



**LINKING TORTILLA PRICE POLICIES TO HOUSEHOLD FOOD
CONSUMPTION AND CHILD NUTRITIONAL INTAKE: POTENTIAL
OUTCOMES OF GLOBALIZATION IN RURAL MEXICO**

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A Dissertation

Presented to the Faculty of the Graduate School
of Cornell University

In Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy

by

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August 2010

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Cornell University 2010

Globalization can potentially lead to more market competition, reduced prices and higher purchasing power for consumers in the long run. In short term, however, vulnerable populations can be negatively affected by market volatilities without appropriate protection policies in place.

In 1998, as part of NAFTA requirements, the Mexican government terminated tortilla price regulation, creating a real-life situation for studying the short-term effects of globalization policies. Using data from 836 poor households across 6 states in Mexico, this study addresses two questions: first, “does the consumption of main foods become more sensitive to prices after the policy change?”, and second, “does children’s intake of key nutrients become more sensitive to prices?”

First, we analyzed household consumption of tortilla with regards to prices of tortilla and 11 common foods in 1999 compared to 1998. Unlike some evidence in the literature, price of tortilla was not significantly lower in 1999 for our sample (adjusted for inflation). Our results, however, showed that households’ consumption of tortilla became more “sensitive” to changes in the prices of tortilla and some other main staples (beans, milk, sugar, onions, and tomato) after the policy change.

Second, we used data on children’s daily intake of nutrients. Slopes for demand of 11 nutrients in response to prices of 12 staple foods were tested for differences between two years. In 1999, an increase in price of chicken was more

likely to decrease intake of protein, iron, and calcium, and an increase in price of tomato was associated with a larger shift toward fat intake compared to 1998.

These findings show that household consumption was more “sensitive” to prices in 1999, concluding that volatile market prices were more likely to affect consumption. We also showed that rapid price changes for chicken and tomato as two main foods for children could negatively affect their intake. Finally, we conclude that in evaluating the short-term impact of globalization, even in the absence of significant changes in prices or consumption, elasticity (or sensitivity) of consumption and nutrient intakes to prices can change significantly, thus providing valuable information on potential vulnerabilities of populations at risk of undernutrition.

BIOGRAPHICAL SKETCH

Mandana Arabi was born in 1974 in Tehran, Iran. She finished her primary education in 1992 as the high school Valedictorian at the National Organization for Development of Exceptional Talents (NODET, or Farzanegan). The same year, she started medical school at the Tehran University of Medical Sciences and received her Doctor of Medicine (M.D.) degree with honors in 2000. She practiced medicine briefly before she was recruited as the research adviser by the office of Maternal and Child Nutrition at the Ministry of Health and Medical Education (MOH) in Iran.

At the Iranian MOH, she worked on the evaluation of the national salt iodization program, which later became the first successful Universal Salt Iodization in the Middle East and North Africa region of the World Health Organization. Later, she became the head of the liaison office in the MOH for a \$32 Million World Bank project for improving maternal and child nutrition in Iran.

She started her studies in International Nutrition at Cornell University in 2001, with a focus on maternal and child nutrition, and minors in agricultural economics and epidemiology. In 2002-2003, she was the focal point for cross-country analyses of a PAHO (Pan American Health Organization) study on infant feeding practices in Brazil, Jamaica, Mexico, and Panama. She joined UNICEF in 2007 as an Infant and Young Child Feeding (IYCF) specialist. She intends to continue working on child nutrition issues in developing countries, hoping to contribute to closing the gaps in global development with cultural sensitivity and a commitment to local empowerment, sustainability, environmental conservation and social justice.

This research is especially dedicated to my son Ilia Parsa Raiszadeh. Without his understanding and patience I could not have completed the journey. Each page I have written in a way represents time spent away from him, but I would like him to know that it also represents my deepest love for him and dedication to his future, and to the future of the children of the world.

I know that he understands.

ACKNOWLEDGEMENTS

I would like to first and foremost acknowledge the ongoing support of my adviser Professor Edward Frongillo. From the moment we spoke over the shaky phone line about my application to Cornell as I was on a field trip in the earthquake-affected areas of Kerman Province in Southern Iran, to this day, he has been a source of advice and inspiration and a friend. He has taught me how a person can make a real difference.

I would also like to thank my committee members, Professor Carole Bisogni, Professor Jean-Pierre Habicht, and Professor Per Pinstrup-Andersen for their guidance and support throughout my studies at Cornell. I am grateful that my life has been touched by such remarkable individuals.

I would like to thank Dr Juan Rivera and other colleagues at the INSP (El Instituto Nacional de Salud Publica) in Mexico who generously provided part of the data for this research. I would also like to thank John Hoddinott at IFPRI (International Food Policy Research Institute) for providing the child nutrition data set and guiding me through the data merging process.

I would like to thank the Divisional of Nutritional Sciences, professors, administrative support staff, and fellow graduate students (including the Nutrition United soccer team), for creating an environment which was ideal not just for academic success, but also for personal growth towards becoming a more conscious citizen of the world. You have made it hard to adjust to the “real world”.

I would like to express my deepest gratitude to my friends Avril Armstrong and Maria Guadalupe Rodriguez (Lupita), who along with their constant encouragement and support provided much-needed childcare for my son on the days before my defense. I will be always indebted to you.

My special thanks to my former chief in Ministry of Health and Medical Education in Iran, Dr Robabeh Sheikholeslam, who introduced me to the world of public health nutrition, and as an Iranian woman has always been a role model for resilience and self-confidence. I hope one day we can join hands again for the children of our beloved Iran.

Though many years have passed, the influence of my teachers and class-mates in Farzanegan (National Organization for Development of Exceptional Talents) has never faded. I thank them from the bottom of my heart and wish them all the best wherever they are. They taught me to go beyond myself, and I am still struggling to keep up to their expectations.

Last but not the least, mom and dad, you are very special. Thank you for all you have done and all you have been. You were able to provide me and my three brothers with a beautiful childhood through years of war, through shortages and bombings of our city and many losses with such courage that made it all look too easy. Only now that I am a parent myself do I recognize what a burden you must have taken on your shoulders to save us from feeling the pressures and to help us keep focused on our studies and our futures. I salute you.

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CHAPTER ONE

INTRODUCTION

The term “Globalization” has been used extensively in the contemporary literature, and would generally refer to a process by which the people of the world are unified into a single society and function together (Stanford Encyclopedia of Philosophy, 2006). Globalization, however, was initially used as a term in economics to refer to open international trade (World Bank, 1997), but the breadth of meanings attached to it has been increasing over time as we better understand its complexities (World Bank, 2002). Globalization has gradually come to encompass anything “supra-territorial”, anything that transcends the geopolitical boundaries of the nation-state and leads to the increasing human proximity. Although still driven by economic incentives, today’s globalization brings a whole array of complex and interactive economic, cultural, technological, social, and environmental trends with it (Rennen, 2003).

Along with major changes in the international trade policies, technological advancements and marketing strategies have crossed national boundaries. It is not just trading goods, but services, capital, people, information and ideas that flow across borders and lead to greater integration of economies and societies today. As such, interest in empirical assessments of the effects of globalization on populations, communities, households and individuals has been on the rise.

Trade liberalization policies have been the subject of controversy and ongoing discussions worldwide. Some believe they can be the principal mechanism for providing better opportunities for the poor and will lead to the international convergence of living standards. Others point to the challenges that they pose for many poor countries in maintaining the health and wellbeing of their citizens in the face of rapidly changing markets.

A compelling argument in defense of economic globalization has been that open trade leads to better economic growth, and eventually less poverty in a country. Studies by Frankel and Romer (1999) and Irwin and Tervio (2002) have shown that countries that are more open to trade tend also to have higher growth rates and incomes per capita. Agenor has found that there appears to be an inverted U-shape relationship between poverty and globalization: at low degrees of globalization, globalization appears to hurt the poor, at higher levels; however, globalization leads to a decline in poverty (Agenor, 2003)

The promise of lower market prices for consumers, an outcome of free trade and increased global competition, has not been completely fulfilled after removal of trade barriers by countries. Some empirical studies have shown that, despite globalization, there has been an overall pattern of fluctuating or random divergence in international commodity prices rather than convergence of prices (Bukonya, 2005), and at least in early stages, price shocks have followed globalization policies in several developing countries (De Janvry, 1997).

The recent global food price crisis particularly has brought much attention to the possible impact of such crises in low- and-middle income countries, in an increasingly globalized world where higher international prices are directly translated into higher domestic prices. In 2007 and 2008 international food and oil prices soared causing riots in over 30 countries, threatening to undo any progress made towards Millennium Development Goals 1 and 4 – eradicating hunger and under-five child mortality. While the rise in prices may have come to the benefit of net food sellers, for the majority of small-scale farmers, rural farm workers and the urban poor in less developed countries who were net food buyers, the global increases were an additional

threat to their survival. High prices consistently forced families to adopt damaging coping strategies to maintain staple food consumption (ACF, 2009).

Understanding the relationship between globalization and economic indicators such as growth, income distribution, and poverty is crucial to reaching a better understanding of its macro-level outcomes and institutionalizing possible protection mechanisms for those most likely to be negatively affected. At the same time, globalization is a phenomenon beyond macro-economic changes, and its final impact on individuals –whether it is “good or bad”- is determined by many processes that tend to affect individuals’ and households’ choices and cultural preferences, and needs to be acknowledged and studied to the extent possible.

Globalization from the health and nutrition perspective

One of the main concerns over the outcomes of globalization has been regarding its effects on health (Diaz-Bonilla, 2002). From new and emerging infectious disease like SARS¹, to the increased market access for potentially harmful products like tobacco, from drug discovery guidelines and intellectual property rights to multilateral trade agreements and their effects on health, the health community has had its hands full in this era of opening international borders.

Globalization has not only been changing the shape of health problems by changing peoples’ environment and habits, but also by affecting the very understanding of public health policies and programs in the global political arena. In global health community, concern is rising as to whether the pressure on emerging economies to participate in competitive markets will make healthcare and welfare increasingly marginalized. Beside the more issue-oriented approaches, however, it is becoming more and more clear that the health community has to be ”going beyond

¹ SARS stands for Severe Acute Respiratory Syndrome.

traditional approaches to public health research, beginning with means of capturing the transnational nature of many health determinants and outcomes” (Lee, 2001).

Nutrition has a special place within the framework of human health, and it is strongly connected to many domains to which globalization is linked, including its economic, environmental, agricultural, socio-cultural, and technological outcomes. Thus, nutritional outcomes of globalization are of major concern both from the health perspective as well as the economic development perspective.

Mild to moderate undernutrition (as defined by low weight for age) is associated with elevated child mortality, and there is an epidemiologic synergism between undernutrition and morbidity (Pelletier et al., 1993). In 2001, 50 to 70% of the burden of death from diarrheal diseases, measles, and malaria and lower respiratory infections in children was found to be attributable to undernutrition (De Onis et al., 2004). According to the Lancet Nutrition Series (Black et al, 2008), undernutrition is the underlying cause of about 30% of child deaths.

Undernutrition is still a major obstacle to development in poor countries. The Millennium Development Goals (MDGs) set by governments and development organizations worldwide have recognized that nutrition plays a key role in the road to development, and policies programs that improve nutritional status are essential to achieving the MDGs (Bloem, 2001, Kiess, 2001). MDG1- “to eradicate extreme poverty and hunger”- has a target of “reducing by half the proportion of people who suffer from hunger” by 2015, and MDG 4 is about “reducing by two thirds the mortality rate among children under five”. Nutrition plays an important role in achieving several other MDGs and is being increasingly recognized as central to development (World Bank, 2006).

Despite progress towards achievement of these goals, there is still a lot to be done. Today, in the developing world, approximately 195 million children under 5 years old are stunted (too short for their age). More than 40 per cent of these children live in South Asia. Due to the high prevalence of stunting in combination with a large population, India alone has an estimated 61 million stunted children, which accounts for more than 3 out of every 10 stunted children in the developing countries (UNICEF, 2009).

The role of diet and nutrition as determinants of chronic non-communicable diseases (NCDs) is also well established (WHO, 1990). Nutrition is coming to the fore as a major modifiable determinant of chronic disease, with scientific evidence increasingly supporting the view that alterations in diet have strong effects, both positive and negative, on health throughout life (WHO, 2003).

Globalization of the world economy has been rapidly changing the traditional diets (Hawkes, 2006). Modern dietary patterns and physical activity patterns have been traveling across countries so rapidly that some have suggested considering chronic diseases “communicable” at level of such risk factors (Choi et al., 2001). Unfortunately, as higher income groups in developing countries learn to benefit from a more dynamic marketplace, lower-income groups may experience higher access to poor quality obesogenic diets. Global economic policies concerning agriculture, trade, investment and marketing affect these individual level outcomes profoundly, and health and nutrition policy-makers have to pay greater attention to these policies in order to address some of the structural causes of obesity and diet-related chronic diseases and ensure a more equitable globalization worldwide.

Understanding short- term effects of globalization: from price shocks to nutritional outcomes

Several pathways for linking globalization to nutrition have been studied. In short-term, there has been evidence that price shocks have followed globalization policies, and that changes in food prices have had some negative impacts on the nutritional status of vulnerable populations. For example, Block et al. (2004) showed that in Indonesia, the economic crisis led households to substitute into lower quality foods to maintain gross energy intake, and the poor quality of diet lead to lower micronutrient intakes by children.

In addition, the inability of the poor to diversify their income sufficiently has been shown to be a reason for their vulnerability to price shocks. This not only puts them at a higher risk for developing nutritional deficiencies, but reduces their ability to benefit from the opportunities provided by the free market (Block and Webb, 2001). Price shocks appear to be the most immediate outcome of globalization policies, especially since most of these policies have been introduced by governments in a rather abrupt manner (Yunez-Naude, 2002).

The effects of price on food demand has been extensively studied by economists, and like any other demand function, food demand functions can be written as a conventional economic demand function with a vector of behavioral outcomes dependant on a vector of prices and a vector of resources including income (Behrman, 2000). Households face Market prices and food purchase usually happens at the household level, but individual characteristics also determine the eventual intake of nutrients. Based on these demand characteristics, Figure 1.1 shows a conceptual framework for the study of the effects of price shocks on household food consumption and individual intake.

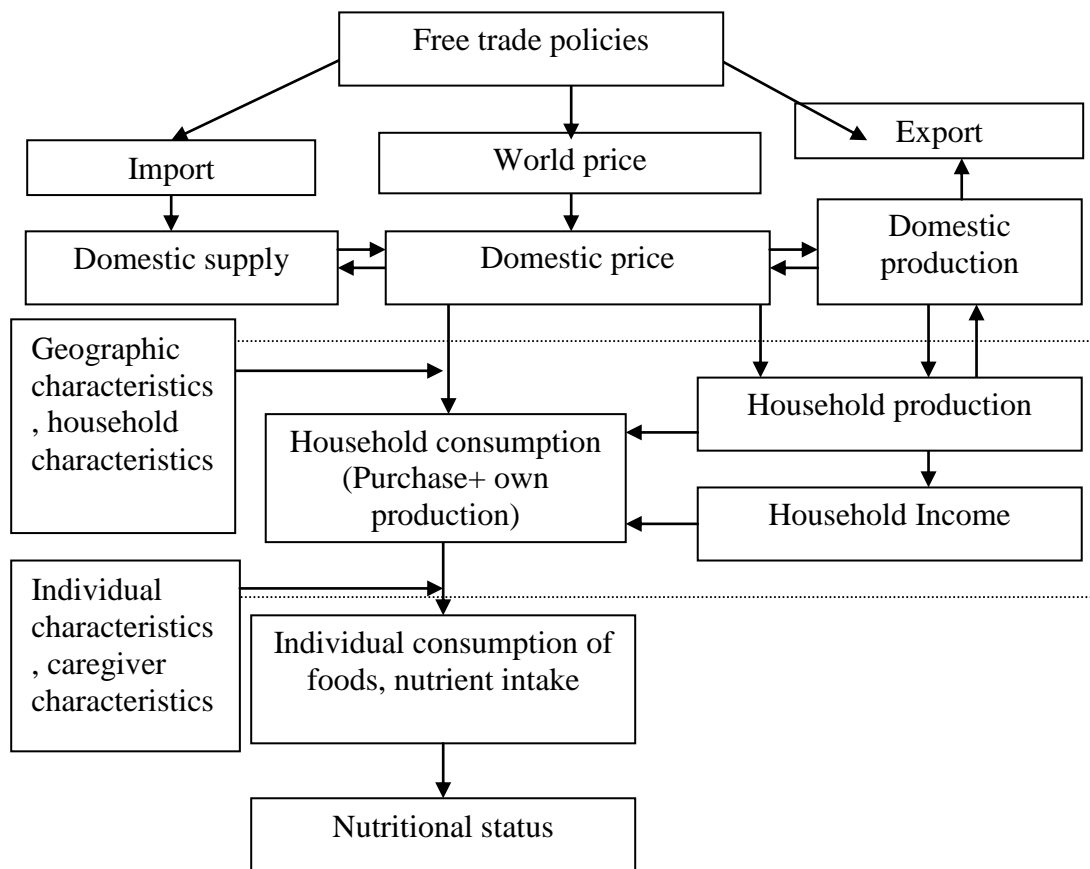


Figure 1.1 Conceptual framework for the effects of free trade policies on nutrition

Mexico and the experience of globalization

Since the introduction of NAFTA, Mexico's experience of market liberalization has served as an exemplary case to study. On one hand, the debate on the effect of NAFTA on commodity prices has been ongoing. Some evidence has shown that only relative prices for producers of import-sensitive commodities in Mexico fell during the 1990s (Lederman, 2003). On the other hand, there is evidence showing that prices of a few staples including corn fell after NAFTA and thus consumers benefited

from lower prices, but it was accompanied by falling agricultural incomes for farmers during this same period (Yunez-Naude 2002).

The effects of open trade policies (e.g. the North American Free Trade Agreement or NAFTA) have been particularly dramatic in rural areas as a result of the impact on the agricultural sector. It has been cited that farmers have been unable to compete with the US agricultural industry, particularly in basic grains, resulting in part from the subsidization of this sector in the United States and from the lack of subsidies available to Mexican farmers (Yunez-Naude, 2002).

In the past, direct government intervention in agriculture was a major component of Mexico's development policy from the second half of 1930 until the beginning of the 1990s. Since its creation in the mid-1960s, the National Company of Popular Subsistence (CONASUPO) played a key role in Mexican agricultural policies, shaping food production, consumption, and rural incomes. Following the debt crisis of 1982, this company was reformed as part of the market liberalization process begun by the government. On January 1, 1999, the Zedillo Administration in Mexico announced the elimination of subsidies for corn bread (tortilla) consumption, and with this, the liquidation of CONASUPO (Yunez-Naude, 2002).

The rural poor in Mexico are mostly agricultural laborers with little ability to make immediate income diversifications in the face of economic shocks. Increased prices could have caused consumption changes at the household level for tortilla, decreased the food budget of families, and subsequently affected their consumption of other major food items. Therefore, what happened to the poor households immediately after the cessation of government tortilla price protection can demonstrate a good example of short-term effects of globalization policies and provide valuable information for further policy decisions.

Research objectives and overview of this dissertation

This dissertation-“linking tortilla price policies to household food consumption and child nutritional intake: potential outcomes of globalization in rural Mexico” attempts to understand the linkages between the phenomenon of globalization and nutrition and assess short-run nutritional outcomes of market shocks. First, it provides a review of the current state of thought on such linkages and lays out a comprehensive framework which can serve as a tool in overall “framing” of globalization from the nutrition perspective. Then, it focuses on an empirical case study of the short-term effects of a pro-globalization policy in Mexico. This dissertation is organized in five chapters:

Following the introduction, Chapter Two of this dissertation will address the conceptual framework linking globalization to nutrition. It contains a critical review of literature and the currently available evidence on potential pathways through which globalization can affect the nutritional status of households and individuals. Thus, Chapter Two will focus on how nutrition can be framed within the much larger framework of macro- and micro- level outcomes of globalization, and how empirical research can be designed to help better understand these relationships and provide a solid evidence base for policies in future.

Chapter Three and four contain a discussion of the empirical findings of this study. As these chapters were written as papers for publication, there is some repetition in their methods section.

Chapter Three will study the short term effects of a pro- globalization policy (i.e. cessation of tortilla price protection at the end of 1998) by the Mexican government on the food consumption of households in rural Mexico. By focusing on short-term rather than long-term effects of globalization, this chapter will focus on

Mexico as a country case-study to identify the changes in household demand and consumption patterns in response to prices between the two years of 1998 and 1999. Thus, it will assess some of the possible effects of this policy change by testing the differences between the two years and finding the determinants of such differences.

Chapter Four will focus on the short term effects of the cessation of tortilla price protection at the end of 1998 by the Mexican government on the children's daily intake of macro- and micro-nutrients. By using 24-hour intake data from more than 800 children in rural Mexico in 1998 and 1999, this chapter will assess whether intake of any of the 11 nutrients studied (energy, protein, fat, sugar, iron, calcium, zinc, vitamin A, vitamin D, vitamin B12, and vitamin C) become more sensitive to prices of major foods after the cessation of tortilla price protection, and if so, what are the possible nutritional outcomes of these changes. The results will then be used to discuss what policies could possibly protect children's intake during the globalization process in Mexico. Finally, Chapter Five describes conclusions and implications of this study based on previous chapters.

CHAPTER TWO
GLOBALIZATION AND NUTRITION: REVIEW OF A CONCEPTUAL
CHALLENGE

Abstract

Globalization or the integration of economies and societies through trade, investment, finance, information, technology, and labor flows is an inescapable feature of the world today. Globalization has been affecting our lives at various levels, and understanding the pathways linking globalization to individual outcomes such as health and nutrition is crucial to formulating effective health and nutrition policies in future. In studying the effects of globalization on individuals and populations, however, different disciplines have used different approaches in definition, measurement, and conceptualization of outcomes of globalization. Thus, the agenda for empirical research especially of an interdisciplinary nature is yet to be clarified. With this background, the purpose of this paper is to review and examine the currently available evidence on potential pathways through which globalization can affect the nutritional status of households and individuals. Furthermore, after discussing the presently available conceptual frameworks linking globalization and nutrition, a conceptual model will be presented, calling for a better, more thorough development of a widely accepted framework. Finally, future challenges and implications for research and policy will be discussed.

