More than Goods: trade in Welfare through Foods

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This document represents part of the author's study programme while at the Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

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List of Acronyms

CDC	Center for Disease Control
CONIN	*Corporación para la la Nutrición Infantil* (Corporation for Child Nutrition), Chile
DFD	Depth of the Food Deficit
FAO	Food and Agriculture Organization of the United Nations
FE	Fixed Effects
GDP	Gross Domestic Product
IMR	Infant Mortality Rate
INTA	*Instituto de Nutrición y Tecnología de los Alimentos* (Institute for Nutrition and Food Technology), Chile
LDC	Least Developed Countries
MDG	Millennium Development Goals
MFN	Most Favoured Nation
NCHS	U.S. National Center for Health Statistics
NTB	Not-tariff Barriers to Trade
R&D	Research and Development
SCS	Small Caribbean States
SD	Standard Deviation
SITC	Standard International Trade Classification
TOT	Terms of Trade
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UNCTAD	United Nations Conference on Trade and Development
WB	World Bank
WDI	World Development Indicators
WFP	World Food Programme
WHO	World Health Organization

WTO World Trade Organization

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I would like to thank my fellow Chileans and Latin Americans for- whether they know it or not- bestowing me with trust and inspiring me to do this work, for by now I know for a fact that we can achieve a better, more equitable and fair Latinoamerica unida where we can all show our true nature and transmit it to the world.

Abstract

This paper examines the impact of trade openness over child and general population food security in Latin American countries, except for Haiti, Cuba and the Small Caribbean States, between 1985 and 2016. In order to do so, we regress 5 trade indicators over 6 food security indicators using a FE panel data model and controlling for macroeconomic situation and the number of food security programmes implemented by each country in each year.

Our results suggest that there is a strong influence of trade over the reduction of undernutrition in its different forms, improving food security in Latin America. Imports have improved weight-for-height and height-for-age indicators due to improvements in food availability, both in nutritional variety and quality. This suggests a stabilization of seasonal fluctuations in food access and consequent prevalence of infectious diseases. On the other hand, exports seemed to have produced an income effect, which in turn has enabled the reduction of extreme forms of undernutrition and allowed for the purchase of more nutritious food.

Relevance to Development Studies

Undernutrition is a relevant factor curtailing development: on an individual level, undernutrition before the age of 24 months determines irreversible deficiencies in neurological, physical and immunological development; thus recurrent infectious diseases, lower educational achievements and diminished intellectual capacity and body strength, all resulting in lower income. At a macroeconomic level, hunger is costly, determined by higher expenditures related to health, education and reduced productivity. And at a global scale, hunger determines social unrest and migrations.

For all the reasons above described, it is relevant to understand the factors that might lead to significant changes in undernutrition in all its forms, and convert this information into policy inputs that subsequently determine the shape- hence impact- of food security social policies

Keywords

Undernourishment, undernutrition, anthropometric indicators, food deficit, Trade, Trade Balance, Latin America.

I: Introduction

"During the 50s (…) when I started working, in my hospital 15 children died a day. And the greatest tragedy was not that children were dying, but that those that survived did whit physical and mental deficiencies. Because of that, of every 100 kids that started primary school, only 20 finished it. Our investigations showed that the cause of this tremendous dropout was the incapacity to learn due to intellectual limitations, consequence of undernutrition"

(Dr. Fernando Mönckeberg in interview with Torres Cautivo. 2015)

Despite sustained efforts by international organizations, governments and private foundations, strong international campaigns such as the Zero Hunger challenge of the WFP, a great percentage of population still suffers from hunger (Panagariya 2002, Zezza et al. 2011). Currently almost 795 million people, mostly women and children in the developing world, feel their lives are defined by hunger (Nooghabi et al. 2017: 1). The future does not look much promising either, for world population is increasing at high rates: more than 50 per cent of such growth, over the next half century, will be due to an increasing population in Africa where in the next 10 years there will be more than 100 million more school aged children (Mountford and Rapoport 2016). In 2050 the world population is expected to require 70% more food calories than those needed in 2006, increasing demand per capita in 1.1% in total, and 0.6% in the developing world excluding China (Nooghabi et al. 2017).

