	T2000	C2003	T1998	T2000	C2003
β	0.1118***	0.1472***	0.2027***	0.1653***	0.1862***	0.2111***
<i>primary03</i>	-1.2907	0.231	-3.7309	-1.6736	-1.9116	-10.2144***
<i>secondary03</i>	-1.2473	-0.9889	-7.3702*	-2.3883	-1.4368	-11.8232**
<i>highschool & higher03</i>	-8.7846	3.3221	-15.4300**	-2.2612	21.4276**	-11.3939
<i>total_member03</i>	1.6600***	1.2776***	0.7885	2.4530***	2.1418***	1.1542*
<i>depratio03</i>	0.1867***	0.0698*	0.2495***	0.2618***	0.1695***	0.3291***
<i>female03</i>	-1.0932	-0.4971	9.6684	-3.3369	-7.7833	4.6021
<i>age03</i>	-0.3720***	-0.2524***	-0.2449***	-0.4675***	-0.3247***	-0.3575***
<i>married03</i>	4.8416	-2.4848	-12.5298	11.0675*	2.8077	4.6126
<i>divorced03</i>	-1.1734	-9.8364	-27.8097***	7.4984	0.7995	-5.6603
<i>indigenous03</i>	-4.307	1.6535	-3.5049	-1.1446	4.4878	3.8628
<i>total_land_ha03</i>	-0.0178	0.1085	0.1153	-0.1008	0.1537	0.1249
<i>irrigation03</i>	0.5118	-1.4598	3.7427	4.2671	-2.5263	-3.0187
<i>CCT_dum03</i>	0.8579	1.9946	0.3455	3.7286*	1.0271	-4.843
<i>selfcons_dum03</i>	-14.2189***	-11.2653***	-12.6642***	-11.7020***	-6.8418**	-6.1886
<i>hhremitt03</i>	-2.9313*	-4.7754***	-2.1503	-4.3671**	-5.0776**	-2.4087
<i>_cons</i>	-23.9998***	33.0394***	9.7111	-44.7135***	-68.1755***	33.6517*
<i>village dummies</i>	yes	yes	yes	yes	yes	yes
No. of Obs	5819	4090	2290	5450	3848	2144
R-squared	0.1575	0.1389	0.1532	0.1825	0.1455	0.1464

Notes:

1) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$ based on Huber-White heteroscedasticity consistent standard errors.

2) The results are based on the estimation of Model 1.

Table A4-5-2. OLS Regression Results of Equation (4.15)

Variables	Food Consumption			Total Consumption		
	T1998	T2000	C2003	T1998	T2000	C2003
β_1	0.3632***	0.3197***	0.3308***	0.4978***	0.3495***	0.4179***
β_2	0.0538***	0.1055***	0.1524***	0.0888***	0.1450***	0.1341**
<i>primary03</i>	-1.3862	0.1357	-4.0994	-1.7005	-2.0753	-10.9160***
<i>secondary03</i>	-1.7352	-1.5119	-7.7163*	-2.825	-2.0331	-12.4322**
<i>highschool & higher03</i>	-10.1581*	3.1056	-16.8231**	-3.9719	21.2146**	-13.7113
<i>total_member03</i>	1.7951***	1.3998***	0.9696*	2.6303***	2.2605***	1.4437**
<i>depratio03</i>	0.1653***	0.0585	0.2325***	0.2332***	0.1581***	0.3020***
<i>female03</i>	-1.6861	-0.1689	9.805	-4.0535	-7.5116	5.0006
<i>age03</i>	-0.3652***	-0.2519***	-0.2621***	-0.4568***	-0.3261***	-0.3815***
<i>married03</i>	4.3451	-2.4892	-11.8344	10.3817	2.7539	5.5939
<i>divorced03</i>	-0.7679	-9.9014*	-27.5046***	7.9903	0.7112	-5.5427
<i>indigenous03</i>	-4.238	1.924	-3.3512	-1.0109	4.7535	4.1721
<i>total_land_ha03</i>	-0.0182	0.1097	0.098	-0.1024	0.1543	0.1005
<i>irrigation03</i>	0.0162	-1.3306	3.0778	3.7905	-2.405	-3.8991
<i>CCT_dum03</i>	0.8718	2.3849	0.4506	3.6406*	1.453	-4.7281
<i>selfcons_dum03</i>	-13.7424***	-11.1827***	-12.1838***	-11.1817***	-6.8032**	-5.4235
<i>hhremitt03</i>	-2.6127*	-4.5832**	-2.14	-3.9341*	-4.9002**	-2.5448
<i>_cons</i>	-29.9494***	-80.0870***	6.3086	-29.0095**	-69.0818***	28.195
<i>village dummies</i>	yes	yes	yes	yes	yes	yes
No. of Obs	5819	4090	2290	5450	3848	2144
R-squared	0.1655	0.1429	0.156	0.1908	0.1477	0.1507

Notes:

1) * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$ based on Huber-White heteroscedasticity consistent standard errors.

2) The results are based on the estimation of Model 1.

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