Introduction

Globalization or the integration of economies and societies through trade, investment, finance, information, technology, and labor flows is an inescapable feature of the world today. Many argue that it is not even a new phenomenon. International trade has been a main factor in prosperity of nations throughout history, and the winners have been those cultures that were able to engage in cross-border exchanges. Today's globalization; however, although still driven by economic incentives, brings a whole array of complex and interactive economic, cultural, technological, social, and environmental trends with it (Rennen, 2003).

As such, innumerable words have been devoted to the discussion and critique of this phenomenon, but a lack of common understanding regarding the definition and conceptualization of its different outcomes leaves the concerned scientist, practical politician, or ordinary citizen equally at a loss.

A considerable body of opinion is arguing that globalization has led to substantial economic progress among rich and poor countries alike, and it can be the principal mechanism for the "international convergence of living standards" (Dollar, 2001). If so, then such a force should be nothing but most welcome in a world with vast disparities in health, income, and wellbeing.

Many scholars also point to the challenges that globalization poses for poor countries, challenges that are most commonly directed at the vulnerable socio-economic groups within these countries and eventually worsen the income gaps between the rich and the poor. Anecdotal references have reported that globalization has not worked for everyone, and that the poor in some developing countries have lost their livelihoods and become more vulnerable to economic shocks (Oxfam, 2002).

Nevertheless, beyond such scholarly debates, empirical analyses are called for to identify the factors that can enable a greater number of people to benefit from the opportunities provided by globalization. Evidence-based policies can be crucial in supporting the vulnerable populations in times of market volatility. In studying the effects of globalization on individuals and populations, however, different disciplines have used different approaches in definition, measurement, and conceptualization of outcomes of globalization, and the future agenda for empirical research especially of an interdisciplinary nature is still to become clear.

One of the main concerns over the outcomes of globalization has been regarding its effects on health (Diaz-Bonilla, 2002). From new and emerging infectious disease like SARS², to the increased market access for potentially harmful products like tobacco, from drug discovery guidelines and intellectual property rights to multilateral trade agreements and their effects on health, the health community has had their hands full in this era of opening international borders.

Nutrition, on the other hand, with its special place within the framework of human health, is strongly connected to many other domains to which globalization is linked, including its economic, environmental, socio-cultural and technological outcomes. Individuals' food intake and food choice behaviors are outcomes of a complex and interrelated network of social, household and individual level determinants. Macro-level changes like food prices and market availability of new and unknown food items, cultural influences from around the globe and marketing practices of multinational corporations have all been shaping the new face of nutrition in this millennium(Hawkes, 2006).

² SARS stands for Severe Acute Respiratory Syndrome.

Malnutrition is still a major obstacle to development in poor countries. Mild to moderate undernutrition is associated with elevated child mortality, and there is an epidemiologic synergism between malnutrition and morbidity (Pelletier et al., 1993). In 2001, 50 to 70% of the burden of death from diarrheal diseases, measles, and malaria and lower respiratory infections in children was attributable to undernutrition (de Onis et al., 2004). Millennium Development Goals (MDG) set by governments and development organizations worldwide have recognized that nutrition plays a key role in the road to development, and policies programs that improve nutritional status are key to achieving the MDGs (Bloem, 2001, Kiess, 2001).

The role of diet and nutrition as determinants of chronic Non-Communicable Diseases (NCDs) is also well established (WHO, 1990). Nutrition is coming to the fore as a major modifiable determinant of chronic disease, with scientific evidence increasingly supporting the view that alterations in diet have strong effects, both positive and negative, on health throughout life (WHO, 2003). Globalization of the world economy has been rapidly changing the traditional diets. Modern dietary patterns and physical activity patterns have been traveling across countries so rapidly that some have suggested considering chronic diseases “communicable” at level of such risk factors (Choi et al., 2001).

With this background, the purpose of this paper is to review and examine the currently available evidence on potential pathways through which globalization can affect the nutritional status of households and individuals. Furthermore, after discussing the presently available conceptual frameworks linking globalization and nutrition, a conceptual model will be presented, calling for a better, more thorough development of a widely accepted framework.

Such a framework provides valuable insights in studying the complexity of the nutrition effects of globalization, and links them to the more macro-level changes in poverty, growth, and inequality. Furthermore, the possibility of drawing viable policy solutions out of the available research and the call for new approaches for additional research will be discussed.

To address the objective of this paper, we have organized this work in several sections. It should be noted that several of the reviewed paper had not clearly stated their conceptual frameworks. Therefore, we have attempted to extract their proposed framework through two sections. The first section discussed different definitions of globalization by various authors. Knowing the definition they have used is quite helpful in knowing what phenomenon they have in fact studied. The next section, discussed the measures of globalization used by various authors. Again, in addition to and sometimes even in the absence of a definition, how they measured globalization will tell us a lot about how they have narrowed down their more general view of the phenomenon of globalization into a measurable entity.

The next section will focus on the specific pathways and links that each author has empirically studied. These studies can be generally categorized into studies of macro-level effects and studies of micro-level effects of globalization. Among the macro-level outcomes of globalization, changes in poverty, inequality, and growth are addressed, and among micro-level outcomes effects on health, nutrition and food security will be reviewed. Finally, a comprehensive conceptual framework will be presented. The last section will discuss the challenges of globalization for nutrition policy and practice.

Sources of information for this paper have been journal articles, books, and policy reports dealing with some aspect of globalization. These include studies of both

macro-level outcomes like poverty and growth and micro-level outcomes including household food security and individual health.

In search of a shared meaning: “What is Globalization?” “

The World Bank definition of globalization is “Freedom and ability of individuals and firms to initiate voluntary economic transactions with residents of other countries” (World Bank, 2000b). The economic dimensions of globalization have been defined as the “growth in cross-border economic activities” (World Bank, 2000b), or “the widening and deepening of international flows of trade, finance and information in a single integrated global market” (UNDP, 1997).

Globalization is also defined as the process through which goods and services, capital, people, information and ideas flow across borders and lead to greater integration of economies and societies. Milanovic (2002) mentions that empirically, globalization translates into greater mobility of the factors of production (capital and labor) and greater world integration through increased trade and foreign investments.

Many of these definitions tend to be inclusive only of the economic aspect of this process. Such notions inherently lead to assessing the impacts of globalization on human lives only through the lenses of economic rationality.

Vacchino (2000) points out that the concept of globalization has different meanings, generally reflecting the growing importance of economic, social, and cultural aspects of a worldwide scope. Globalization as such is a concept both dynamic and comprehensive in nature, which makes it complicated to reach a universally accepted definition.

Some authors have found it useful to view the concept as a historical process with a changing face. Through globalization, gradually the extent to which social, economic, and cultural processes affect human beings has started to move beyond the

boundaries of territories and nations and thus has led to significant changes in the potential actors and decision makers (Dookeran, 1998). Such a notion emphasizes the importance of being sensitive to time as an important variable in studies of the globalization process.

There is increased agreement on that globalization is a complex phenomenon. Rennett and Martens(2003) define contemporary globalization as an intensification of an array of cross-national cultural, economic, political, and social processes that lead to establishment of structures and global integration at different levels (local, regional, national, supranational, and global). They suggest that, instead of attempting to define globalization by emphasizing particular factors (economic, technological, etc), it may be more useful to look at it as a multi-dimensional, pluralistic phenomenon and frame it within the context of past and current processes taking place in multiple dimensions. This definition, although complex, is concordant with the view on globalization in terms of not just de-territorialization, but also a multi-dimensional and multi-factorial process (Huynen, 2005).

To conclude, although some of these definitions better grasp the complexity of the globalization process, there are others that isolate some of these effects--mostly in the realm of macroeconomics--and fall into over-simplification. Subsequently, they end up taking only one or two aspects of globalization (e.g., free-trade) as representative of the whole globalization process.

From the nutrition perspective, along with the major changes in the international trade policies, technological advancements and marketing strategies have crossed national boundaries. It is not just trading goods, but services, capital, people, information and ideas that flow across borders and lead to greater integration of economies and societies today. This is the phenomenon that has been changing the

face of traditional diets, people perspectives on food and their choices and preferences. In our view, “globalization encompasses anything 'supra-territorial', anything that transcends the geopolitical boundaries of the nation-state and leads to the increasing human proximity”. Although still driven by economic incentives, today’s globalization brings a whole array of complex and interactive economic, cultural, technological, social, and environmental trends with it (Rennen, 2003).

Does it really matter how we define globalization? Yes. Without a common understanding of the phenomenon, any conclusions or value judgments on the positive or negative effects of globalizations, has little value in setting up a research agenda and serving as a basis for national and international policies. We need a somewhat similar definition to be able to discuss and debate a phenomenon in the first place. Many people have used terms like westernization, liberalization, free-trade and globalization interchangeably. We need to know what globalization is, as well as to decide what it is not (Scholte, 2000). A clear definition and a conceptual framework to portray the multiple domains in which globalization can affect individuals will serve as a “think model” and set the agenda for future research (Huynen, 2005).

Measures of globalization

As mentioned before, in addition to the definition used by authors to explain globalization, the measures they have used can also provide valuable information about their underlying conceptual framework.

To measure globalization, even narrowly defined to focus on trade and financial integration, is an onerous task. In particular, it is difficult to find an adequate measure of trade openness and various proxies for openness have been used in the literature. In his assessment of the effects of globalization on income distribution, Milanovic (2002) and Dollar (2001), like many others, use two measures: ratio of sum

of import and exports in country's GDP, and percent share of FDI (Foreign Direct Investment) in GDP.

Agenor (2003) uses the average tariff rate (that is, total tariff revenue divided by the value of imports), to measure trade globalization. He mentions that the most popular indicator of trade openness, the ratio of the sum of nominal exports and imports to GDP, is too sensitive to short-run fluctuations in world commodity prices and therefore not very reliable.

Authors in the public health-related areas have recently become much more aware of the necessity of addressing global influences on health. Hawkes (2005) investigates the role of Foreign Direct Investment (FDI) on changes in the diets of people in developing countries, recognizing FDI as a “a key process generating greater global economic integration (globalization)” along with trade, communication and migration, etc.

Aside from indicators of financial integration and openness to trade, there is little mention of other actual measures for of the globalization process. There is an urgent need for better more pluralistic approaches to the study of globalization (Woodward, 2001; Huynen, 2005). Measures (or indices) are needed that include variables like changes in migration, information flow, cultural integration, and so forth to help us better assess the overall impacts of globalization, specially on more distal outcomes like individual health and nutrition.

Globalization and macro- and micro- level changes

After the more general discussion of different definitions and measures of globalization in the current literature, we will focus more on the specific pathways and links that each author has empirically studied. These studies can be generally

categorized into studies of macro-level effects and studies of micro-level effects of globalization.

Among the macro level outcomes of globalization, changes in poverty, inequality, and growth are the ones addressed most frequently, whereas among the more terminal outcomes of globalization, effects on health, nutrition and food security have been discussed by different authors. Furthermore, in order to better determine the dependant variables and pathways studied, conceptual models in each instance will be presented.

Macro-level outcomes

Changes in Poverty

It has been argued that trade openness may facilitate the acquisition of new inputs, less expensive or higher-quality intermediate goods, and improved technologies, which enhance the overall productivity of the economy. Access to a variety of foreign inputs at a lower cost shifts the economy-wide production possibility frontier outward, thereby raising productivity. Moreover; there are many types of useful knowledge that are not embodied in material inputs (such as production engineering and information about changing product patterns) that can also be transferred as a result of trade with more advanced countries.

In contrast, it is now increasingly recognized that the process of globalization entails significant risks and potentially large economic and social costs. Openness to global capital markets has brought greater volatility in domestic financial markets, particularly in countries whose financial systems were weak to begin with and whose economic policies lacked credibility. Trade liberalization in some countries has led to reduced demand for more skilled labor and lower real wages in the short run; and

combined with a low degree of inter-sectoral labor mobility, job losses and income declines have often translated into higher poverty rates.

Many studies assessing the effect of globalization on poverty are concerned with economic growth rather than poverty, although Agenor (2003) assesses the relationship between globalization and poverty using a cross-country regression framework, by means of unbalanced panel data for a group of developing countries.

Although the econometric methodology used in his paper does not allow one to take a firm stand regarding issues such as causality, it provides a useful first step (subject to the caveats discussed below) in an attempt to disentangle the effects of globalization *per se* on poverty.

He found that there appears to be a reasonably robust, inverted U-shape relationship between poverty and globalization: at low degrees of globalization, globalization does hurt the poor (Agenor, 2003). At higher levels, however, globalization leads to a decline in poverty.

One possible explanation he proposes is that beyond a certain threshold a greater degree of real and financial integration brings with it (or induces governments to implement) far-reaching domestic institutional reforms that improve the ability of private agents to save and invest, strengthen the financial system and the regulation and supervision of financial intermediaries (and therefore the ability of the economy to wither large external shocks), and more generally improve the “social and legal infrastructure” that is conducive to greater risk taking.

The author concludes that regardless of the exact mechanism that may be at play, the striking implication of the globalization-poverty curve is that, paradoxically; globalization may hurt the poor in some countries “not because it went too far but rather because it did not go far enough”(Figure 2.1). Put differently, by focusing on

different portions of the curve, both advocates and opponents of globalization have been missing part of the story.

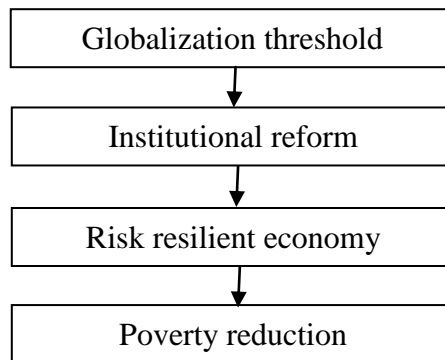


Figure 2.1. Linking globalization to poverty reduction (based on Agenor, 2003)

Two main points emerge from his discussion. The first is that it is usually difficult to draw clear-cut theoretical conclusions regarding the effect of globalization on poverty as a result of conflicting effects, both in the short and the long run. Empirical studies are thus important to assess whether net effects are positive or negative. The second is that it is possible that strong non-linearities may be involved in the relationship between globalization and poverty.

One of the advantages of his study is that he emphasizes that determining whether globalization is (on net) “good” or “bad” for the poor is--as is often the case in economics--an empirical issue, not a matter of faith. This is a reminder of a point that has often been “lost” by partisan views on both sides of the debate.

Nevertheless, it is worth mentioning that cross-country regressions--most notably in the context of empirical growth economics--have been the subject to criticism for their - specification and the fragility of many of the results that they lead to (Temple, 1999). Some believe they are useful tools with significant advantages over “event” or “case” studies. Such studies generally suffer from sample selectivity bias

and are unable to isolate with any degree of precision the independent effect of a particular variable or set of variables (that is, in the present context, the impact of globalization on poverty, as opposed to domestic factors and exogenous shocks).

There are a number of other arguments suggesting a kind of an opposite effect for globalization. For example, they mention that opening a country's markets to foreign firms can reduce the market power of domestic firms and increase competitive pressures on them. Thus, in the short term, the inability to compete, and the presence of labor market rigidities may hamper the reallocation of all categories of labor from the non-tradables sector to the tradables sector that an open trade policy in the shape of a reduction in tariffs normally entails (Agenor and Aizenman (1996)).

As a result, both unemployment and poverty may increase and persist over time. Therefore, Agenor's conceptual model should be revisited with a few questionable links that remain to be elucidated (Figure 2.2):



Figure 2.2. Linking globalization to poverty, a modified view of Agenor's framework

Changes in economic growth

Studies by Frankel and Romer (1999) and Irwin and Tervio (2002) have shown that countries that are more open to trade tend to have higher growth rates and incomes per capita. Investment has been shown as the most important channel through which trade openness raises growth, accounting for more than 60 percent of the total effect (Wacziarg (1998). Empirical evidence also suggests that in countries with higher levels of education, people are able to learn different skills from their trade partners which in turn adds to the enhanced growth effects of trade liberalization.

Countries that have opened themselves the most to trade in the last two decades (the “new globalizers”) have, on average, grown the fastest through reduction of import tariffs (average 34 percentage points since 1980) (World Bank 2002). In comparison, developing countries that saw no growth in per capita incomes over that period reduced their import tariffs by only 11 percentage points on average.

Authors make the assumption that because trade is good for growth, and growth is allegedly good for the poor (on average, increased growth raises the incomes of the poor in proportion to those of the population as claimed by Dollar and Kraay (2001)); then trade (in better words international economic integration) is good for the poor. The conceptual model for this paper can be portrayed as such (Figure 2.3):

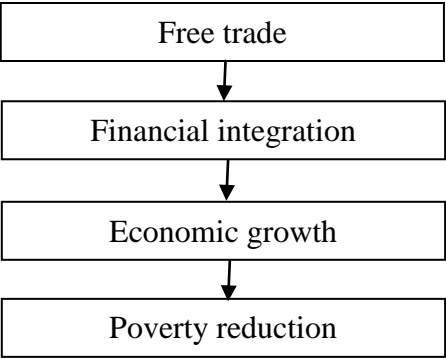


Figure 2.3. Linking globalization (defined as free trade) to poverty reduction via economic growth (based on Dollar and Kraay, 2001)

There is significant controversy as to the exact magnitude (if not direction) of the benefits associated with trade liberalization. For example, Rodriguez and Rodrik (1999) cautioned that several empirical cross-country studies lack robustness. Other authors have also cautioned that the results from this study must be viewed with skepticism mainly because of inherent difficulties in comparing income distribution data *across countries*. Furthermore, their data were heavily concentrated in the 70s and 80s, before globalization had really peaked for those countries.

Overall, recent empirical analyses are beginning to cast some doubt on the largely unchallenged assumption that increased globalization has been good for growth, and hence poverty reduction. Weisbrot et al present data for the 1980-2000 period that show globally, economic growth has slowed down dramatically, especially in the less developed countries as compared with the 1960-80 period. The trends in income distribution and poverty suggest that growth may not have been sufficiently high, socially broad-based, and stable to help alleviate poverty, at least for a subset of developing countries (Diaz-Bonilla, 2002).

The positive effects of free-trade emphasized in the new theories of trade and growth take place mostly in the production of advanced manufactured products, such as high-technology goods. Therefore, if a country is lagging behind technologically, openness to trade can reduce the growth rate (Matsuyama, 1992). Opening an economy to trade may discourage domestic research and development activities, for instance by inducing the poorer countries to allocate too much of their limited supply of skilled labor to the production of manufactured goods. In such conditions, facilitation of international trade activities may decelerate growth. Hence, there are still question marks remaining in the conceptual model connecting trade liberalization to increased

growth, and also connecting increased growth to actual reduction of poverty (Figure 2.4).

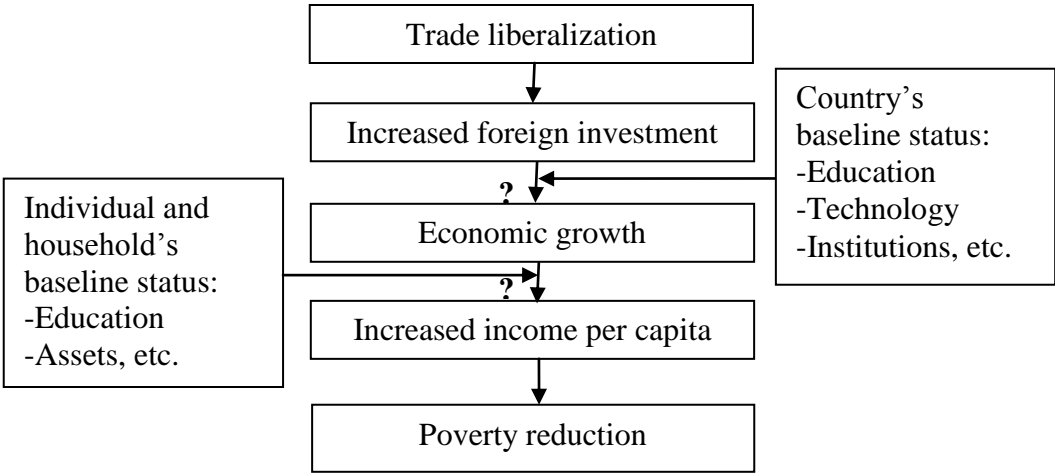


Figure 2.4. Linking globalization (defined as free trade) to poverty reduction via economic growth (based on Dollar and Kraay, 2001)

Changes in inequality

Global food supplies per person are sufficient today to meet energy requirements of all people, if the food were distributed according to needs (Pinstrup-Andersen, 2002). Thus, the failure of a large share of the world population to meet food needs is a reflection of widespread poverty, which in turn is associated with a very skew and deteriorating relative income distribution.

The inequality does not just include income inequality, but it is of a more general nature. It is not a problem limited to developing countries either, as 10% of all US households suffer from food insecurity as well.

A key problem associated with financial openness is that access to world capital markets tends to be asymmetric. Many developing countries (including some of the richer ones) are able to borrow on world capital markets only in “good” times, whereas in “bad” times they tend to face credit constraints. On the other hand, in recent years financial globalization in many transition and developing economies has

taken the form of greater penetration of the domestic financial system by foreign banks. This makes their economies quite vulnerable to international changes in the market. This pictures yet another example of countries being affected unequally by globalization.

Aside from inequalities among countries, there is an increasing concern about the effects of globalization on the income distribution within countries. The effects of globalization on income distribution within rich and poor countries are a matter of controversy. While international trade theory in its most abstract formulation implies that increased trade and foreign investment should make income distribution more equal in poor countries and less equal in rich countries, finding these effects has proved elusive.