Clearly, food, nutrition and the way people feed themselves is a matter around of which life revolves since the beginning of times. It has determined migrations and conflicts (Cambanis. 2015, Gibson et al. 2011, Nguyen and Winters 2011, Nooghabi et al. 2017, Zezza et al. 2011) all along history (Oliver-Smith 2009), thus it has probably shaped the way we live our lives nowadays. On an individual level, food can also determine a life path (Ayuso 2017, Azzarri and Zezza 2011, Mandalakas 2001) starting by being one of the global risk factors for death of children under 5 years of age (Hanf et al. 2013): it can doom a baby inside its mother womb if the latter does not have enough resources to feed herself appropriately, and then fulfil the breast milk needs of the new-born (Ayuso 2017, Mandalakas 2001); it condemns the child to recurrent infections due to a faulty immune system; it undermines body strength building and neurological development, which in turn determines that such baby that is not yet born will have a lower intellectual capacity than his or her peers (Azzarri and Zezza 2011, Karamba et al. 2011, Mandalakas 2001). The mechanisms through which nutrition hinders future development are

accumulative and progressive, meaning they tend to aggravate in adult life (Gaviria and Palau 2006).

Education can be affected by neurological development constraints if there is undernourishment before 24 months of age, and a more immediate response to food deficits by lack of concentration and limitations to the learning process. Thus, there is late inclusion in the educational system, higher absenteeism, lower results and higher school dropouts (Behrman et al. 2014, Gaviria and Palau 2006, Jara Navarro 2008).,

All of this determines lower future income. It is such a burden that there is a general acceptance of the fact that "[c]hildhood and maternal undernutrition is the single leading cause of the global burden of disease" (Pongou et al. 2006: 648). To make matters worse, a chronically undernourished woman will probably give birth to an undernourished child, thus perpetuating the cycle of undernutrition across generations (Mtumwa et al. 2016).

Hunger is costly and curtails development (Ayuso 2017, INEC 1999): at the macroeconomic level, expenditures related to undernourishment are associated to health, education and productivity (Pongou et al. 2006). Regarding individual health, undernourishment raises vulnerability in people and affects their life expectancies. Concretely: there are higher private costs due to treatment and medical attention; public expenses due to higher Health Care System necessities, for the immune system is impaired as a result of poor diets and individuals "are more susceptible to several infectious diseases, such as malaria, meningitis and pneumonia" (De Onis and Blössner 2003: 518, Pongou et al. 2006); and opportunity costs due to loss in human capital.

This Research Paper seeks to enrich this current discussion. To that end, the research question of this paper is **whether trade openness influences child food security- and if so, to what extent- in Latin American countries**[1] excluding the Small Caribbean States[2] but Jamaica, Cuba and Haiti selected by data availability and similar demographic and socioeconomic progressions in recent history. It is expected for trade to have a significant and beneficial effect

[1] Countries included in this research are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela R.B.

[2] Small Caribbean States include, according to the World Bank, Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname and Trinidad and Tobago.

over child food security through the channel of increased diversity of foods and their nutritional characteristics, which can tackle a wider range of nutritional deficiencies and, for those products that can be substitutes of themselves, accessed at a relative lower price.

The ulterior motivation for this research lies on the Chilean nutritional policy, led by Dr. Fernando Mönckeberg Barros, that resulted in the problem of undernourishment evolving in an extraordinary speed: in 1975 the prevalence of undernutrition for children un 6 years of age was 15.5%; in 1985, 10% of the population was stunted and there was 12% of low birth weight; and in 1987, 26% of mothers were undernourished. These figures drop to less than 1% in 1995, 2%, 5% and 15% in 1998, for each indicator respectively (Albala et al. 2001: 173, Torres Cautivo. 2015) and in 1998 undernutrition was officially eradicated in Chile. Due to these astonishing results, this programme has either been or attempted to be replicated in many other countries, with different outcomes.