Milanovic in 2002 presents a study which attempts to gauge the effects of globalization from how the overall shape of income distribution changes (income at different decile levels), rather than from a simple calculation of what happens to one summary statistic like the Gini coefficient, thus getting a much better grasp on how globalization affects the entire distribution. The analysis conceptualizes the expected changes in income distribution as such: less developed countries are affected by globalization principally in two ways. First, they are able to export more of their own goods, and they can be expected to receive investments from the capital-rich countries. Less developed countries will tend to export low-skill intensive products, as they have low-skill labor abundantly and with a lower price.

The more advanced countries have an advantage in skill-intensive products and tend to export these. This causes a reduction in relative wages of highly- skilled workers in less developed countries. As a result, it appears that income inequality *within* the less developed countries should go down; where mirroring these

developments, income distribution in more developed countries should become more unequal.

Starting from this model, Milanovic analyzed income levels across ten deciles of income distribution based on data from national household surveys (1988 and 1993, with comparable income inequality statistics). He finds some evidence that at a very low-income level, it is the rich who benefit from openness. As income level rises, that is for countries like Colombia, Chile or Czech Republic, the situation changes and the relative income of the poor and the middle class rises compared to the rich (Figure 2.5).

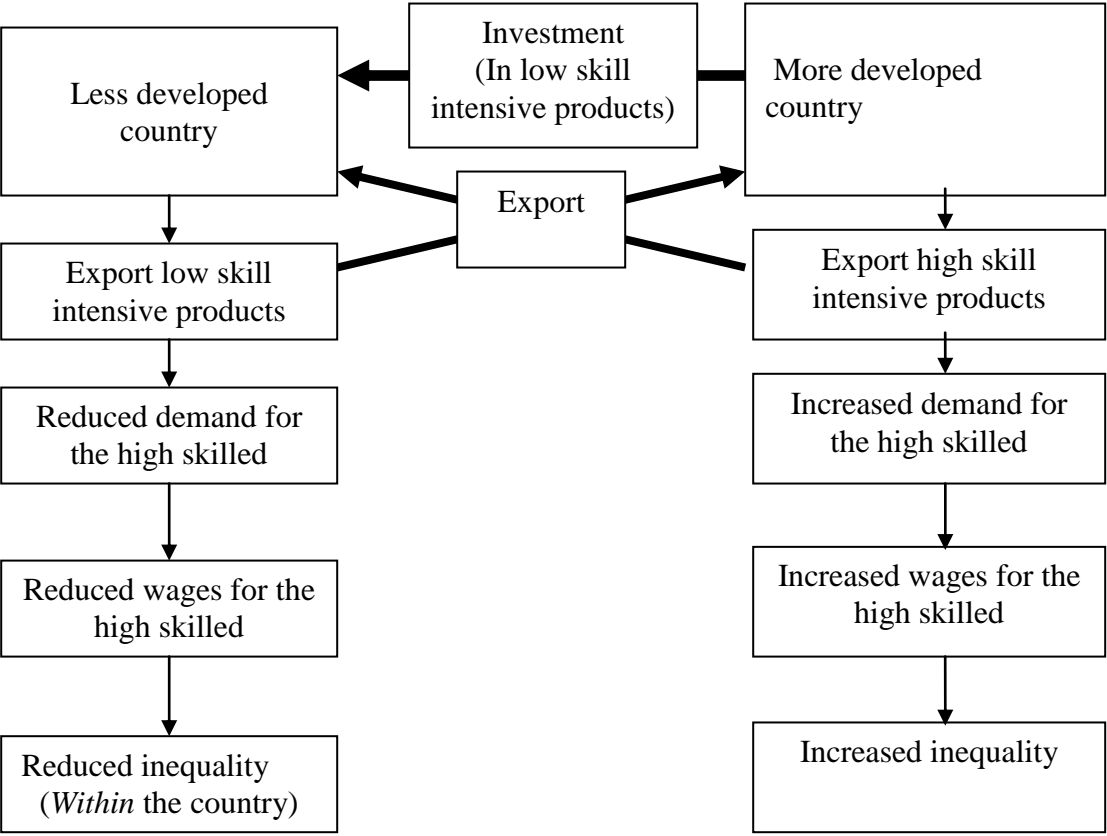


Figure 2.5. Linking globalization to inequality in income distribution (based on Milanovic, 2002)

These results run *counter* to simple factor-price equalization theory conceptualized before with two types of labor. Also, when regional dummy variables were introduced, they tended to override the effect of income level. Thus, openness seems to be associated with improved equality in rich countries and transition economies, not to have much of an effect in Asia, and to be associated with worsening inequality in Latin America and Africa.

This brings the focus of discussion to yet another important aspect of inequality, and that is the fact that there is not enough information on the effects of globalization on different regions of the world. Literature is quite lacking in any mention of what is going on in some of the most controversial areas of the world, e.g., the Middle East.

These left-out regions of the world have undergone globalization, and have been affected by the universal policies of international institutions such as the World Bank and IMF, without having had much of a say in the policy making process. Data on Latin America is also very limited; the list does not end here either.

Micro-level outcomes

Changes in health

The relationship between globalization and economic growth, income distribution, and poverty provides the general background for health outcomes (Diaz-Bonilla, 2002). The picture does is not so in the context of globalization. Globalization brings with itself many processes that tend to affect individuals' and households' choices and cultural preferences. These processes are among the effects of globalization that are not unique to developing countries or specific cultures.

One example of the complexities would be that of the obesity epidemic. Of special concern to nutritionist, obesity has been among the dominant unmet global

health issues, with Western countries topping the list (WHO, 2002). By eliminating personal boundaries and affecting individual's choices, mostly through intense advertisement, globalization has played a major role in the obesity epidemic.

Globalization is not only changing the shape of health problems by changing peoples' environment and habits, but is also affecting the very understanding of public health policies and programs in the global political arena. Thus, another point of concern in portraying a conceptual framework for the effects of globalization on health and nutrition is to distinguish between its impacts on health *outcomes* from its impact on health *policies* (Koivusalo, 2006).

In the area of health policies, as the major forces towards globalization come from the economic perspective and the dominance of the ideology of individualism, public health professionals are becoming increasingly concerned about the future of public health as a discipline based on collective actions. Thus, public health professionals recognize the need for the "public health movement to exert a more central role in human affairs" (Beaglehole, 2004) more than ever.

Availability and quality of health services is changing together with the new and emerging health problems. With the growing concern over the future of health systems, many health protection measures are recognized that do not produce direct health outcomes but play a major role not only in disease prevention, but also in treatment and control of its adverse outcomes. Especially in the short term, some aspects of globalization, for example intellectual property rights, affect public health policies and health care system financing much more than specific health outcomes (Koivusalo, 2006).

All in all, research on the health impacts of globalization has been very much issue-oriented. It is more and more recognized that we need to go beyond case studies

and understand far better the micro-macro linkages between globalization and health of individuals and population groups. Lee suggests that” this requires going beyond traditional approaches to public health research, beginning with means of capturing the transnational nature of many health determinants and outcomes” (Lee, 2001).

Changes in nutrition

Food security

Linking the impact of liberalization to food security is a complex task as there is considerable overlap between trade policies and other issues both domestic and international. Davis (2001) mentions three fundamental impacts globalization has had on food security:

- Changes in regulation of agricultural trade, moving towards a more open, liberal trading regime under the auspices of WTO, thus severely curtailing the scope for national determination of the policy framework for food production within countries.
- Moving the notion of food security from just focusing on the global and national food supplies towards nutritional security of households and individuals.
- Opening potential key areas in genomics, bioinformatics, transformation, molecular breeding, diagnostics and vaccine technology. However, it is hard to say that the related international regulation and policy-making process has been moving together with the development of such new technologies.

In an attempt to assess the actual impact the liberalization has had so far on food security, poverty, ecological sustainability, gender, etc; Medeley (1999) draws upon reports from 27 case studies and experiences of the effects of trade liberalization. On the key question of what trade liberalization has done to people who are already

food insecure, their evidence appears remarkably consistent. He summarizes his message in a sentence from a study in Kenya – "liberalized trade, including WTO trade agreements, benefits only the rich while the majority of the poor do not benefit but are instead made more vulnerable to food insecurity."

Medeley's conclusions, however, are in most part based on anecdotal rather than empirical evidence. Such anecdotes, though important tools in raising awareness about the possible issues that may arise after globalization, are not a strong enough evidence base to make general conclusions about trade liberalization policies.

International free-trade in its true sense is in many cases distorted by imposed regulations especially from developed countries and bilateral trade agreements. Kym Anderson (2005) has shown that in the absence of such distortions, real net farm incomes would rise in developing countries with a move to free trade, thereby alleviating rural poverty and ensuring better food security.

In contrast to attempts in making "good or bad" value judgments about globalization, more in depth studies of the underlying causes of *vulnerability* of the poor to economic shocks provides a practical understanding of how the poor can be enabled to benefit from trade. In rural settings, for example, Rubio et al. (2004) have found that agricultural households with more diversified economic activities fared better than non-agricultural households, or households more specialized in agriculture. Therefore, providing opportunities for income diversification can serve as a positive policy option in such settings.

Individual food choices and preferences

With the rise of advertising, many consumers in developing countries shift toward modern, imported products, and availability of thousands of new brands greatly affects their choices. Since the late 20th century, radical changes have been

noted in individuals' eating habits. Rapid urbanization and the processes triggered by globalization, have forced products all over the world to blend and mix, destroying age-old eating habits.

The cultural, economic and social effects of these new eating standards are felt differently, varying by social class, although they extend throughout society. But the poorest groups are always the most vulnerable to this mass approach to nutrition. Lacking proper information, they are more severely affected by advertising and marketing strategies of the 'modern foods'.

This is one aspect of the effects of globalization on nutrition and consequently health that has not received enough attention. Even if globalization and increased imports of food staples reduce prices for consumers (an assumption yet to be proved in different contexts), we cannot simply assume that -at least in nutritional terms- consumers will be better off.

From one perspective, globalization provides access to a broad spectrum of food products, thus decreasing their dependability on limited local products. This diversification of food sources will ideally make the Market more resilient to sudden shortages and provide consumers with adequate food options even in times of decreased local production like draughts.

At the same time, however, introduction of new products and intensive food marketing leads to drastic shifts in food preferences that may not necessarily be good for health. To put it simply, "consumption that is good for economy may not be necessarily good for health" (Koivusalo, 2006). Unfortunately, food policy has been at times more in line with achieving the economic outcomes rather than the health outcomes, a trend which may have been in part responsible for the global nutrition transition and the obesity epidemic. Ultimately, it is the challenge for nutritionists as

well as food and agriculture policy makers to come up with solutions that are both nutritionally sound and economically viable.

The relationship between supply and demand in this case is in both directions. If nutrition education can change people's attitude, their increased demand for healthier products can encourage production and marketing of such items. On the other hand, if marketing practices are regulated so that being health becomes a requirement for consumer products, more nutritious foods will be promoted to the consumers and become available in the market.

Linkages of globalization and nutrition: a conceptual framework

Study of various definitions, measures, and outcomes proposed for the study of "globalization" reveals that it is not just one phenomenon; and it may be more practical to deconstruct it into different major forces in order to be able to test any particular relationships between global changes and specific outcomes such as nutritional status.

The main aspects of globalization affecting nutrition are trade liberalization, migration, flow of technology, products, labor force and information, which lead to changes in labor markets and income sources, and finally food security and food choices. To portray a conceptual model for the interaction of these forces and the pathways through which they affect nutrition, we can think of the effects of globalization on nutrition in the context of food security (availability, accessibility, sustainability of food sources).

In the literature, the macro level changes of globalization have been formulated through its effects on poverty, growth, and inequality. It is still open to argument as to which of these constructs comes first, or is the best way to build a conceptual model upon. One has also got to deal with a complicated and

interdependent system of variables, which presumably can end up in affecting individual's food choices, food security, nutrition, and health status.

Finally, it is worth noting that in such a conceptual model:

- Change happens at different levels (international/national, community, household, individual)

- Many of the forces are interrelated and interconnected.

- One has to devise methods to isolate any two points to test for a causal relationship

- There are very few papers that actually present a conceptual model for the connecting globalization to health outcomes (Huynen, 2005; Labonte, 2004).

On the other hand, the nutritional and health status of a person are interdependent, and turn both are influenced by three underlying determinants, which operate mostly at the household level. The degree of food security, the level and quality of care-providing activities, and the health environment (e.g. access to health services) comprise these determinants (Smith and Haddad, 2000).

Based on the above notions, the following conceptual framework aims at connecting the conceptual framework of nutrition within health outcomes (UNICEF, 1999) to the frameworks proposed for the effects of globalization on health in general (Figure 2.6).

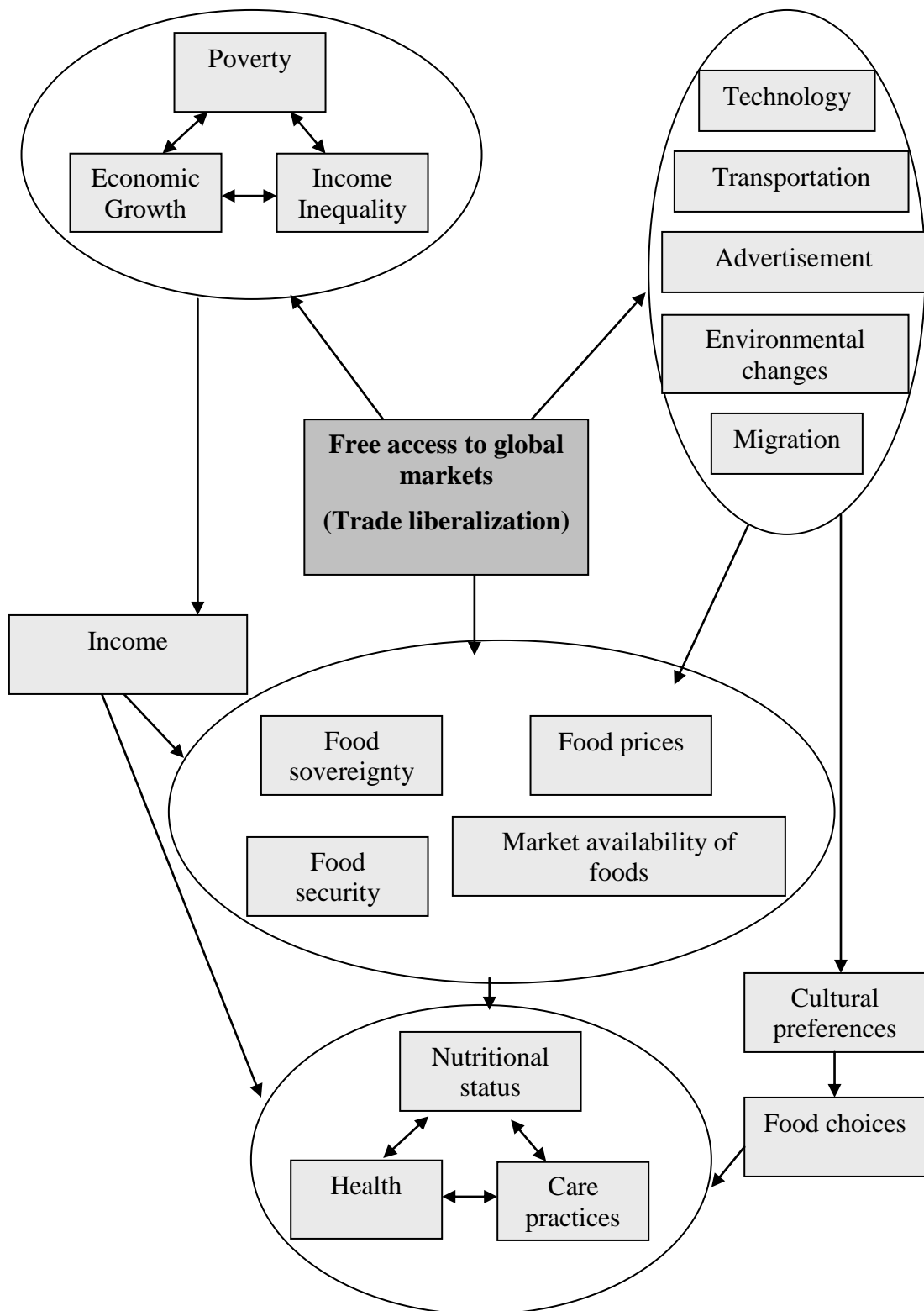


Figure 2.6. Linking trade liberalization to nutrition

Challenges of globalization for research and policy

The current challenges of globalization for nutrition can be categorized in three categories, namely, existing knowledge gaps, difficulty of translating present evidence into concrete and feasible policies, and difficulty of engaging in true debate to break down the existing polarized views on globalization to be able to reach solutions to address these challenges.

Knowledge gaps

In assessing the effects of globalization, there seems to be a greater focus on looking at macro level outcomes including growth and poverty rates and changes in trade capacities and foreign investment in developing countries. On the other hand, what needs to be of special interest to public health and nutrition policy would be what is happening to individuals, and whether there are some vulnerable populations that are being negatively affected. Such outcomes will not be visible by looking at national level aggregate, and their study needs a different approach and methodology.

It seems that rather than focusing on coming up with overall global findings and recommendations, there should be more emphasis on the more in-depth and inclusive case-studies of countries with the entire possible social, economic, and political variables taken into account.

Studies are needed that detail, for example, which transnational corporations are taking over land, how much is involved, how many local farmers are losing their land, and how people's nutrition is affected by these changes. In such cases, there is also important to find out which social groups are more negatively affected, and formulate policies that can strengthen their resources.

At the same time, we need to focus on ways to make findings from such case-studies more applicable to other contexts. One way would be to develop a comparable index or measure for globalization. There needs to be policies with focus on especially

vulnerable populations groups, including small farmers in developing countries (Narayanan and Gulati and Pinstrip-Andersen 2002). This can be achieved through “Enabling policies” aimed at removing the constraints (removal of credit constraints; reduction of transaction costs, building of social capital, public investment in rural infrastructure, and institutional innovation); and “coping policies” to minimize or avoid adverse effects (social safety nets, risk management instruments enhancing rural non-farm income generating opportunities, and investment in research and technology for small farmers).

Policies need to have multiple outcomes in mind. For example, social justice and social cohesion are necessary to have functional markets (Stiglitz, 2002), increase flow of trade and move toward financial integration. Social development is not only part of the process of making globalization work for the poor, but also as a solution to the present inequalities. Furthermore, economic and social policies need to be an integrated whole in both national and international decision-making to achieve sustainable development worldwide that works for the poor as well as the rich within countries.

Globalization, if guided and wisely utilized, has the potential to cultivate social, political and economic change and provide a ground to build “healthier” societies in every sense of the word. Still, such a multi-faceted phenomenon also calls for a multi-disciplinary approach. Researchers should attempt to reach out to other disciplines and employ all the knowledge available to become a more reliable and effective resource for national and international policymaking processes with optimized the outcomes. This would also imply building partnerships that go beyond the traditional boundaries of disciplines to address problems that would eventually be of concern to all.

Translating evidence into concrete and feasible policies

There is little mention of how to make policies adaptable to different cases in different social contexts. What works for Sub-Saharan Africa may not be a good solution for Latin American countries. Additionally, there are still many gaps in the information available on the most basic economic and social characteristics of many countries worldwide.

Along with the development of internationally active institutions, there should be channels designed to help countries define their specific problem areas and have the choice to act accordingly. In this regard, the nutrition community has a comparative advantage because of its experience and presence in the field. Individual nutrition information data (e.g. 24-hour intake of nutrients) can be combined with household level information on food choices and other characteristics to lead more macro-level policies as well.

Engaging in true debate and breaking down the existing polarized views

Finally, one has to be cognizant of differences in agenda and differences of paradigms at the global level. Some kind of framework is needed that would connect all the most representative social actors (workers, enterprises and key NGOs, national authorities, etc.) and establish a basic common agenda around which they could advocate and mobilize. At the same, there needs to be a clear definition of “who will have the final say” in such matters as international trade regulations. This brings us again to the importance of institutional change at the global level to guarantee participation from all the stakeholders.

On the other hand, concern for the environment has increased in recent years and there has been growing demand for greater attention to environmental safety.

Environmental technology can yield promising results if designed and implemented by people who are directly in contact with the environment.

Forces of globalization are already in effect in many communities. As nutritionists and public health practitioners, we may no longer “afford” not to take a stand, and as scientists, we cannot take a stand unless we have obtained the proper evidence and have been able to devise viable policy options. Without a common understanding of the definition, measures and conceptualization of its outcomes, the debate over globalization will be ongoing without setting a clear agenda for research and generating concrete evidence to support arguments.

Rather than agonizing ourselves into make value judgments about globalization, it is time for a more pluralistic approach, since our historical evidence shows that it is not one simple phenomenon and it has been changing extensively over time (Chang, 2003). As nutritionists, it may be more practical to ask ourselves “how we can shape globalization to improve the nutritional status of the poor” instead of “whether globalization is good or bad” for nutrition”.

CHAPTER THREE

EFFECTS OF FOOD PRICE CHANGES ON HOUSEHOLD TORTILLA CONSUMPTION IN RURAL MEXICO: POTENTIAL NUTRITIONAL OUTCOMES OF GLOBALIZATION POLICIES

Abstract

Free trade policies are claimed to bring national prices closer to international prices and provide consumers with higher purchasing power in the long run. In short term, however, the nutritional status of vulnerable populations can be negatively affected if appropriate protection policies are not into effect. As part of the requirements for NAFTA, the Mexican government announced the termination of its tortilla price regulation, CONASUPO, in late 1998. This study looks at household consumption of tortilla with regards to tortilla prices in 1998 and 1999 in rural Mexico to assess whether there were price changes between the two years and, if so, how the changes affected consumption in poor households. Consumption models of 11 most commonly consumed commodities were created for 836 poor households across 6 states and 55 municipalities in Mexico for 1998 and 1999. The price of tortilla was not significantly lower in 1999 after adjustment for inflation. Tortilla consumption had not increased, and after controlling for household characteristics affecting consumption (SES, HH size, type of job, location, etc), the regression coefficients for tortilla prices were -12.60 ($p=.007$) in 1998 and -14.50 ($p<0.005$) in 1999. Household's consumption of tortilla also became more sensitive to the prices of beans, sugar, milk, and onions. These findings show consumers were generally more sensitive to price changes in 1999 compared to 1998 and volatile market prices were more likely to affect consumption in a negative manner.

Introduction

Undernutrition contributes to over one half of deaths in preschool children in developing countries (Pelletier et al, 1995). Millennium Development Goals (MDGs) set by governments and development organizations worldwide include a reduction in child mortality by two-thirds by 2015; thus, policies and programs that improve nutritional status are essential to achieving the MDGs (Bloem, 2001, Kiess, 2001). Macroeconomic food policies have the potential to reduce undernutrition by increasing access to food as well as enhancing the quality of the diet, which can both improve the nutritional status.

Factors such as better access to food through creating more efficient agricultural sectors, generation of employment and income for the poor and higher food security have been proposed to link food policies to nutritional outcomes (Timmer, 1985). Very little, however, is understood about the mechanisms and the magnitude of the effects of macroeconomic food policies such as food price policies on nutritional status (Torlesse, 2003).

Many poor households in developing countries lack the resources they need to grow or purchase sufficient food, thus their diet is deficient in energy and nutrients. In Latin America, 11.8% of preschoolers are stunted and 5% of them are underweight (De Onis, 2004). In Mexico, according to a national survey conducted in 1998, there were still high prevalences of stunting (17.7%) and anemia (27.2%) in children younger than 5 years (Rivera, 2003). Most of these undernourished children live in rural areas.

Poor households use a large share of their income to purchase food (Regmi, 2001), and sharp increases in the price of foods can greatly reduce their purchasing power. The effect of price hikes on a household's ability to meet its nutritional needs can be particularly acute when food staples are affected because these foods account

for the bulk of food expenditure among the poorest households. On the other hand, landlessness is a main factor in vulnerability of the poor to market price shocks, since it makes them more dependent on the markets for their daily food. Finally, some individuals within households, especially women and children, are likely to be more affected by these circumstances (Kaiser, 1991).

If households do not possess enough resources to deal with rising food prices, they will have to reduce the amount or quality of the food they purchase. At the aggregate levels, it has been shown that in response to price shocks many households have adopted complex survival strategies, but there is little known about why different population groups respond differently to shocks and what the factors are that can enable them to benefit from market changes (Audley, 2003).

Globalization policies have been implemented in many developing countries especially in the past two decades with hopes to achieve faster economic growth and decrease poverty (World Bank, 2002). In 1992, the European Union lifted barriers to internal trade in goods and labor, and in 1994 NAFTA (North American Free Trade Agreement) took effect calling for immediately eliminating duties on half of all U.S. goods shipped to Mexico and Canada, and gradually phasing out other tariffs over a period of about 14 years (NAFTA Secretariat, 2008).

These policies call for elimination of government price protections, tariffs and subsidies and openness to trade and foreign direct investment. Beghin et al. (2002) estimate that the removal of all agricultural subsidies and trade barriers could increase rural real value added in low- and middle income countries by \$60 billion per year, exceeding most targets for development assistance by almost 20%.

Theory says that as cheap imports enter the country, the consumers invariably benefit from lower market prices for various commodities because then the prices will be closer to world market prices and hence more competitive. Yet, some empirical

studies have shown that, despite globalization, there has been an overall pattern of fluctuating or random divergence in international commodity prices rather than convergence of prices (Bukonya, 2005) , and at least in early stages, price shocks have followed globalization policies (De Janvry, 1997).

Does globalization benefit the poor? Does the elimination of government price protection policies lead to volatile markets and price shocks? And, do the benefits from these policies outweigh the risks? Since the introduction of NAFTA, Mexico's experience of market liberalization has served as an exemplary case to study in order to answer these questions and provide policy recommendations for other agricultural economies in the Global South as well as developed countries (Patel, 2003).

On one hand, the debate on the effect of NAFTA on commodity prices has been ongoing. Some evidence has shown that only relative prices for producers of import-sensitive commodities in Mexico fell during the 1990s (Lederman, 2003). Yunez-Naude (2002) has found that NAFTA accelerated the convergence of internal prices to those in USA for exported crops from Mexico but did not alter the way that domestic prices of major imported crops were related to international prices. On the other hand, there is evidence showing that prices of a few staples including corn fell after NAFTA and thus consumers benefited from lower prices, but it is accompanied by the observation that agricultural incomes for farmers also fell during this same period (Yunez-Naude 2002).

As for the trends in food consumption, even before NAFTA, data from the economic crises of 1982 and 1987 in Mexico show that the combination of reduced family budgets and the withdrawal of subsidies on basic foodstuffs had forced Mexican families to reduce both the quantity and quality of their food intakes (Dookeran, 1998). Trends in infant mortality show a relationship to economic downturns as well.

At the same time though, Mexico has been undergoing a prolonged and protracted epidemiological transition, accompanied by population aging. It has experienced spectacular rates of increase in adult overweight and obesity in the last decade, showing a 78% increase at the national level between 1988-1999 (from 33.1% to 59.6 % over a period of 11 years) (Rivera, 2002). Rapid increases in obesity are also observed among children.

Finally, the Mexican government has made an effort to buffer the vulnerable populations from the negative impacts of its globalization economic policies by protection programs like PROCAMPO for farmers and PROGRESA (now OPORTUNIDADES)³ for poor households. The government's commitment to such social assistance policies calls for a better empirical assessment of the situation in the economic background of the past few years (post NAFTA) in Mexico to develop effective food policies to make trade more beneficial for the poor.

From the second half of 1930 until the beginning of the 1990s, direct government intervention in agriculture was a major component of Mexico's development policy. Since its creation in the mid-1960s, the National Company of Popular Subsistence (CONASUPO)⁴ played a key role in Mexican agricultural policies, shaping food production, consumption, and rural incomes. Following the debt crisis of 1982, this company was reformed as part of the market liberalization process begun by the government in preparation for NAFTA. Starting from November 1993, per-hectare payments to farmers gradually replaced guaranteed prices for corn and

³ PROGRESA (Programa de Educación, Salud y Alimentación), currently called oportunidades, is an anti-poverty and human resource program with conditional cash transfers to the poor and is aimed to improve the nutritional status of poor children and improve education and health in Mexico.

⁴ CONASUPO stands for Compañía Nacional de Subsistencias Populares, Mexico's National Company for Popular Sustenances. CONASUPO supported producer incomes by establishing import quotas and by implementing a mandated pan-Mexico prices for producers of various commodities including corn and tortilla, prices that it was able to maintain by intervening directly in processing, storage and distribution (Avalos-Sartorio, 2006).

other basic crops in Mexico, under a new program called PROCAMPO⁵. Finally, On January 1, 1999, president Zedillo's administration in Mexico announced the elimination of subsidies for corn bread (tortilla) consumption, and with this, the complete liquidation of CONASUPO took place (Yunez-Naude, 2003).

Corn tortilla is the most commonly consumed staple in Mexico. After elimination of corn subsidies (which happened at an earlier stage of the liquidation of CONASUPO before the tortilla subsidies were eliminated), there was a sharp increase in tortilla prices at the national level (Yunez-Naude, 2003). Thus, it can be assumed that elimination of tortilla price protection served as a final blow to consumers. Increased prices could have caused consumption changes at the household level for tortilla, decreased the food budget of families, and subsequently affected their consumption of other major food items. Therefore, the effects on the poor households immediately after the cessation of government tortilla price protection can demonstrate a good example of short-term effects of globalization policies and provide valuable information for further policy decisions.

Previous studies have used household survey data to examine how the impact of price shocks differs across households in Mexico, and have considered several potential adjustment mechanisms: changes in household structure, changes in fertility, changes in household labor supply, changes in child schooling, and inter-household transfers (McKenzie 2003). There is little evidence, however, to link such outcomes to health and nutritional status of individuals.

Considering this background, the objective of this paper is to study the short-term effects of a pro-globalization policy by the Mexican government on the food

⁵ PROCAMPO was implemented as a support measure to compensate farmers for anticipated adverse effects of NAFTA reforms; specifically, to help producers adjust to the removal of guaranteed prices for basic grains and oilseeds (De Ferranti et al., 2005).

consumption of households in rural Mexico. This study will focus on Mexico as a country case-study to identify the changes in household demand and consumption patterns in response to prices between the two years of 1998 and 1999, which is before and after the cessation of tortilla price protection by the government. Thus, it will assess some of the possible effects of this policy by testing the differences between the two years and finding the determinants of such differences.

This paper will address these specific questions:

1) What are the differences in household consumption and expenditure and market prices for staple foods between 1998 and 1999 (before and after cessation of tortilla price protection)?

2) Did household consumption of staples become more sensitive to prices of major foods after the policy changes?

3) What are the possible nutritional outcomes of these changes?

Methods

Data

In this paper, data have been used from the evaluation of PROGRSA (Programa de Educacion, Salud, y Alimentacion) in rural Mexico. PROGRESA (currently Oportunidades) is an anti-poverty and human resource program with conditional cash transfers to the poor and is aimed to improve the nutritional status of poor children and improve education and health in rural Mexico (World Development report, 2004).

Evaluation had been integrated within PROGRESA from its very beginning. The PROGRESA impact assessment included data collection from 506 localities in 7 south-central states⁶ of Mexico which were randomly assigned to receive benefits

⁶ Guerrero, Hidalgo, Michoacan, Puebla, Queretaro, San Luis Potosi , and Veracruz

either starting in mid 1998 (320 ‘treatment localities’) or two years later (186 ‘control localities’) (INSP, 1998).

PROGRESA-eligible households in both treatment and control localities took part in a series of household surveys called “ENCEL”. The ENCEL surveys were conducted by IFPRI (International Food Policy research Institute) and contained information on educational attainments, household purchase and consumption, time allocation and gender relations.

ENCEL surveys, however, did not include basic nutritional data like individual 24-hour food consumptions or anthropometric information on children. This information was collected separately by Mexico’s Instituto Nacional de Salud Publica (INSP) in two rounds, August-September 1998 and October- December 1999, in six of the seven states⁷ and only for women and children. The INSP survey was a longitudinal rotating child-based sample partially overlapping the ENCEL surveys⁸.

The dataset used for the current study was originally created from INSP surveys, and contained information on child growth and some household characteristics of children who had observations both in 1998 and 1999 (Behrman, 2000). For the current study, however, in order to assess the effect of price changes in consumption, information on the prices as well as household food consumption was needed. Therefore, INSP datasets were merged with the corresponding round of ENCEL to provide full information for each household.

Merging was done by matching unique identifiers including information on state, municipality, locality, household id number, and child’s birth date in the two

⁷ Guerrero, Hidalgo, Puebla, Queretaro, San Luis Potosi , and Veracruz

⁸ Design, sampling, sample size calculations and other aspects of the collection of these data are summarized in INSP (1998) and Behrman (2000).

datasets for 1998 and 1999. This produced a sample of 836 households with at least one under-five year old child (403 boys and 433 girls) in each year.

Basic characteristics

Overall, 393 households were in the PROGRESA treatment localities and 435 in control localities. All households had at least one child who was between the ages of 6 months and five years (mean age 21.8 months). Mean household size in 1998 was 7.1.

The PROGRESA treatment and control communities were similar in baseline characteristics including access to piped water and electricity (Table 3.1). About 36.8% of households had access to piped water and 64.3% had access to electricity. The floor in 56.3% of the houses was made of dirt.

Most (96.4%) of the household heads were male, with 67.9 % of them being married to their partners and 26.4% in open union. Overall, 25.8% spoke an indigenous language. Most the heads of households were agricultural laborers (70.7%), the rest were mostly non-agricultural workers (12.5%), self employed (8.6%), or members of an agricultural commune or “ejido”⁹ (5.5%).

Mean years of schooling for heads of households was 3.58 years and for mothers was 3.87 years. Mothers’ mean age was 30.1, and very few of them had paid jobs (0.03%).

⁹ The word "ejido" means "commons". In Mexico, an ejido refers to a community of people who share ownership of their land. The ejidos are made up of groups of families.

Table 3.1. Characteristics of the study households at baseline

Mean household size (SD)	7.10 (2.57)
Living conditions	
Access to piped water	36.8%
Electricity	64.3%
Floor made of soil	56.3%
PROGRESA participation	
Yes	47.5%
No	52.5
State of residence	
Guerrero	8.3%
Hidalgo	23.3
Puebla	26.6
Queretaro	9.7
San Luis	17.6
Veracruz	14.5
Mothers' characteristics	
Mean age (SD)	30.1 (7.2)
Mean years of schooling (SD)	3.87 (2.79)
Paid employment	0.03%
Household head characteristics	
Sex male	96.4%
Marital status	
Open union	26.4%
Married	67.9
Single	0.8
Indigenous	25.8%
Occupation	
Ag. laborer	70.7%
Non-Ag. worker	12.5
Self-employed	8.6
Ejidatario/comunero	5.5
Family labor no-pay	1.4
Other	1.3
Mean years of schooling (SD)	3.58 (2.59)

Modeling the effects of price changes on household tortilla consumption

On a general level, demand functions can be written with a vector of behavioral outcomes dependant on a vector of prices and a vector of resources. Thus, a linear demand function for food (f) for household facing prices PF and with resources RF and a vector of stochastic terms (V) is:

$$Z_f = b_{PF} + b_{RF} + V,$$

Where b is the parameter to be estimated and indicate the impact of the variables for which they are coefficients on the demands for Z_f (Behrman, 2000). For this study, the outcome of interest is consumption of tortilla (Z_t), and the predictors include P_t (price of tortilla), as well as prices of other household food items, and a series of community and household levels characterizes that affect consumption (see below).

Originally, IFPRI household surveys contained information on weekly consumption of 40 main food items. Based on the preliminary results on frequency of consumption by the households, twelve most commonly consumed food items were chosen for further analysis, including beans, chicken, corn, egg, milk, oil, onion, potato, rice, sugar, tomato, and tortilla (Figure 3.1).

All of the prices for 1999 were adjusted for inflation based on the rate between October 1998 and November 1999 published by the National Bank of Mexico. In addition, the prices of commodities in the datasets had non-normal distributions, so log-transformation was used to reach normality.

This transformation, however, means that the slopes of the regression from these models will not be the real price elasticities of demand. It should be noted though that the main objective for these models is to test the differences in the

relationship of consumption to prices between the two years (whether household consumption has become less or more price-sensitive). Therefore, with the log-transformed prices it will still be possible to test for the differences between the two years and reach the objective.

Since tortilla consumption was reported at the household level, model is controlled for household size and age and sex composition. Use of household expenditure to control for income effects would cause endogeneity problems; therefore, other indicators of socioeconomic status (availability of water and electricity as well as quality of building material) and occupations types of household heads were included in the model. Based on previous studies of food demand, education of mothers and heads of households, ethnicity, regional characteristics and PROGRESA participation are controlled for in the model as well (Hoddinott and Skoufias, 2004, Behrman and Hoddinott, 2000).

In conclusion, for the particular household decision of interest in this paper (consumption of a tortilla), the demand relation can be written as (Dong, 2004):

Household tortilla consumption (Z_t) = f (\log (price of tortilla (P_t)), \log (price of corn (P_c)), \log (price of rice (P_r)), \log (price of beans (P_b)), \log (price of milk (P_m)), \log (price of sugar (P_s)), \log (price of chicken (P_{ch})), \log (price of tomato (P_{to})), \log (price of onion (P_o)), \log (price of oil (P_{oi})), \log (price of potato (P_p)), \log (price of eggs (P_e)), SES (water, floor, electricity), number of adults, number of children <5, number of children 6-12, number of children 13-18, region (state level), education of HH head, education of mother, type of job of HH head (9 categories), marital status, ethnicity, PROGRESA participation)

Missing prices

As with any consumption data, for each food there are many zero consumption values for a particular purchase period (7 days in this case). In the PROGRESA

datasets, this will lead to a missing value for the price of that commodity as well, because households have only reported prices for the foods they have purchased.

A theory-based approach to the treatment of missing data under the assumption of multivariate normality, based on the direct maximization of the likelihood of the observed data is called the “EM algorithm” (Little and Rubin, 1987). To say it briefly, EM uses a series of designated variables as predictors for imputing the missing data, and is thus capable of better preserving the variances and co-variances than does conventional regression imputation.

In this study, AMOS 6 –a software designed for usage as an extension to SPSS 14- was used to deal with missing data. AMOS uses maximum likelihood estimates even in the presence of missing data (Anderson, 1984) to offer better regression estimates. After providing a conceptual framework to the program, it uses the available variables to generate a new dataset with missing values replaced by imputed values. It should be mentioned that this analysis is only possible under the assumption that the data on prices is missing at random ¹⁰(Wothke, 1996).

Zero consumptions

To assess the potential effect of the government’s cessation of tortilla price protection at the end of 1998, separate models are needed for the years 1998 and 1999, so that they will then be tested for differences between the regression slopes. An OLS model, however, would not provide good estimates due to multiple instances of zero consumption of commodities reported by the households in the specific recall period of the ENCEL surveys.

¹⁰ Rubin and Little (1987) distinguish the processes that generate the missing data with respect to the information they provide about the unobserved data. Missing values of a random variable Y can be missing completely at random(MCAR, missing entirely unrelated statistically to the values that would have been observed), missing at random(MAR, somewhat more relaxed, missing-ness and data values statistically unrelated conditional on a set of predictor variables x), and non-ignorable (missing-ness conveys probabilistic information about the values that would have been observed)

In asking about food consumption in a survey, it is possible that some households will report zero consumption of certain food items, because of its costs, personal preferences, or because that food was simply not purchased during the reported purchase period. On the other hand, it is quite possible that there are differences in response to price changes between buyers versus non-buyers of a commodity and that estimates derived from traditional regression methods may be inappropriate for grasping such differences (Amemiya, 1985).

This study will use a standard Tobit estimator to address the issue of zero consumption. In a Tobit model, the dependent variable is not just 0 or 1, but has a significant number of observations at 0 and the rest are continuously distributed over positive values (Amemiya, 1985). Use of a Tobit model is a novel approach to demand analysis and will provide a much better estimate of the relationship between prices and consumption of commodities for which the censoring problem has been particularly significant (FAO, 2003).

A Tobit model can be modeled with the dependent variable (Y^*) as a latent variable, such that if $Y^* \geq 0$ one observes Y and if $Y^* < 0$, $Y = 0$. Y^* is normally distributed, and meets all the classical linear assumptions.

$$Y = \begin{cases} Y^* & \text{if } Y^* \geq 0 \\ 0 & \text{if } Y^* < 0 \end{cases}$$

and

$$Y^* = \beta_1 + \beta_2 X + u$$

Note: Y^* is the latent, unobservable variable. Y is the observed variable, which is equal to zero if the latent variable is less than zero. Y^* is normally distributed, with $u \sim N(0, \delta^2)$

This model can be written specifically for this study as (Dong, 2004):

Tortilla consumption (Z_t) = Y^* if $Y^* \geq 0$

Tortilla consumption (Z_t) = 0 if $Y^* < 0$

$Y^* =$ Household tortilla consumption (Z_t) = f (log (price of tortilla (P_t)), log (price of corn (P_c)), log (price of rice (P_r)), log (price of beans (P_b)), log (price of milk (P_m)), log (price of sugar (P_s)), log (price of chicken (P_{ch})), log (price of tomato (P_{to})), log (price of onion (P_o)), log (price of oil (P_{oi})), log (price of potato (P_p)), log (price of eggs (P_e)), SES (water, floor, electricity), number of adults, number of children <5, number of children 6-12, number of children 13-18, region (state level), education of HH head, education of mother, type of job of HH head (9 categories), marital status, ethnicity, PROGRESA participation)

Statistical analyses for the Tobit model were done using PC-SAS (release 9.1, SAS Institute Inc, Cary, NC) on a dataset generated from AMOS6 with the missing prices replaced by imputed value (AMOS data files were converted into SAS-compatible files using Stat Transfer version 7). Tobit analysis was performed using the **proc qlim** procedure in SAS.

Since there were many significant differences between prices in 1998 and 1999, regression comparison was used to test for the difference between the two years. This was done by including a dummy variable for year in the model (Year) as well as interaction terms for year and prices (Year*log (price of tortilla), Year*log (price of corn), etc) to test for the significance of differences in the slope of regression between the two years (Table 3.2).

Results

Per capita consumptions

Per capita consumption of bean, chicken, oil, tomato and tortilla did not significantly change between the two years. In 1999 compared to 1998, consumption of corn decreased from 1.14 bushels per person per week to 0.82 ($p < 0.001$), egg consumption decreased from 0.22 dozens to 0.17 ($p < 0.05$), milk consumption decreased from 0.20 liters to 0.13 ($p < 0.005$), onion consumption decreased from 0.16 kg to 0.09 ($p < 0.005$), potato consumption decreased from 0.30 kg to 0.11 ($p < 0.005$), and rice consumption decreased from 0.11 to 0.08 ($p < 0.05$). It was only the per capita consumption of sugar that significantly increased from 0.23 to 0.25 kg per person per week from 1998 to 1999 ($p < 0.005$) (Figure 3.1).

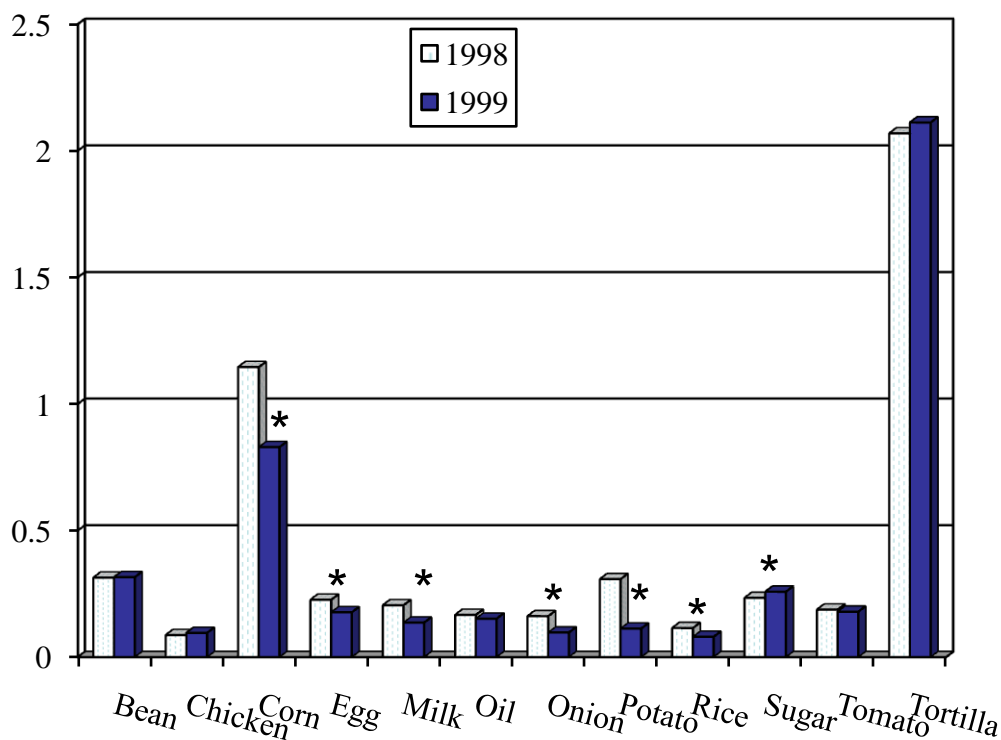


Figure 3.1. Changes in mean per capita consumption of the most commonly consumed foods between 1998 and 1999

* shows significant differences at $p < 0.05$ level

Note: Unit of consumption has been bushels for corn, liters for oil and milk, dozens for eggs and kilograms for all others. Recall period was seven days.

Prices

Overall, prices of bean, chicken, onion, potato, and tomato were significantly lower in 1999 compared to 1998. On the other hand, prices of milk and rice increased between the two years significantly (Figure 3.2).

Price of tortilla, oil, sugar and egg did not show any significant changes between the two years in this sample.

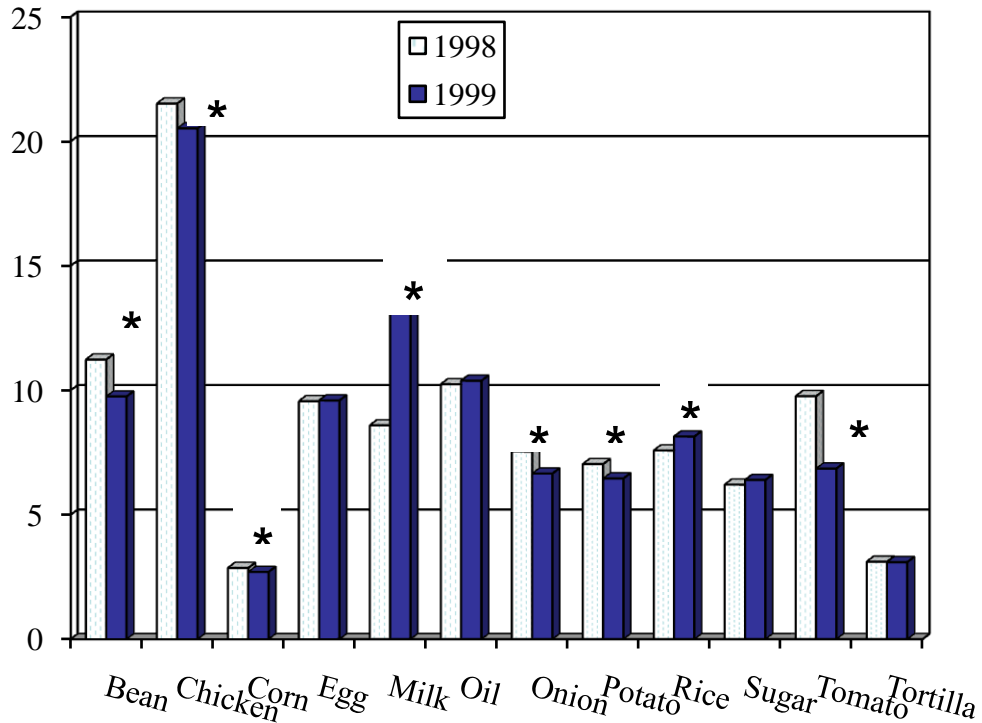


Figure 3.2. Changes in mean prices of the most commonly consumed foods between 1998 and 1999

* shows significant differences at $p < 0.05$ level

Note: Prices for 1999 have been adjusted for inflation using inflation rates published by the National Bank of Mexico.

Expenditures

Mean monthly per capita expenditure was significantly lower in 1999 compared to 1998 (154.31 pesos (SD=130.17) in 1998 and 128.67 (SD=78.67) in 1999, $p<0.005$).

Directions of changes in per capita expenditures on food were different from the expenditures on non-food items. Per capita food expenditure decreased between the two years (117.80 compared to 86.52, $p<0.005$), but per capita non-food expenditure increased significantly (37.42 compared to 42.13, $p=0.05$). (Figure 3.3)

Looking at the total food expenditure as percent of total expenditure showed that food expenditure was 75.31% of the total expenditure in 1998 and 69.51% of the total expenditure in 1999.

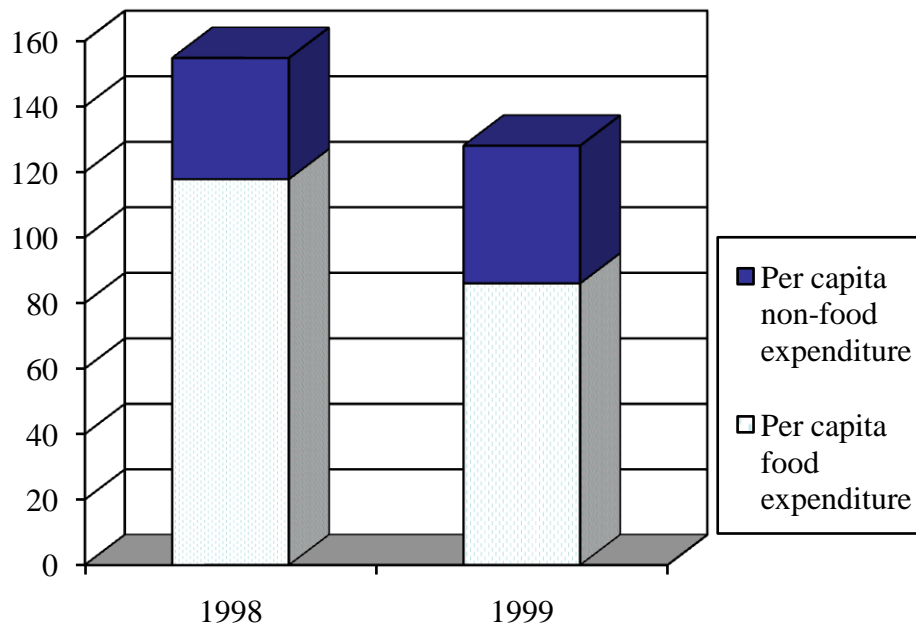


Figure 3.3. Mean per capita monthly expenditures in 1998 and 1999, with food and non-food values shown separately

Note: Numbers are in pesos

The effect of price changes on tortilla consumption

Table 3.2 summarizes the estimates from the Tobit models.

Overall, consumption of tortilla become significantly more sensitive to changes in the prices of tortilla ($p=0.013$), bean ($p<<0.0001$), milk ($p<<0.0001$), sugar ($p=0.025$), and onion ($p=0.0019$). Consumption of tortilla become marginally more sensitive to changes in the prices of tomato as well ($p=0.056$). In addition, consumption of corn became less sensitive to market prices ($p<<0.0001$).

Table 3.2. Tobit analysis results from 1998 and 1999

Parameter	Estimates		Test of difference between the two years (Pr > t) ¹¹
	1998	1999	
Log(Price of tortilla)	- 12.60** ¹²	-14.50**	0.013
Log(Price of corn)	-11.69**	-6.44**	<0.0001
Log(Price of rice)	-1.44* ¹³	-1.54*	0.38
Log(Price of bean)	-1.50**	-4.94**	<0.0001
Log(Price of milk)	10.96**	17.20**	<0.0001
Log(Price of sugar)	-0.79**	-2.90**	0.025
Log(Price of chicken)	-0.05	-2.89*	0.97
Log(Price of tomato)	-1.20**	-1.51**	0.056
Log(Price of onion)	-1.81**	-2.78**	0.0019
Log(Price of oil)	-0.30	-0.32	0.15
Log(Price of potato)	1.20	0.59	0.25
Log(Price of egg)	0.39	0.44	0.91
State 1(Guerrero)	7.92**	22.06**	
State 2(Hidalgo)	-1.58*	-2.68**	
State 3(Puebla)	5.95**	2.69**	

¹¹ Values in the fourth column are significance level for interaction terms in the model (Year*log (price of tortilla), etc). $P<0.05$ shows that the slope of regression has been significantly different between the two years.

¹² * *shows that the parameter estimates were significant in the model (for that particular year) at $p=0.05$ level

¹³ * shows that the parameter estimates were significant in the model (for that particular year) at $p=0.5$ level

Table 3.2. (Continued)

Parameter	Estimates		Test of difference between the two years (Pr > t)
	1998	1999	
State 4(Queretaro)	3.35**	4.04**	
State 5(SanLuis)	-1.47*	-0.82*	
State 6(Veracruz)	1.57 **	1.65**	
Electricity	0.89**	0.93**	
Piped water	-1.29**	-1.89**	
Floor material	0.72*	1.43**	
Job 1 (Ag. worker)	-2.03**	-1.85**	
Job 2 (Non-Ag. laborer)	-1.56	-2.73**	
Job 3 (self-employed)	0.35	-1.88*	
Job 4 (business owner)	-3.94*	-7.07*	
Job 5 (family worker)	0.36	2.29*	
Job 6 (non-paid)	-1.75	-1.07	
Job 7 (co-op member)	-7.35*	-1.29	
Job 8 (ejidario)	-3.45**	-2.72**	
Household size	1.66**	1.93**	
Marital status of the head of household	-2.93**	-0.023	
Ethnicity (indigenous)	-1.56**	-1.44**	
PROGRESA participation	0.17	0.93*	
Food expenditure	0.0003**	0.002**	Calculated from the model with omitted income instruments
Non-food expenditure	0.002**	0.001**	Calculated from the model with omitted income instruments(piped water, floor, electricity)

Discussion

The aim of this study was to assess the potential nutritional outcomes of the cessation of tortilla price protection –as an economic globalization policy- at the end of 1998 in Mexico. This was done by looking at the changes in prices and consumption of the common staples and overall expenditure patterns of families in 1998 and 1999, and then testing the changes in the effects of prices on household consumption between the two years.

Our findings showed that in 1999 compared to 1998, consumption of tortilla did not change significantly, but consumption of a few other staples including corn, eggs, milk, onions, potatoes and rice decreased. On the other hand, prices of tortilla did not change significantly, but prices of milk and rice were significantly higher and prices of bean, chicken, onion, tomato and potato were significantly lower in 1999 compared to 1998. Finally, the trends in income (as indicated by changes in the household expenditure) showed that incomes were significantly lower in 1999, and this was because household had a lot less to spend on food compared to the non-food items.

These patterns show that, in assessing the effects of government's tortilla price policy, looking at tortilla as a single commodity will not grasp the extent to which individuals' nutrition can be eventually affected. Our results revealed that in the context of this single policy change, at least in short-term, neither the price nor the amount of consumption of tortilla was significantly affected for the rural poor. These findings are in line with some similar findings in the literature in other countries.

Households even in the poorest areas insure their quantity of staple food consumption through various coping mechanisms in short-term (Skoufias, 2005; Rubio, 2004). Data collected by the Nutrition and Health Surveillance System (NSS) in Indonesia during the economic crisis of the late 1990s has shown that even in the

presence of higher rice prices (the main dietary staple in Indonesia), rice consumption did not change, but there was reduced consumption of other non-rice items including animal products (Bloem, 2000).

Skoufias has found that in rural Mexico household food consumption was completely insured from any of the five idiosyncratic shocks examined in their case study (i.e., loss of land, harvest, animals, home, and other items). Also, their overall results from a five-country study (i.e., Bangladesh, Ethiopia, Mali, Mexico, and Russia) confirm that informal insurance arrangements are more likely to cover consumption of food than non-food (Skoufias et al, 2005).

Rubio et al. (2004) have used cross-sectional data from before and after the 1994 Mexican peso crisis to analyze rural household vulnerability to macroeconomic shocks. In addition to the fact that food consumption was generally insured against shocks, their findings show that agricultural households suffered slightly less from the crisis than non-agricultural households, and among them those with a higher proportion of corn and bean production for self-consumption fared better than households which engaged in stronger market participation.

Apparently, consumers are generally more aware of their quantity of intake and take measures to avoid declines in calorie consumption, while fluctuations in micronutrient intake go unnoticed for the most part (Bouis et al, 1997). For this reason, studying the changes in the quantity of consumption of foods per se may not be the best indicator of nutritional outcomes of a policy in the short-run.

Based on such findings, we also studied the changes in the nature of the relationship of food consumption with its determinants including prices and income. Our results showed that households' consumption of tortilla became more sensitive to changes in the prices of tortilla as well as a few other main staples including bean,

milk, sugar, onions, and tomato (as shown by the increase in the slope of regressions in Table 3.2).

What “becoming more sensitive to prices” could mean for nutrition is that households will be more and more basing their food choices on the market prices rather than their actual preferences or nutritional needs. Ideally, one expects to see relatively robust consumptions of staple food items. Households can continue to have a relatively stable food consumption pattern in the face of market price shocks by spending a higher portion of their income on food. Nevertheless, if the overall income decreases as well and a household’s food expenditure is already taking up the main portion of their income, it will be less likely for them to meet their nutritional needs.

In fact, we found that household expenditure (or income), decreased significantly between 1998 and 1999 in our sample. Similar changes have been observed by MacMillan et al. (2005) in rural Mexico, revealing that the real income of small farmers in Mexico dropped between 1995 and 2001. They suggest that this can be explained by the reduction in the price of corn (which was seen in the present study as well). Though the majority of the farmers in their study did not participate in the market, they did report that their most important source of income from their primary occupation was the value of home consumption. Thus, even for those farmers who did not participate in the market, the imputed value of real income fell (MacMillan, 2005).

In addition, the mean for the share of food expenditure from total household expenditure in this study population was 75.31% and 69.51 % in 1998 and 1999 respectively, whereas it is about 26.62 % at the national level in Mexico (FAO, 2003). This should not be surprising since Mexico is known to have high degrees of social inequality (Frenk, 2006). Sabates has also found that for the lowest income decile in Mexico, food expenditure comprises 64.7% of the total expenditure (Sabates et al, 2001), a number which is close to the findings of the present study. This large

difference in share of food budget shows that the families in our study were indeed among the poorest of the poor, and most of their income was already spent on their day-to-day subsistence needs leaving them less capable to cope with higher prices.

Therefore, both these findings (i.e., decreasing income, high share of food expenditure in total expenditure) indicate that the observed increase in price-sensitivity in the short-run could mean higher vulnerability to market shocks and more possibility of adverse nutritional outcomes due to globalization policies in longer-term for the rural poor in Mexico.

These findings will be particularly alarming if the promise of reduced food prices due to globalization cannot be actually met in the long-run. A recent Economic Research Service study projected that open trade will cause long run real world food prices to increase by about 12 percent (even though developing countries' exports would increase by about 30 percent) compared to those of 1999. In this report, it is hypothesized that trade liberalization, by leading to removal of farmer subsidies in developed countries, can be expected to raise world food prices, because removal of subsidies induces farmers to reduce their output in the long run (Trueblood, 2001).

In addition, the Mexican tortilla market is practically a monopoly as the two largest companies, GIMSA and MINSA account for 70% and 27% of the market respectively (Nadal, 2000) and work like cartels using their market power to set higher prices. Cessation of price protection by the government would only make it easier for them to lead the market to their benefit. Although we did not observe a significant rise in the price of tortilla between the two years, there has been some evidence that it has indeed shown an upward trend in the years following NAFTA at the national level in Mexico (Patel, 2003).

Our study has several advantages. First, it addresses a crucial link in the conceptual framework linking globalization to nutrition and eventually health. With

widespread implementation of globalization policies by many developing countries especially in the past two decades, there is a great need for better understanding the mechanisms and the magnitude of the effects of macroeconomic food policies such as food price policies on nutritional status (Torlesse, 2003).

In addition, Mexico is of particular interest in assessing the impact of economic changes on nutrition and health due to NAFTA and the government's commitment to providing support to the poor. The study population from PROGRESA impact evaluation was among the poorest of the poor in Mexico and well below the poverty line. This makes our findings very relevant to future policies aiming to provide better coping mechanisms for the poor in Mexico.

The focus on short-run impacts of "globalization" in this paper also has several advantages. First, using short-run changes seem to be more appropriate for studying the impacts of market price changes on the poor (MacMillan, 2005). The poor as Barrett and Dorosh (1996) say "are likely to be teetering on the brink of survival" and therefore are not probably the main beneficiaries of the supply-side effects of price changes due to globalization.

Second, our outcome of interest is eventually the nutritional status of children within these poor households. Children under five years of age are extremely vulnerable and any declines in their nutritional status may not be later reversible. Thus, short-run impacts of globalization policies on consumption patterns of households with children will provide valuable information for future policies to protect children's nutrition during similar crises.

Finally, the use of changes in sensitivity of consumption to prices is a novel approach to studying the short-term effects of price policies on nutrition. Previous work has been focused on addressing the actual changes in food consumption and

expenditure during crises which as discussed earlier may not completely grasp the extent to which individual's nutrition can be eventually affected.

To justify our conclusions, however, we must also address possible limitations, sources of bias or lack of congruency in the analysis. First, this analysis used two surveys in 1998 and 1999; and there may be other changes in the economic environment beside the tortilla price policy change at the end of 1998 to have created the observed outcomes. Therefore, the statistical findings do not provide evidence of a cause and effect relationship between the policy change and household consumption.

The trends for inflation rate in the years preceding the study have been generally upward. While part of the inflation itself may have been caused by the cessation of tortilla price protection in 1998, there may have been other factors in play. There is evidence indicating that variability in market prices has been higher than that of import prices after NAFTA in a continuous manner. Although opening borders to imports since NAFTA has caused variation for the import prices to fall 10%, it has not been that effective in reducing price volatility for market prices as much (Avalos-Sartorio, 2006). Therefore, it is likely that what we have observed has been in fact part of a trend in consumers' response to higher price *volatility* in the post-NAFTA era.

Ideally, a Computable General Equilibrium model (CGE) which can incorporate changes in all the different sections of the economy can provide a better picture of the impacts of macro-economic policies (Pinstrup-Andersen et al., 1990). Nevertheless, in the absence of a CGE model, household models such as the one used in this study are particularly suited to analyze impacts especially in cases where households are both consumers and producers and have been used widely to assess policy impacts in cases like agricultural reforms (World Bank, 2003).

Second, due to the household survey limitations, there were between 20-40% missing values for prices of household foods and imputation was used to account for

the missing prices. Although the relatively high number of missing values does impose a constraint on the analysis, the theory-based approach (i.e., EM algorithm) used in this study has several advantages over the conventional regression imputation and has been shown to provide better estimates (Wothke et al. 1996). It should be noted, though, that this algorithm is based on the crucial assumption that the prices are missing at random. This is a strong assumption, especially because missing prices in these surveys were in fact due to reporting of zero consumption of that specific food item by the household for the recall period. Therefore, the challenge would be to determine if zero purchases are due to infrequent purchases, or due to nonuse or some economic circumstances. Unfortunately, the current design of household surveys does not usually allow us to make this distinction (Blisard, 2003).

Another caveat in interpreting the results of this study is the fact that the survey questionnaires for PROGRESA evaluation collected information on household food purchase rather than the actual consumption. Thus, we know how much food was “available” to be consumed and use that information as a close proxy for consumption, because we do not have any information about the amount not consumed for various reasons (food wasted, lost during preparation (inedible parts, etc)). This is a limitation that exists with using household surveys in general as compared to actual intake assessments. For example, 24-hour intake assessments use food composition tables that generally allow one to calculate the edible portion of foods.

In addition, there can be considerable heterogeneity with broad food categories such as “chicken” or “rice”, and such heterogeneity may be correlated with household characteristics (Hoddinott, 2004). These limitations could be overcome by having 24-hour intake recalls rather than purchase recalls, however, the resources for that kind of extensive data collection are not always available to researchers.

Finally, this study is only looking at the household level consumption and cannot account for intra-household differences. Therefore, any conclusions about the effects on children's nutrition would be based on the assumption that the dietary intake of children is directly affected by variation in food expenditure and consumption at the household level. We believe, however, that there is still value in assessing the overall household food consumption. It has previously been hypothesized and demonstrated that the amount of money available to households to purchase foods and household overall consumption determines the quantity and quality of food consumed by children (UNICEF, 1990).

The findings of this study once again confirm that poor households are at greater risk of nutritional deficiencies due to market shocks, which can be due to many factors including their lower overall income, higher share of food expenditure in their total income, and the dependence of their incomes to agricultural markets.

These findings invite further investigation along several dimensions. A matter of great importance will be to assess to effects of food price policies on child micronutrient status, since there has been evidence of concentration of adverse nutritional consequences of economic crises at the micronutrient level elsewhere (Block et al, 2003).

Were some households less vulnerable due to factors such as nutrition knowledge? Are there differences in response to crises due to intra-household allocation differences based on age and gender? These are questions that if answered can better differentiate the impacts of economic shocks by types of household in policy-relevant ways and better inform the design of interventions to help the poor resist the damaging nutritional impacts of economic crises.

CHAPTER FOUR

DOES GLOBALIZATION CHANGE THE DYNAMICS BETWEEN FOOD PRICE AND NUTRIENT INTAKE? IMPLICATIONS OF PRICE ELASTICITIES OF CHILD NUTRIENT INTAKE FOR FOOD POLICY IN RURAL MEXICO

Abstract

Globalization can potentially lead to more competition, reduced prices and higher purchasing power for consumers in the long run. In short term, however, vulnerable populations can be negatively affected by market volatilities without appropriate protection policies in place. This study used data from 828 children in 6 states in Mexico from 1998 and 1999 to test if children's daily intake of nutrients became more sensitive to prices after introduction of a globalization policy in Mexico. The slopes for demand of 11 nutrients in response to prices of 12 staple foods were tested for differences across years. In 1999 (vs. 1998), increase in price of chicken was more likely to decrease intake of protein (regression coefficients for 1998=-6.63, 1999=-11.38, $p=0.04$), iron (-6.76 vs. -9.54, $p=0.03$), and calcium (-2.44 vs. -4.74, $p=0.04$). Increase in price of tomato was associated with a larger shift toward fat intake in 1999 compared to 1998 (4.13 vs. 12.5, $p=0.04$). We conclude that rapid price changes for chicken and tomato as two main foods for children negatively affected their intake. We also conclude that in evaluating the short-term impact of globalization, even in the absence of significant changes in prices or consumption, elasticity (or sensitivity) of consumption and nutrient intakes to prices can change significantly, thus providing valuable information on potential vulnerabilities of populations at risk of undernutrition.

Introduction

The statistics are stark; undernutrition¹⁴ is a leading killer. In 2001, 50 to 70% of the burden of death from diarrheal diseases, measles, and malaria and lower respiratory infections in children was attributable to undernutrition (de Onis et al., 2004). In children with vitamin A deficiency, the risk of dying from diarrhea, measles, and malaria is increased by 20-24 % (Rice et al, 2004). Likewise, zinc deficiency increases the risk of mortality from diarrhea, pneumonia, and malaria by 13-21% (Caulfield and Black, 2004).

Undernutrition has complex causes that involve biological as well as socioeconomic and cultural determinants. In children, it mostly results from poor diets, in quantity or quality, and from infectious diseases. These factors originate from insufficient access to nutritious foods, poor sanitation and health services, and inadequate parental care practices (UNICEF, 1990). Uneven distribution of resources, knowledge and opportunities among the members of the society where under-nutrition is most prevalent are the underlying roots of many nutritional risk factors.

Many poor households in developing countries lack the resources they need to grow or purchase sufficient food; thus their diet is deficient in energy and nutrients. It is estimated that about 130 million children were underweight in 2005 (21% of all children) (De Onis et al., 2004). In Latin America, 11.8% of preschoolers are stunted and 5% of them are underweight. In Mexico, according to a national survey conducted in 1998, there were still high prevalence of stunting (17.7%) and anemia (27.2%) in children younger than 5 years (Rivera and Sepulveda, 2003).

Given its significance for the health and performance of the population, the prevention of malnutrition is of paramount importance (World Bank, 2006). Nutrition

¹⁴ Malnutrition in its broad sense can be referred to both under-nutrition and over-nutrition. For the purpose of this paper; however, it will be referring to under-nutrition.

plays a key role in achieving the majority of the Millennium Development Goals¹⁵, and policies and programs that improve nutritional status should be essential parts of the development agenda (Gillespie and Haddad (2003)). The multi-factorial causation of malnutrition, however, calls for multi-sector policies and programs to prevent or ameliorate the problem and its consequences.

Globalization, economic shocks, and vulnerability

We live in a rapidly changing world. With increasing globalization, or integration of countries in the world economy, sectoral policies including food and agricultural policies are moving toward market-oriented approaches (Leathers, 2004). Countries open borders to trade by reducing impediments to imports and exports, eliminating subsidies and encouraging foreign investment.

The compelling argument in defense of economic globalization has been that as cheap imports enter the country, the consumers invariably benefit from lower market prices for various commodities because then the prices will be closer to world market prices and hence more competitive. Yet, some empirical studies have shown that, despite globalization, there has been an overall pattern of fluctuating or random divergence in international commodity prices rather than convergence of prices (Bukenya, 2005), and at least in early stages, price shocks have followed globalization policies (De Janvry, 1997).

¹⁵The eight Millennium Development Goals (MDGs) form a blueprint agreed to by all the world's countries and the entire world's leading development institutions to be achieved by the year 2015. In brief, the MDGs include: 1. Eradicate extreme poverty and hunger, 2. Achieve universal primary education, 3. Promote gender equality and empower women, 4. Reduce child mortality, 5. Improve maternal health, 6. Combat HIV/AIDS, malaria, and other diseases, 7. Ensure environmental sustainability, and 8. Develop a global partnership for development. Gillespie and Haddad (2003) argue that nutrition plays a key role in achieving the first six of the eight goals.

Understanding the vulnerability of the rural poor to such macroeconomic shocks has been the subject of attention for many researchers and policymakers in recent years. Vulnerability (i.e., the ability to response to a shock) has become an even better indicator of poverty than a static measure like the current level of welfare (World Bank, 2001). A number of these studies have indicated that some groups within a population are more vulnerable to shocks than others.

Glewwe and Hall (1998) have reported that in urban settings, more educated heads of households with fewer children were less vulnerable to adjustment programs of the late 1980s in Peru. In rural settings, Rubio et al. (2004) have found that agricultural households with more diversified economic activities fared better than non-agricultural households, or households more specialized in agriculture. In addition, among agricultural households, those with a higher proportion of bean and corn production for own consumption fared better than households with more dependence on the market.

Socioeconomic factors are not the only underlying roots of vulnerability. From the nutritional perspective, some individuals can be more vulnerable to developing deficiencies as well. For example, children are considered to be the most vulnerable members of the society (Blossner and de Onis, 2005), since they have special nutritional needs and lower immunity against diseases. It is also very difficult to later reverse deficiencies that have occurred earlier in life (Martorell et al., 1994).

The relationship between economic vulnerability and nutritional vulnerability can be both ways. Poverty and lack of resources lead to deficient diets, and undernutrition can further contribute to economic vulnerability. Ross and Horton (1998) have shown that the adult labor productivity lost as a result of childhood iron deficiency can lead to substantial reductions in GDP (Gross Domestic Product) of a

country. This is one of the reasons why the vicious cycle of poverty and undernutrition can be perpetuated generation after generation (World Bank, 2006).

Nutritional outcomes of economic shocks

What are the nutritional outcomes of economic shocks? And where should we be looking for the likely signs of short-term effects of economic shocks?

The impact of economic crises on nutritional outcomes has been addressed in several studies (Bloem and Darnton-Hill, 2000, de Pee et al., 2000). In most circumstances, one of the main pathways through which economic shocks have affected nutrition has been through food prices. There are various economic analyses of changes in food demand (i.e., effects of changes in food prices on consumer consumption of food items), and a few of them have incorporated nutritional factors into their food demand analyses (Huang, 2000 and 1996).

Some of these studies fit demand equations for specific nutrients as functions of income and socio-demographic variables from household survey data (Devaney et al. 1989 and Basiotis et al., 1983). Others propose various formulas to calculate nutrient elasticities in order to measure price and income effects on nutrient availability. The underlying demand models in such studies are generally driven from the household food demand models rather than data collected on individuals' nutrient intakes (Sahn, 1998, Gould et al., 1991).

Conventionally, many studies have focused on demand for energy as the main outcome of interest, since micro-nutrient deficiencies are not usually considered during economic crises unless macronutrient deficiencies become noticeable (Gitau et al., 2005). It has been shown, however, that there are essential differences between changes in demand for energy and demand for micronutrients in response to shocks.

Consumers are keenly aware of and take measures to avoid declines in energy consumption, while fluctuations in micronutrient intake go unnoticed for the most part.

Thus, despite the fact that energy consumption typically is concentrated in a single staple food (e.g., rice in Bangladesh), consumers react to increases in prices either by switching to other energy-dense staples (e.g., wheat instead of rice) or reducing expenditures for non-staples and nonfoods to protect (to a large extent, if not completely) acceptable levels of energy consumption (Bouis et al, 1997), a choice that, unfortunately, can lead to lower quality diets and higher rates of micro-nutrient deficiencies.

Block et al. (2004) showed that the nutritional consequence of the Indonesia's crisis were particularly concentrated at the micronutrient level. In the context of their study, the economic stress led households to substitute into lower quality foods to maintain gross energy intake. Similarly, a study in Zambia showed that a period of increased price of the staple food, maize, was associated with decreased plasma vitamin A and E levels, rather than decreased energy consumption (Gitau, 2005). Based on such findings, there is an increasing body of evidence suggesting that public interventions to protect the poor during crises should specifically include safeguards, not simply for gross caloric intake, but the quality of diet as well.

It seems logical to assume then that micro-nutrients as well as macro-nutrients show the likely signs of short-term effects of economic shocks (Block et al., 2004); and a comprehensive framework for studying the effects of globalization on nutritional status of consumers has to include changes in their overall dietary profile rather than energy or protein availability (Huang, 2000).

Globalization and the Mexican experience

Since the introduction of NAFTA¹⁶, Mexico's experience of market liberalization has served as an exemplary case for studying the effects of globalization

¹⁶ In January 1994, Canada, the United States and Mexico launched the North American Free Trade Agreement (NAFTA) and formed the world's largest free trade area. NAFTA called for immediately

on a population. There is evidence that instead of a somewhat uniform reduction of prices for consumers, only relative prices for import-sensitive commodities in Mexico fell during the 1990s (Lederman, 2003). On the other hand, there is evidence showing that prices of a few staples including corn fell after NAFTA and thus consumers benefited from lower prices, but it was accompanied by the observation that agricultural incomes for farmers also fell during this same period (Yunez-Naude 2002).

As for the trends in food consumption, even before NAFTA, data from the economic crises of 1982 and 1987 in Mexico show that the combination of reduced family budgets and the withdrawal of subsidies on basic foodstuffs had forced Mexican families to reduce both the quantity and quality of their food intakes (Dookeran, 1998).

Trends in infant mortality show a relationship to economic downturns as well. Furthermore, according to a national survey conducted in 1998, there were still high prevalences of stunting (17.7%) and anemia (27.2%) in children younger than 5 years in Mexico (Rivera and Sepulveda, 2003).

In preparation for NAFTA, the Mexican agricultural sector had to undergo some fundamental changes. Since mid-1960s, the National Company of Popular Subsistence (CONASUPO)¹⁷ had played a key role in Mexican agricultural policies, shaping food production, consumption, and rural incomes through direct government intervention.

eliminating duties on half of all U.S. goods shipped to Mexico and Canada, and gradually phasing out other tariffs over a period of about 14 years (NAFTA Secretariat).

¹⁷ CONASUPO stands for *Compania Nacional de Subsistencias Populares*, Mexico's National Company for Popular Sustenances. CONASUPO supported producer incomes by establishing import quotas and by implementing a mandated pan-Mexico prices for producers of various commodities including corn and tortilla, prices that it was able to maintain by intervening directly in processing, storage and distribution (Avalos-Sartorio, 2006).

Following the debt crisis of 1982, this company was reformed as part of the market liberalization process. Starting from November 1993, per-hectare payments to farmers gradually replaced guaranteed prices for corn and other basic crops in Mexico, under a new program called PROCAMPO¹⁸. Finally, On January 1, 1999, president Zedillo's administration in Mexico announced the elimination of subsidies for corn bread (tortilla) consumption, and with this, the complete liquidation of CONASUPO took place (Yunez-Naude, 2002).

Corn tortilla is the most commonly consumed staple in Mexico. After elimination of corn subsidies (which happened at an earlier stage of the liquidation of CONASUPO before the tortilla subsidies were eliminated), there was a sharp increase in tortilla prices at the national level (Yunez-Naude, 2002).

It can be assumed that elimination of tortilla price protection served as a final blow to consumers. Increased prices could have caused consumption changes at the household level for tortilla, decreased the food budget of families, and subsequently affected their consumption of other major food items. Therefore, what happened to the poor households immediately after the cessation of government tortilla price protection can demonstrate a good example of short-term effects of globalization policies and provide valuable information for further policy decisions.

Previous studies have used household survey data to examine how the impact of price shocks differs across households in Mexico, and have considered several potential adjustment mechanisms: changes in household structure, changes in fertility, changes in household labor supply, changes in child schooling, and inter-household

¹⁸ PROCAMPO was implemented as a support measure to compensate farmers for anticipated adverse effects of NAFTA reforms; specifically, to help producers adjust to the removal of guaranteed prices for basic grains and oilseeds (De Ferranti et al., 2005).

transfers (McKenzie 2003). There is little evidence, however, to link such outcomes to health and nutritional status of individuals, especially children.

Considering this background, the objective of this paper is to study the short-term effects of a pro-globalization policy by the Mexican government on the nutrient intake of under-five year old children in rural Mexico. This study will focus on Mexico as a country case-study to identify the changes in nutrient intake in response to prices between the two years of 1998 and 1999, which is before and after the cessation of tortilla price protection by the government. Thus, it will assess some of the possible effects of this policy by testing the differences between the two years and finding the determinants of such differences.

This paper will address these specific questions:

- 1) Did children's intake of any of nutrients become more sensitive to prices of major foods after the cessation of tortilla price protection?
- 2) What are the possible nutritional outcomes of these changes?

The results will be used to discuss what policies could possibly protect their intake during the globalization process in Mexico.

Methods

Data

In this paper, data have been used from the evaluation of PROGRESA (Programa de Educación, Salud y Alimentación) in rural Mexico. PROGRESA (currently Oportunidades) is an anti-poverty and human resource program with conditional cash transfers to the poor and is aimed to improve the nutritional status of poor children and improve education and health in rural Mexico (World Development report, 2004).

Evaluation had been integrated within PROGRESA from its very beginning. The PROGRESA impact assessment included data collection from 506 localities in 7

south-central states¹⁹ of Mexico which were randomly assigned either to receive benefits starting in mid 1998 (320 ‘treatment localities’) or to receive identical benefits two years later (186 ‘control localities’) (INSP, 1998).

PROGRESA-eligible households in both treatment and control localities took part in a series of household surveys called “ENCEL”. The ENCEL surveys were conducted by IFPRI (International Food Policy research Institute) and contained information on educational attainments, household purchase and consumption, time allocation and gender relations.

ENCEL surveys, however, did not include basic nutritional data like individual 24-hour food intakes or anthropometric information on children. This information was collected separately by Mexico’s Instituto Nacional de Salud Publica (INSP) in two rounds, August-September 1998 and October- December 1999, in six of the seven states²⁰ and only for women and children. The INSP survey was a longitudinal rotating child-based sample that partially overlapped the ENCEL surveys²¹.

The dataset used for the current study was originally created from INSP surveys and contained information on child growth and some household characteristics of children who had observations both in 1998 and 1999 (Behrman, 2000). For the current study, however, in order to assess the effect of price changes in children’s daily intake of nutrients, information on the prices as well as child food consumption was needed. Therefore, INSP datasets were merged with their corresponding round of ENCEL to provide full information for each child.

Merging was done by matching unique identifiers including information on state, municipality; locality, household id number and child’s birth date in the two

¹⁹ Guerrero, Hidalgo, Michoacan, Puebla, Queretaro, San Luis Potosi , and Veracruz

²⁰ Guerrero, Hidalgo, Puebla, Queretaro, San Luis Potosi , and Veracruz

²¹ Design, sampling, sample size calculations and other aspects of the collection of these data are summarized in INSP (1998) and Behrman (2000).

datasets for 1998 and 1999. This produced a sample of 836 children (403 boys and 433 girls) in each year (This dataset was originally created by Behrman and Hoddinott to assess the effects of PROGRESA participation on child nutrition (Behrman and Hoddinott, 2000)).

Children's 24 hour intake data were collected by asking the primary caregivers about the amount and time of consumption of all food items by the child in the preceding day. This information on intake of foods was used in combination with the Mexican food composition table (used by the INSP for the Mexican National Nutrition Survey in 1999) to calculate total daily intakes of energy (kcal), protein, fat, sugar, iron, calcium, zinc, vitamin A, vitamin B12, vitamin D and vitamin C by children in each year.

Socio-economic (SES) conditions were assessed using information about construction materials used to build the house, sanitary infrastructure, and possession of selected household goods as reported by informants and by observing their conditions.

Basic characteristics

Overall, 393 households were in the PROGRESA treatment localities and 435 in control localities. All households had at least child who was between 6 months and 5 years old (mean age 21.8 months). Mean household size in 1998 was 7.1.

The PROGRESA treatment and control communities were similar in baseline characteristics including access to piped water and electricity. About 36.8% of households had access to piped water and 64.3% had access to electricity. The floor in 56.3% of the houses was made of dirt (Table 4.1).

Table 4.1. Characteristics of the study households at baseline

Mean household size (SD)	7.10 (2.57)
Living conditions	
Access to piped water	36.8%
Electricity	64.3%
Floor made of soil	56.3%
PROGRESA participation	
Yes	47.5%
No	52.5
State of residence	
Guerrero	8.3%
Hidalgo	23.3
Puebla	26.6
Queretaro	9.7
San Luis	17.6
Veracruz	14.5
Mothers' characteristics	
Mean age (SD)	30.1 (7.2)
Mean years of schooling (SD)	3.87 (2.79)
Paid employment	0.03%
Household head characteristics	
Sex male	96.4%
Marital status	
Open union	26.4%
Married	67.9
Single	0.8
Indigenous	25.8%
Occupation	
Ag. laborer	70.7%
Non-Ag. worker	12.5
Self-employed	8.6
Ejidatario/comunero	5.5
Family labor no-pay	1.4
Other	1.3
Mean years of schooling (SD)	3.58 (2.59)

The majority of the household heads (96.4%) were male, with 67.9 % of them being married to their partners and 26.4% in open union. Overall, 25.8% spoke an indigenous language. Most the heads of households were agricultural laborers (70.7%), the rest were mostly non-agricultural workers (12.5%), self employed (8.6%), or members of an agricultural commune or “ejido” ²²(5.5%).

Mean years of schooling for heads of households was 3.58 years and for mothers was 3.87 years. Mothers mean age was 30.1, and very few of them had paid jobs (0.03%).

Table 4.2 summarizes the characteristics of the study children. There are comparable number of children in each group in PROGRESA treatment and control groups. A table of most frequently consumed foods by the children in 1998 and 1999 is available in Appendix 1. There were no significant differences in growth indicators or other baseline characteristics between cases and controls (Appendix 2).

Table 4.2. Characteristics of the study children at baseline

	PROGRESA	Non-PROGRESA
Child age (months)		
6-9	94	102
9-12	43	38
12-24	85	95
24-60	171	200
<i>missing</i>	-	-
Child sex		
Boy	198	205
Girl	194	228
Missing	1	2
Total	393	435

²² The word "ejido" means "commons". In Mexico, an ejido refers to a community of people who share ownership of their land. The ejidos are made up of groups of families.

Modeling the effects of price changes on nutrient intakes

In a general level, demand functions can be written with a vector of behavioral outcomes dependant on a vector of prices and a vector of resources. Thus, a linear demand function for food for household facing prices PF and with resources RF and a vector of stochastic terms (V) is:

$$Z_f = b_{PF} + b_{RF} + V,$$

Where b is the parameter to be estimated and indicate the impact of the variables for which they are coefficients on the demands for Z_f (Behrman, 2000). For this study, the outcome of interest is intake of a nutrient (Zn), and the predictors include P_t (price of tortilla), as well as prices of other household food items, and a series of individual, household and community that affect nutrient intake (see below).

Originally, IFPRI household surveys contained information on weekly consumption of 40 main food items. Based on the preliminary results on frequency of consumption by the households, twelve most commonly consumed food items were chosen for further analysis, including beans, chicken, corn, egg, milk, oil, onion, potato, rice, sugar, tomato, and tortilla (Figure 4.1).

All of the prices for 1999 were adjusted for inflation based on the rate between October 1998 and November 1999 published by the National Bank of Mexico. In addition, the prices of commodities in the datasets had non-normal distributions, so log-transformation was used to reach normality. Also, most of the nutrient intakes were skewed, therefore, square root of amounts were used in the model instead. This transformation provided the distribution closest to normal for nutrient intakes.

These transformations, however, mean that the slopes of the regression from these models will not be the real price elasticities of demand. It should be noted

though that the main objective for these models is to test the differences in the relationship of consumption to prices between the two years (whether household consumption has become less or more price-sensitive). Therefore, with the log-transformed prices it will still be possible to test for the differences between the two years and reach the objective.

In order to better demonstrate changes in the overall dietary profile of children, and based on former studies to the problem nutrients in Mexico (Rivera, 2003), intake of 11 macro- and micro-nutrients were modeled separately in response to changes in prices. These nutrients included: energy, protein, fat, sugar, iron, calcium, zinc, vitamin A, vitamin D, vitamin B12, and vitamin C.

As with many household survey data, for each food there are many zero consumption values for a particular purchase period (7 days in this case). In the PROGRESA datasets, this will lead to a missing value for the price of that commodity as well, because households have only reported prices for the foods they have purchased.

A theory-based approach to the treatment of missing data under the assumption of multivariate normality, based on the direct maximization of the likelihood of the observed data is called the “EM algorithm” (Little and Rubin, 1987). To say it briefly, EM uses a series of designated variables as predictors for imputing the missing data, and is thus capable of better preserving the variances and co-variances than does conventional regression imputation.

In this study, AMOS 6 –a software designed for usage as an extension to SPSS 14- was used to deal with missing data. AMOS uses maximum likelihood estimates even in the presence of missing data (Anderson, 1984) to offer better regression estimates. After providing a conceptual framework to the program, it uses the available variables to generate a new dataset with missing values replaced by imputed

values. This analysis assumes that the data on prices are missing at random²³ (Wothke, 1996).

Multiple regression was used to assess the estimates for the effects of prices on intake. To assess whether there were significant differences between the models in 1998 and 1999, regression comparison was used to test for the difference between the two years. This was done by including a dummy variable for year in the model (Year) as well as interaction terms for year and log of prices (Year*log (price of tortilla), Year*log (price of corn), etc) to test for the significance of differences in the slope of regression between the two years. We ran the model separately for each of the nutrients. For example, the demand model for energy intake can be summarized as (Dong, 2004):

$\sqrt{\text{child energy intake (24 hour)}} = f(\text{Log(price of tortilla), log (price of corn), log(price of rice), ..., State(1-6), availability of electricity, water, floor material, occupation (1-8), household size, marital status, ethnicity, PROGRESA participation, education lever of head of household, education level of mother (if not head of household), child age, Year, Year*log(price of tortilla), Year*log(price of corn), ...})$

Finally, a total of 132 nutrient-price slopes²⁴ were estimated. These nutrient-price slopes include both own and substitution effects of a change in a commodity price. For example, sugar does not contain any fat, but one percentage increase in log (price of sugar) will increase fat intake by 6.10, probably through substitution of sugar by high-fat foods.

²³ Rubin and Little (1987) distinguish the processes that generate the missing data with respect to the information they provide about the unobserved data. Missing values of a random variable Y can be missing completely at random (MCAR, missing entirely unrelated statistically to the values that would have been observed), missing at random (MAR, somewhat more relaxed, missing-ness and data values statistically unrelated conditional on a set of predictor variables x), and non-ignorable (missing-ness conveys probabilistic information about the values that would have been observed)

²⁴ The term slope is being used here instead of elasticities because due to non-normal distribution, log of prices were used in the model instead of prices themselves.

Statistical analyses were done using PC-SAS (release 9.1, SAS Institute Inc, Cary, NC) on a dataset generated from AMOS6 with the missing prices replaced by imputed value (AMOS data files were converted into SAS-compatible files using Stat Transfer version 7).

Results

Changes in Prices

Overall, prices of bean, chicken, onion, potato, and tomato were significantly lower in 1999 compared to 1998. On the other hand, prices of milk and rice increased between the two years significantly (Figure 4.1). Price of tortilla, oil, sugar and egg did not show any significant changes between the two years in this sample.

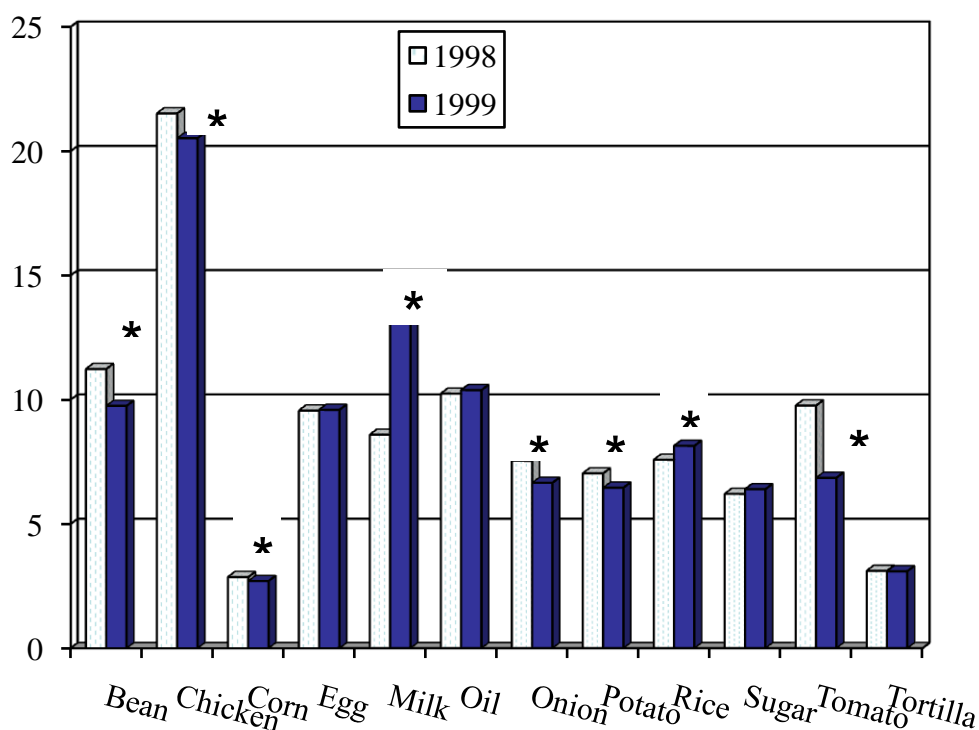


Figure 4.1. Changes in mean prices of the most commonly consumed foods between 1998 and 1999

* shows significant differences at $p < 0.05$ level

Note: Prices for 1999 have been adjusted for inflation using inflation rates published by the National Bank of Mexico.

Changes in expenditures

Mean monthly per capita expenditure was significantly lower in 1999 compared to 1998 (154.31 pesos (SD=130.17) in 1998 and 128.67 (SD=78.67) in 1999, $p<0.005$). Directions of changes in per capita expenditures on food were different from the expenditures on non-food items. Per capita food expenditure decreased between the two years (117.80 compared to 86.52, $p<0.005$), but per capita non-food expenditure increased significantly (37.42 compared to 42.13, $p=0.05$). (Figure 4.2)

Looking at the total food expenditure as percent of total expenditure showed that food expenditure was 75.31% of the total expenditure in 1998 and 69.51% of the total expenditure in 1999.

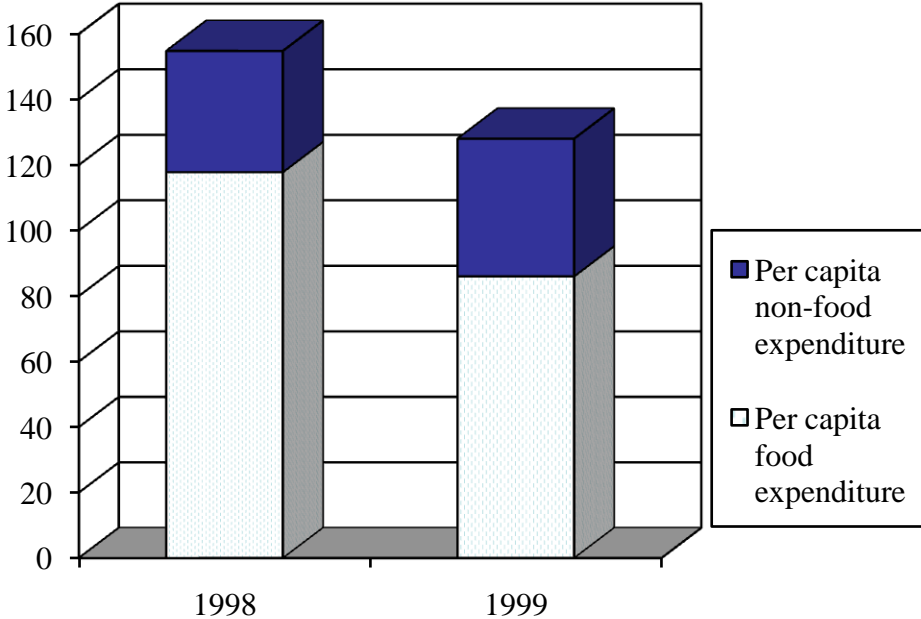


Figure 4.2. Mean per capita monthly expenditures in 1998 and 1999, with food and non-food values shown separately
Note: Numbers are in pesos

Modeling the effects of prices on child nutrient intake

a. Differences in estimates between the two years

The difference between the two years in the slope of intake was significant for the effect of log (price of chicken) on **protein intake** (estimate for 1998=-6.63 and for 1999=-11.38, $p=0.04$). This means that one percent increase in the log (price of chicken) would decrease daily protein intake by 6.63 grams per day in 1998 but by 11.38 grams in 1999. In other words, children's intake of protein became more sensitive to changes in the price of chicken in 1999 compared to 1998 (Table 4.3).

Table 4.3. Effects of prices on children's daily **protein intake**, differences of estimates between 1998 and 1999 (R-square for 1998=0.14, 1999=0.12)

Parameter	Estimates		Test of difference between the two years (Pr > t) ²⁵
	1998	1999	
Log(Price of bean)	-0.26	0.26	0.41
Log(Price of chicken)	-1.04	-2.78	0.04**
Log(Price of corn)	0.47	0.35	0.45
Log(Price of egg)	-0.22	-0.10	0.99
Log(Price of milk)	0.01	0.44	0.28
Log(Price of oil)	0.25	0.34	0.52
Log(Price of onion)	0.27	0.29	0.86
Log(Price of potato)	-0.01	-0.04	0.78
Log(Price of rice)	-0.56	-0.39	0.71
Log(Price of sugar)	-0.13	-0.45	0.75
Log(Price of tomato)	-0.57	-0.38	0.32
Log(Price of tortilla)	0.33	0.42	0.97
State 1	0.75	-0.58	
State 2	0.85	-0.39	
State 3	2.42	-0.70	

²⁵ Values in this column are significance levels for interaction terms in the model (Year*log (price of tortilla), etc). $P<0.05$ (noted with **) shows that the slope of regression has been significantly different between the two years.

Table 4.3. (Continued)

Parameter	Estimates		Test of difference between the two years (Pr > t)
	1998	1999	
State 4	0.90	-1.28	
State 5	1.38	-1.01	
State 6	1.82	2.60	
Electricity	0.15	0.68	
Piped water	0.18	0.44	
Floor material	0.15	0.13	
Job 1 (Ag. worker)	0.86	0.13	
Job 2 (Non-Ag. laborer)	2.03	0.55	
Job 3 (self- employed)	1.96	0.52	
Job 4 (business owner)	-0.27	2.46	
Job 5 (family worker)	0.81	-0.57	
Job 6(co-op member)	-0.99	5.71	
Job 7 (ejidario)	1.07	1.20	
Household size	0.12	0.12	
Marital status (HH head)	0.22	0.27	
Ethnicity (indigenous)	-0.05	-0.01	
PROGRESA participation	0.79	0.99	
Education years (mother)	0.03	0.009	
Education (HH head)	-0.26	0.21	
Child age (months)	0.05	0.06	

The difference between the two years in the slope of intake was significant for the effects of Log (Price of tomato) on **fat intake** (estimate for 1998=4.13 and for 1999=12.5, p=0.04). This means that one percent increase in the log (price of tomato) would increase daily fat intake by 4.13 grams per day in 1998 but by 12.5 grams in 1999. In other words, children's intake of fat became more sensitive to changes in the price of tomato in 1999 compared to 1998 (Table 4.4).

Table 4.4. Effects of prices on children's daily **fat intake**, differences of estimates between 1998 and 1999 (R-square for 1998=0.11, 1999=0.18)

Parameter	Estimates		Test of difference between the two years (Pr > t) ²⁶
	1998	1999	
Log(Price of bean)	0.29	0.56	0.98
Log(Price of chicken)	0.65	0.56	0.22
Log(Price of corn)	-0.22	-0.88	0.25
Log(Price of egg)	0.38	0.48	0.15
Log(Price of milk)	-0.35	-0.17	0.78
Log(Price of oil)	-1.15	-1.28	0.11
Log(Price of onion)	0.09	0.33	0.93
Log(Price of potato)	0.18	0.55	0.49
Log(Price of rice)	-0.09	-0.34	0.70
Log(Price of sugar)	0.16	0.27	0.97
Log(Price of tomato)	0.31	0.61	0.04**
Log(Price of tortilla)	-0.24	-0.04	0.96
State 1	-0.41	-2.03	
State 2	0.57	-0.17	
State 3	1.11	-0.40	
State 4	-0.09	-1.41	

²⁶ Values in this column are significance levels for interaction terms in the model (Year*log (price of tortilla), etc). P<0.05 (noted with **) shows that the slope of regression has been significantly different between the two years.

Table 4.4. (Continued)

Parameter	Estimates		Test of difference between the two years (Pr > t)
	1998	1999	
State 5	1.78	0.99	
State 6	3.00	3.09	
Electricity	0.08	0.39	
Piped water	0.19	-0.15	
Floor material	0.09	-0.42	
Job 1 (Ag. worker)	1.17	-0.02	
Job 2 (Non-Ag. laborer)	1.78	1.11	
Job 3 (self-employed)	1.27	-0.50	
Job 4 (business owner)	2.66	0.82	
Job 5 (family worker)	1.92	-1.94	
Job 6(co-op member)	2.06	4.57	
Job 7 (ejidario)	0.80	0.42	
Household size	0.05	0.25	
Marital status (HH head)	-0.19	0.22	
Ethnicity (indigenous)	-0.34	-0.51	
PROGRESA participation	0.14	0.62	
Education years (mother)	0.07	0.15	
Education (HH head)	-0.44	0.60	
Child age (months)	0.04	0.04	

The difference between the two years in the slope of intake was significant for the effects of Log (Price of chicken) on **iron intake** (estimate for 1998=-6.76 and for 1999=-9.54, p=0.03). This means that one per cent increase in the log (price of chicken) would decrease daily iron intake by 6.76 grams per day in 1998 but by 9.54

grams in 1999. In other words, children's intake of iron became more sensitive to changes in the price of chicken in 1999 compared to 1998 (Table 4.5).

Table 4.5. Effects of prices on children's daily **iron intake**, differences of estimates between 1998 and 1999 (R-square for 1998=0.14, 1999=0.13)

Parameter	Estimates		Test of difference between the two years (Pr > t) ²⁷
	1998	1999	
Log(Price of bean)	-0.16	-0.04	0.35
Log(Price of chicken)	-0.66	-1.68	0.03**
Log(Price of corn)	-0.07	-0.17	0.86
Log(Price of egg)	-0.33	-0.04	0.36
Log(Price of milk)	0.20	0.30	0.90
Log(Price of oil)	0.25	0.19	0.77
Log(Price of onion)	0.30	0.15	0.74
Log(Price of potato)	-0.20	-0.16	0.34
Log(Price of rice)	-0.05	-0.23	0.39
Log(Price of sugar)	-0.53	-0.30	0.38
Log(Price of tomato)	-0.27	-0.06	0.75
Log(Price of tortilla)	0.03	0.17	0.99
State 1	0.63	-0.17	
State 2	0.49	-0.31	
State 3	1.20	0.52	
State 4	0.36	-0.58	
State 5	0.34	-0.47	
State 6	0.42	0.48	
Electricity	-0.12	0.26	
Piped water	0.24	-0.15	
Floor material	0.23	-0.15	
Job 1 (Ag. worker)	0.56	-0.03	
Job 2 (Non-Ag. laborer)	1.17	0.06	

²⁷ Values in this column are significance levels for interaction terms in the model (Year*log (price of tortilla), etc). P<0.05 (noted with **) shows that the slope of regression has been significantly different between the two years.

Table 4.5. (Continued)

Parameter	Estimates		Test of difference between the two years (Pr > t)
	1998	1999	
Job 3 (self-employed)	0.93	0.35	
Job 4 (business owner)	-0.39	0.98	
Job 5 (family worker)	-0.08	-0.12	
Job 6 (co-op member)	-0.53	-0.23	
Job 7 (ejidario)	0.91	0.48	
Household size	0.08	0.11	
Marital status (HH head)	0.13	0.09	
Ethnicity (indigenous)	0.02	0.31	
PROGRESA participation	0.51	0.47	
Education years (mother)	0.22	0.15	
Education (HH head)	-0.20	-0.04	
Child age (months)	0.02	0.03	

Finally, the difference between the two years in the slope of intake was significant for the effects of Log (Price of chicken) on **calcium intake** (estimate for 1998= and for 1999=, $p=0.05$). This means that one percent increase in the log (price of chicken) would decrease daily iron intake by 6.76 grams per day in 1998 but by 9.54 grams in 1999. In other words, children's intake of iron became more sensitive to changes in the price of chicken in 1999 compared to 1998 (Table 4.6).

Table 4.6. Effects of prices on children's daily **calcium intake**, differences of estimates between 1998 and 1999 (R-square for 1998=0.16, 1999=0.12)

Parameter	Estimates		Test of difference between the two years (Pr > t) ²⁸
	1998	1999	
Log(Price of bean)	-1.33	-1.12	0.10
Log(Price of chicken)	-2.44	-4.78	0.05**
Log(Price of corn)	1.18	1.67	0.09
Log(Price of egg)	-0.02	-0.02	0.35
Log(Price of milk)	-0.08	-0.04	0.68
Log(Price of oil)	-0.04	-1.23	0.25
Log(Price of onion)	-1.03	-1.96	0.19
Log(Price of potato)	-0.18	-1.52	0.58
Log(Price of rice)	-1.10	-0.23	0.64
Log(Price of sugar)	-1.98	-2.31	0.89
Log(Price of tomato)	-1.02	-1.31	0.64
Log(Price of tortilla)	-0.43	-0.55	0.24
State 1	-0.37	-1.74	
State 2	-0.87	-0.88	
State 3	3.61	2.56	
State 4	0.01	0.02	
State 5	-2.42	-2.06	
State 6	3.87	3.46	
Electricity	1.69	1.49	
Piped water	0.59	1.29	
Floor material	0.49	0.85	
Job 1 (Ag. worker)	3.26	-0.75	
Job 2 (Non-Ag. laborer)	8.69	1.18	
Job 3 (self-employed)	7.59	1.83	
Job 4 (business owner)	-5.18	-0.74	

²⁸ Values in this column are significance levels for interaction terms in the model (Year*log (price of tortilla), etc). P<0.05 (noted with **) shows that the slope of regression has been significantly different between the two years.

Table 4.6. (Continued)

Parameter	Estimates		Test of difference between the two years (Pr > t)
	1998	1999	
Job 5 (family worker)	-0.78	-3.20	
Job 6(co-op member)	-3.06	2.61	
Job 7 (ejidario)	3.74	1.27	
Household size	0.55	0.22	
Marital status (HH head)	-0.03	1.13	
Ethnicity (indigenous)	-1.13	-0.65	
PROGRESA participation	2.79	2.26	
Education years (mother)	0.18	0.12	
Education (HH head)	-0.48	-1.02	
Child age (months)	0.15	0.16	

In all the other models, interaction terms for year* log of price for none of the foods were significant, meaning that the slope of the demand curve for that nutrient's intake in response to prices did not change significantly between the two years.

b. Matrix of slopes to assess the potential effects of price changes on nutrient intakes

A model similar to “section a” without the year interactions was used for assessing the effects of changes of prices on daily intake of nutrients that did not have different slopes. Table 4.7 shows the estimates (slopes of regressions) from running the model for each nutrient.

As mentioned in section a, slopes of regressions were only significantly different between the two years for the effects of log (price of chicken) on protein and iron intake, and log (price of tomato) on fat intake. Therefore, for these three, there are two separate values shown in the corresponding cell.

Table 4.7. Matrix of slopes for the effects of price changes on nutrient intake (square roots of intakes were used in the model to achieve normal distribution)

NUTRIENT	LOG PRICE OF BEANS	LOG PRICE OF CHICKEN	LOG PRICE OF CORN	LOG PRICE OF EGG	LOG PRICE OF MILK	LOG PRICE OF OIL
Energy	-1.53	-0.61	0.63	-0.99	0.64	0.99
Protein	-0.26	-1.04/-2.78	0.45	-0.18	0.22	0.28
Fat	0.36	0.58	-0.68	0.40	-0.30	-1.18
Sugar	-0.26	0.03	-0.19	0.08	0.18	-0.35
Iron	-0.14	-0.66/-1.68	-0.07	-0.30	0.22	0.19
Calcium	-1.13	-2.44/-4.78	1.57	-0.02	-0.04	-0.9
Zinc	-0.29	-0.05	0.07	-0.14	0.35	-0.10
Vitamin A	3.38	0.81	8.91	1.04	3.13	4.91
Vitamin D	-0.04	1.61	-0.09	0.21	0.28	-0.19
VitaminB12	0.04	0.22	0.01	0.07	0.06	-0.09
Vitamin C	-1.26	-1.24	0.43	0.15	0.88	-0.60

	LOG PRICE OF ONION	LOG PRICE OF POTATO	LOG PRICE OF RICE	LOG PRICE OF SUGAR	LOG PRICE OF TOMATO	LOG PRICE OF TORTILLA
Energy	1.21	0.29	0.67	0.94	-0.93	-1.68
Protein	0.29	-0.04	-0.44	-0.33	-0.52	0.32
Fat	0.19	0.34	-0.21	0.18	0.31/0.61	-0.20
Sugar	0.16	-0.44	0.32	-0.27	0.07	0.35
Iron	0.28	-0.18	-0.13	-0.48	-0.09	0.13
Calcium	-1.80	-0.98	-1.00	-2.08	-1.18	-0.48
Zinc	-0.24	-0.16	-0.03	-0.23	-0.07	0.23
Vitamin A	1.77	-4.57	5.93	-3.23	-2.26	3.16
Vitamin D	0.53	-1.82	-0.36	-0.57	-0.21	0.81
VitaminB12	0.06	-0.22	0.08	-0.14	-0.03	-0.04
Vitamin C	0.51	-0.15	-0.05	0.04	-0.54	0.39

For all others, we ran the models with the combined data from 1998 and 1999, and there is only one estimate reported. In this table, each estimate shows the effect of one percent increase in log of price of a food on the square root of the intake of a nutrient.

The effect of price of chicken on iron intake appears to be the highest among all the foods studied. Therefore, a percent increase in price of chicken will cause the highest decrease in iron intake. Also, a percent increase in price of corn will cause the highest increase in vitamin A intake of children. An increase in price of beans or onions will lead to decreased zinc intakes.

Discussion

The aim of this study was to assess the potential nutritional outcomes of the cessation of tortilla price protection –as an economic globalization policy- at the end of 1998 in Mexico. This was done by looking at the changes in prices and intakes of micro- and macro-nutrients by children in 1998 and 1999, and then testing the changes in the effects of prices on intake of each nutrient between the two years.

Price of tortilla did not change significantly between the two years, but prices of milk and rice were significantly higher and prices of bean, chicken, onion, tomato and potato were significantly lower in 1999 compared to 1998. The observed trends in prices in our sample are consistent with findings from the much larger IFPRI studies. Hoddinot (2004) has found that the majority of food prices have fallen in real terms regardless of community between November 1998 and November 1999, with no significant differences between PROGRESA treatments and controls.

The trends in income (as indicated by changes in the household expenditure) showed that incomes were significantly lower in 1999, and this was because household had a lot less to spend on food compared to the non-food items.

We also studied the changes in the dynamics between food prices and nutrient intake. Our results showed that children's intake of protein, iron, and calcium became more sensitive to changes in the prices of chicken in 1999 compared to 1998. The slopes for all three were negative, meaning that an increase in the price of chicken would lead to a greater decline in intake of any of the three nutrients. We also found that an increase in price of tomato would be leading to a larger shift toward fat intake in 1999 compared to 1998 (4.13 vs.12.5, $p=0.04$).

Since the price of chicken and tomato both decreased significantly between the two years, it appears that despite the decrease in household income, children's intake generally was not negatively affected by the policy change. The change in slope, however, shows that children's intake became more sensitive to prices of these foods, which can be of concern depending on the expected future price trends.

What "becoming more sensitive to prices" could mean for nutrition is that households will be more and more basing their food choices on the market prices rather than their actual preferences or nutritional needs. Therefore, a price shock will potentially have a larger effect under the new demand characteristics of children's intakes.

Ideally, from the nutritional perspective, one would expect to see an individual's intake to be driven by internal needs and personal preferences. In the face of economic shocks and market changes, one would hope that households can continue to have a relatively stable food consumption pattern by spending a higher portion of their income on food, or by shifting their choices in a way that ultimately does ensure adequate intake of nutrients. In reality, however, this rarely happens.

Even under normal conditions, individuals do not make food choices directly based on their nutrient needs. Aside from their overall energy consumption, fluctuations in micronutrient intake go unnoticed for the most part (Bouis, 1997).

Consequently, in times of economic if the overall income decreases and a household's food expenditure is already taking up the main portion of their income, it will be less likely for them to meet their nutritional needs.

Nutrient elasticities can provide valuable direction for policy recommendations in such cases. For example, Ali (1999) has noticed that in Taiwan, demand elasticity of calcium from leafy vegetables is even higher than milk. Therefore, he has suggested that policies that decrease the price of vegetables could mitigate calcium deficiency in Taiwan more effectively. In our study, we found that the effect of price of chicken on protein, iron, and calcium was largest, and became even more so after the government policy change (Table 4.7). Similarly, increases in price of tomato would lead to higher fat intake. Therefore, we conclude that price regulation policies for chicken and tomato as two main foods in children's diet could help protect their intake during the globalization process in Mexico.

Although the main policy change affected the price of tortilla at the national level; we did not observe any changes in sensitivity of intakes to price of tortilla. This observation could have several explanations.

First, it can be that as discussed earlier, families protect the overall consumption of their main staple food (tortilla) even in the face of economic shocks. At the nutrient level, since tortilla is only a major contributor to energy rather than micro-nutrients (e.g. iron), and energy consumption is generally better ensured, we did not observe any changes in the slopes.

A second explanation could be that tortilla, though a main component of the adult diets does not play an important role in children's diets. Our assessment of the most frequently consumed foods by children, however, indicated otherwise. Tortilla was the most commonly consumed food item by children both in 1998 and 1999 (Appendix 1). These assessments, however, led us to a third explanation.

Tortilla, though used generically, is in fact in 3 different types in Mexico, namely, black or blue corn tortilla, white corn tortilla, and yellow corn tortilla. In our sample, black or blue corn tortilla was the most commonly consumed food by children (31.7% in 1998 and 30.9% in 1999). White corn tortilla was not as frequently consumed (5.4% in 1998 and 4.8% in 1999). Yellow corn tortilla did not appear among the first 15 most frequently consumed foods by children (Appendix 1).

Unfortunately, data on the prices at the household level did not make this distinction, and each household reported a single price and consumption level for “tortilla”, in general. This may have been a reason why we were not able to observe any effects that changes in prices of subcategories of tortilla might have had on the slopes of children’s nutrient intake.

Further study of the details of NAFTA provides some evidence that there is reason to be concerned about this distinction. A recent USDA report has shown that the majority of US corn exports to Mexico has and still does consist of yellow corn, which is primarily used as an ingredient in animal feed. In the feed market, yellow corn from the United States is supplementing Mexican production, which is insufficient to meet growing domestic needs. In fact, broader access to US feed corn is fostering the development and growth and development of Mexico’s hog and poultry sectors, enabling them to compete better with US and Canada.

In contrast, white corn is cultivated mainly for direct human consumption. In the food market, however, although trade liberalization has exposed Mexican corn farmers for the first time to significant competition from US producers, the support of the Mexican government has played a crucial role in keeping white corn competitive, so much so that there has even been a gradual decrease in US imports of white (food) corn to Mexico (Zahnister et al., 2004). Therefore, the post-NAFTA trends in prices of white and yellow corn (and white and yellow corn tortilla), may have been quite

different, and had we been able to obtain different prices of different types of corn tortilla, we may have been able to better demonstrate the effects of cessation of price protection on nutrition. To our knowledge, there are no other studies that have made such a distinction either (Yunez-Naude, 2002).

Households in our study population were both producers and consumers of corn. With the above distinction between different types of corn crops, however, it appears that they were consumers of the type of corn that was not in fact affected that much by trade liberalization (prices did not likely decrease), whereas they were commercial producers of the type that was subject to a lot of competition. Furthermore, with another upcoming challenge in near future, full liberalization of US-Mexico corn trade in 2008, together with increasing concentration of millers and processors of corn in Mexico, the more commercially oriented rural corn producers in Mexico may be in danger of facing additional shocks.

Experience with economic shocks around the world has taught us a few lessons. Studies of famine situations in Africa have concluded that income diversification outside of cropping can enable households to better face economic shocks. For example, Pender (2000) argues that national policies in the Horn of Africa should favor “rural non-farm development”. Heyer and Campbell (1999) also propose that “non-farm activities... need to be encouraged” to avoid famines in South West Ethiopia. Likewise, a European Union policy document on food security in Ethiopia suggests that “the main strategy to be developed should focus on off-farm employment” (ADE, 1996).

The poorest households, however, face many barriers to realization of their preferred diversification choices, especially if they are already resource constrained (Block and Webb, 2001). In our study, more than 70% of heads of households were agricultural laborers with farm activities being their main source of income.

Furthermore, in 1998 households' own production of foods was almost entirely limited to corn and tortilla. Hence, at least in short-term, their ability for income diversification appears minimal, leaving them vulnerable to further price shocks without proper support mechanisms.

It is in such conditions that macro-economic food policies can play a major role in reducing malnutrition and improving the nutritional status of vulnerable populations in during economic transition. If based on country- and context-specific evidence, however, they can be a valuable instrument in protecting the poor against the short-term economic shocks and making globalization more beneficial to them in the longer run.

This paper, by taking advantage of the presence of data for 24-hour recalls as well as household surveys for the study population, has created a matrix of elasticities that can be a useful tool for food policy recommendations. Such matrices enable policy-makers in a country to focus on policies that better solve their “problem nutrients” (AVDRC, 2000).

In Mexico, results of a comprehensive national nutrition survey in 1999 have shown that the principal public nutrition problems are stunting in children < 5 years of age, iron and zinc deficiency, and low serum vitamin C concentrations at all ages, and vitamin A deficiency in children. In addition, overweight and obesity are serious public health problems in women and are already a concern in school-age children (Rivera and Sepulveda, 2003). All these deficiencies were generally more prevalent in the lower socioeconomic groups, in rural areas, in the south and in Indigenous population.

With these problems in the mind, there are several important policy recommendations one can make using our matrix. Based on our findings, lower chicken prices can ensure more suitable intakes of iron, calcium, and protein, and will

also have the added benefit of improving zinc and vitamin A intakes (Table 4.7). In addition, increases in price of tomato seem to shift children's diets toward higher fat intake, which is not desirable. It appears that at least in the early stages after the national policy change, keeping some level of price regulation for chicken and tomato as two main foods in children's diet could possibly protect their intake during the globalization process in Mexico. Such policies, however, are not very much favored in the long run as they will not allow the full benefits of a competitive free market to be transferred to the local markets. Alternatively, putting targeted social protection mechanisms in place (e.g. vouchers for high quality foods, conditional transfers, etc) can help buffer households' consumption of high-quality foods in the face of increasing prices and market volatility caused by globalization policies.

One of the advantages of this study is that it makes an effort to create a framework that permits us to link the macro-level effects of globalization policies on food prices to the micro-level nutritional outcomes (i.e. nutrient intake of children), which can serve as a guide for developing protective policies for the poor at the times of economic shocks. In addition to presenting a tool for context-specific policy recommendations, one of the strengths of this study is that it focuses on children's intake within the household. It has been shown elsewhere that the impact of economic factors and household resources may be masked if diverse age groups within the household are aggregated (Sahn, 1997).

Changes in nutrient availability in response to prices (nutrient elasticity) have been calculated using household consumption survey data by combining the information on household food consumption and nutrient contents of food items (Huang et al., 2000 and 1996). These surveys, however, contain information on the quantity and expenditure of food consumed at the household level, and may not be good indicator of an individual's intake of nutrient. This problem can be more

significant if for some reason one expects differential intra-household allocation of foods, for example in the case of young children where both quantity and quality of food given to children can be different from those of adults.

It has already been suggested that survey techniques developed by nutritionists (i.e. 24-hour recalls) give more reasonable values for nutrient elasticities than household surveys (Bouis, 1994). Their scope, however, has been limited to comparisons of elasticities for energy intake generated from the two methods. This study, to our knowledge, is the first study to use 24-hour nutrient intake of children in place of household survey data to create a comprehensive profile of nutritional impacts of price changes.

In addition, Mexico is of particular interest in assessing the impact of economic changes on nutrition and health due to NAFTA and the government's commitment to providing support to the poor. The study population from PROGRESA impact evaluation was among the poorest of the poor in Mexico and well below the poverty line. This makes our findings very relevant to future policies aiming to provide better coping mechanisms for the poor in Mexico.

The focus on short-run impacts of "globalization" in this paper also has several advantages. Using short-run changes seem to be more appropriate for studying the impacts of market price changes on the poor (MacMillan, 2005). The poor as Barrett and Dorosh (1996) say "are likely to be teetering on the brink of survival" and therefore are not probably the main beneficiaries of the supply-side effects of price changes due to globalization. As mentioned earlier, income diversification policies seem to be less realistic options for the poor in short term as well and other protective mechanisms need to be put in place.

To justify our conclusions, however, we must also address possible limitations, sources of bias or lack of congruency in the analysis. First, this analysis used two

surveys in 1998 and 1999; and there may be other changes in the economic environment beside the tortilla price policy change at the end of 1998 to have created the observed outcomes. Therefore, the statistical findings do not provide evidence of a cause and effect relationship between the policy change and household consumption.

The trends for inflation rate in the years preceding the study have been generally upward. While part of the inflation itself may have been caused by the cessation of tortilla price protection in 1998, there may have been other factors in play. There is evidence indicating that variability in market prices has been higher than that of import prices after NAFTA in a continuous manner. Although opening borders to imports since NAFTA has caused variation for the import prices to fall 10%, it has not been that effective in reducing price volatility for market prices as much (Avalos-Sartorio, 2006). Therefore, it is likely that what we have observed has been in fact part of a trend in consumers' response to higher price *volatility* in the post-NAFTA era.

Second, due to the household survey limitations, there were between 20-40% missing values for prices of household foods and imputation was used to account for the missing prices. Although the relatively high number of missing values does impose a constraint on the analysis, the theory-based approach (i.e., EM algorithm) used in this study has several advantages over the conventional regression imputation and has been shown to provide better estimates (Wothke et al. 1996).

It should be noted, though, that this algorithm is based on the crucial assumption that the prices are missing at random. This is a strong assumption, especially because missing prices in these surveys were in fact due to reporting of zero consumption of that specific food item by the household for the recall period. Therefore, the challenge would be to determine if zero purchases are due to infrequent purchases, or due to nonuse or some economic circumstances. Unfortunately, the

current design of household surveys does not usually allow us to make this distinction (Blisard, 2003).

Another caveat in interpreting the results of this study is the fact that we only had one observation of 24-hour intake per child for each year. Nutrient intake, however, is known to be quite variable, and more than one observation is needed to assess subject (inter-person) and residual (intra-person) contributions to variance (Hebert, 2000). This would have been, however, a larger issue if we were making judgments on the adequacy of the intakes for these children. In order to define the “problem nutrients”, we used the findings of a national probabilistic study of children’s intake to support our findings (Rivera and Sepulveda, 2003).

Finally, our nutrient intake model assessed the effects of changes of prices for the most commonly consumed foods by the households. Although most of these foods did in fact appear to be among the 10 commonly consumed foods by children as well (Appendix 1), analysis of children’s 24-hour diet revealed a few common food items which were not included in the household questionnaires. More specifically, pasta was one of the foods which appeared to be frequently consumed by children and for which, we did not have any price information since it had not been included in the household survey. Including all the commonly consumed foods by children as well as households in the model would have given us a better idea of the effects of market price policies on children’s intake specifically.

Policies designed to integrate the global food market – on agriculture, trade, FDI and promotional marketing – have been developed in the economic sphere, yet deeply influence food consumption patterns (Hawkes, 2006). Their approaches, however, have been subject to intense ideological debate. The financial crisis in many Asian economies in the late 1990s revealed some of the weaknesses of globalization strategies. Over the past decade, experts have pointed out that policies imposed by

international bodies do not always take into account the special circumstances of each country and at least in the short-term can have negative impacts on vulnerable populations (Stiglitz, 2002). Many have called for the globalization process to be reformed so that it can better help poor countries.

Globalization of the world economy has been rapidly shaping the nature of dietary change (Hawkes, 2006). Although consumer incomes, behaviors and desires are clearly important in their choice of foods; it is when these changes converge with the macro structural forces that dietary shifts take place. As such, with the increasing interconnectedness of markets and consumers worldwide, it becomes more evident that globalization policies are not just global economic policies, but global food and global health policies.

Economic shocks are not only important events from the economic and political points of view, but -maybe even more immediately-, from the perspective of their health and nutritional impacts, which can be at times irreversible (Leathers, 2004). With child survival being such a high priority on the agenda for achieving the Millennium Development Goals worldwide, the health and nutrition community has also got to learn lessons from economic events to predict, judge, and track their effects on the health and nutrition of populations, and play a much more active role in the global policy process in future (Bloem and Darnton-Hill, 2001).

CHAPTER FIVE

CONCLUSIONS

This research aimed to understand the linkages between the phenomenon of globalization and nutrition and to assess short-run nutritional outcomes of market shocks. First, it provided a critical review of the current state of thought on such linkages, laying out a comprehensive framework which can serve as a tool in overall “framing” of globalization from the nutrition perspective. Then, it focused on an empirical case study of the short-term effects of a pro-globalization policy in rural Mexico on household food consumption and child nutrient intake.

The review of literature led to a few conclusions:

- a. Despite the ever-increasing body of literature on globalization and its outcomes, there is still little consensus on the definition, measurement, and assessment of this phenomenon.
- b. From the nutrition and health point of view, a better understanding of linkages of globalization to individual outcomes is essential to our ability to engage in and influence the current discourse on globalization issues.
- c. A clear definition and a conceptual framework to portray the multiple domains in which globalization can affect individuals will serve as a “think model” and set the agenda for future research (Huynen, 2005).
- d. There are a few areas of knowledge gaps to which the nutrition community can have a significant contribution. One major area is identification of vulnerable populations to economic shocks and the factors that lead to such vulnerability. Such information will not only help devise better coping policies, but will have the additional benefit

of guiding the future research and policy by answering the questions of "what kinds of indicators and outcomes should we even be looking for while assessing the effects of globalization on individuals?". The other knowledge gap is in the area of country-specific research. Again, nutritionists have a great comparative advantage because of their experience in the field and nutrition information data can be used for more macro-level policy making as well.

Results of the study of the effects of tortilla price cessation on household food consumption and child intake revealed that after the policy change at the end of 1998, households' consumption of tortilla became more sensitive to changes in the prices of tortilla as well as a few other main staples including bean, milk, sugar, onions, and tomato.

Our results also showed that children's intake of protein, iron, and calcium became more sensitive to changes in the prices of chicken in 1999 compared to 1998. The slopes for all three were negative, meaning that an increase in the price of chicken would lead to a greater decline in intake of any of the three nutrients. We also found that an increase in price of tomato would be leading to a larger shift toward fat intake in 1999 compared to 1998.

Some conclusions from this research are:

- a. "Becoming more sensitive to prices" could mean that households will be more and more basing their food choices on the market prices rather than their actual preferences or nutritional needs and in the event of future price shocks, their consumption could be more negatively affected.

- b. Households' consumption of tortilla became more sensitive to tortilla prices after the policy change, but at the child level, intake of nutrients did not become more sensitive to tortilla prices. This may be because tortilla was a major contributor to macronutrients (especially energy) in children, and their intake of these nutrients was already relatively adequate both in 1998 and 1999. Apparently, as support by other nationally representative findings in Mexico, nutritional deficiencies are mostly at the micronutrient level in children.
- c. In children's diet, however, there was a distinction between consumption of locally produced corn tortilla (black or blue corn tortilla and white corn tortilla) and imported (yellow corn) tortilla. The former was the most frequently consumed food and the latter did not appear to be common. On the other hand, data on the trends in US-Mexico corn trade show that the main part of imported corn from US has been yellow corn and the Mexican government still holds an import quota for white corn. Therefore, there seems to be reason to believe that the trends in prices after the 1998 policy change may have been different for local versus imported corn varieties and had we had access to separate price information; the results may have shown different effects on household and child consumption.
- d. Interpretation of these findings and suggestion of policy options is clearly depending on what market changes are likely to be expected in future. Since these families are both consumers and producers of corn, downward market prices for corn are likely to negatively affect their overall consumption. On the other hand, with higher sensitivity of

- children's intake of some key nutrients to the price of chicken, rapid increases in the market prices could be harmful.
- e. With an upcoming challenge in near future, full liberalization of US-Mexico corn trade in 2008(no import quota for white corn, etc) , and increasing concentration of millers and processors of corn in Mexico, the more commercially oriented rural corn producers in Mexico are going to face further competition, and are in danger of facing additional shocks. In other words, the fact that white corn import is still being regulated appears to have protected local producers to some extent. The real shock may still be yet to happen when the government stops its regulations of corn trade altogether. Therefore, timely policy interventions are going to be needed more than ever.
 - f. Based on our findings, it appears that at least in the early stages after the national policy change, keeping some level of price regulation for chicken and tomato as two main foods in children's diet could possibly protect their intake during the globalization process in Mexico. Such policies, however, are not very much favored in the long run as they will not allow the full benefits of a competitive free market to be transferred to the local markets. Alternatively, putting targeted social protection mechanisms in place (e.g. vouchers for high quality foods, conditional transfers, etc) can help buffer households' consumption of high-quality foods in the face of increasing prices and market volatility caused by globalization policies.

These findings invite further investigation along several dimensions. A matter of great importance will be to assess to effects of food price policies on adult nutrient intake and intra-household allocation as well, and find out whether there are policies that can have multiple outcomes and be beneficial to a greater number of people.

It would also be important to know whether some households are less vulnerable to market price changes due to factors such as nutrition knowledge and education. These are questions that if answered can better differentiate the impacts of economic shocks by types of household in policy-relevant ways and better inform the design of interventions to help the poor resist the damaging nutritional impacts of economic crises.

Finally, due to different consumption patterns for locally produced versus imported varieties of corn, it is crucial to make such distinctions during research design and concurrently analysis and interpretation of findings. Generic categories like “corn” and “tortilla” clearly do not grasp the differences in people’s preferences; in addition, market policies could have differential nutritional outcomes based on the price and availability of the type of products they influence.

APPENDICES

Appendix 1. Most frequently consumed foods by children

These tables show the top ten most commonly consumed foods by children. Water, coffee and tea were excluded from the list although all three did appear among the top ten. It is worth noting that except for pasta, all other foods were among the 40 foods for which prices are reported at the household level and therefore were included in the final analysis.

Most frequently consumed foods by children in 1998

Food item	Percent consuming
Black or blue corn tortilla	31.7
Chicken (meat or broth)	19.8
Milk (powder or fresh)	19.2
Sugar (brown or refined)	12.7
Tomato	12.1
White onion	6.1
Beans	5.1
White corn tortilla	4.8
Egg	2.5
Pasta	2.2

Most frequently consumed foods by children in 1999

Food item	Percent consuming
Black or blue corn tortilla	30.9
Sunflower oil	16.7
Sugar (brown or refined)	16.2
Chicken (meat or broth)	16.2
Milk (powder or fresh)	11.3
Tomato	10.8
White onion	5.6
Beans	5.6
White corn tortilla	5.4
Egg	2.7
Pasta	2.5

Appendix 2.Characteristics of the study children at baseline

Age at baseline (months)	PROGRESA participants		
	Mean Weight for Age Z-score	Mean Height for Age Z-score	Mean Weight for Height Z-score
<6	0.66	-0.76	1.16
6-9	-0.30	-0.88	0.46
9-12	-1.6	-1.49	-0.69
12-24	-1.12	-1.63	-0.18
24-60	-1.46	-1.91	-0.30

Age at baseline (months)	Non-PROGRESA participants		
	Mean Weight for Age Z-score	Mean Height for Age Z-score	Mean Weight for Height Z-score
<6	0.23	-0.15	0.59
6-9	-0.47	-1.00	0.43
9-12	-0.98	-0.89	-0.34
12-24	-1.07	-1.39	-0.39
24-60	-1.29	-1.65	-0.33

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