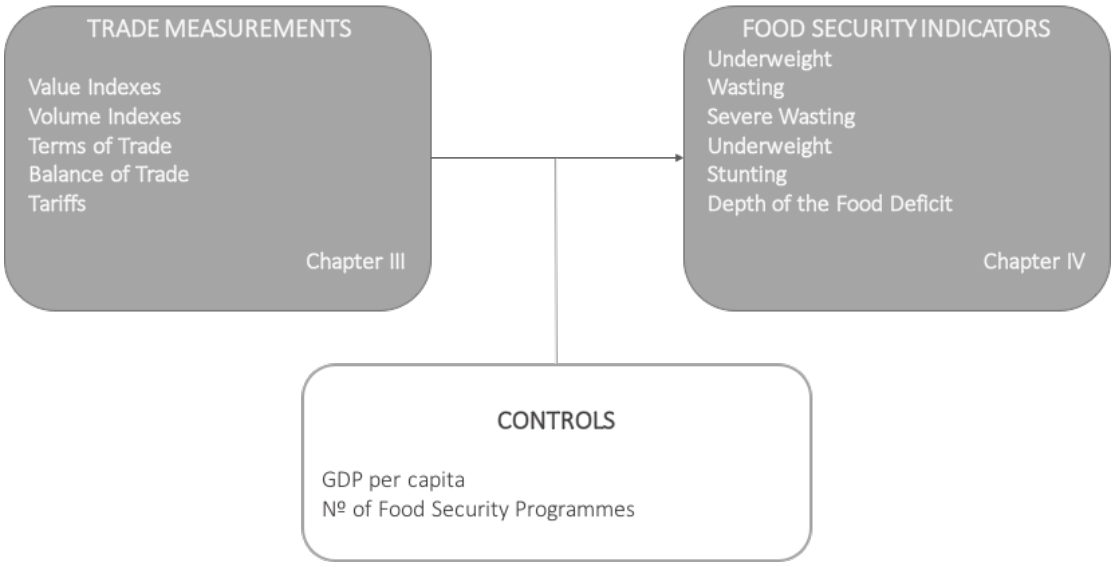
There are many factors that led to the successful Chilean results, namely: the development of a long term State policy with prioritized budget (Ayuso 2017) that provided nutritional supplementation to nearly 70% of the population (Albala et al. 2001: 173), marked significant progress in education and in sanitation, and relied on an extensive coverage of primary health care (Albala et al. 2001). In terms of the Chilean macroeconomic scenario at the time, it was heavily influenced by the "Chicago Boys" (Brender 2010, Clark 2017, Letelier 2016, Quartararo 2005, J. G. Valdés 1995) and public policies implemented from the 1960s onwards that strongly led towards trade openness. Liberalization, privatization, and deregulation reforms in Chile opened its economy to trade and investment more than any other country in Latin America (Fernandes and Paunov 2012: 307, Rodriguez and Rodrik 2000).

This trade liberalization was consistent with the global trend at the time: "[t]he past 50 years have seen an exceptional growth in world trade. Merchandise exports grew on average by 6% annually. Total trade in 2000 was 22-times the level of 1950. GATT and the WTO have helped to create a strong and prosperous trading system contributing to unprecedented growth" (WTO. n.d.). This has led to changes in relative prices of traded goods and income level, reduced food prices and an increase food security (Panagariya 2002), all of which are the subject of this research and shapes the research question.

In order to assess the research question, a FE panel data model will gather information from the included Latin American countries, between the years 1985 until 2016, and seek to determine the impact of trade, in different measurements, over changes in prevalences of different food security indicators and the depth of the food deficit, in a multidisciplinary attempt to quantify the magnitude and significance of the former over the latter. It must be noted at this

stage that this research presents limitations regarding data availability and the proposed model: for the former, national-level database was chosen in order to work with data that could be equally included in all countries, even if that implied discarding rich and complex national-level databases that are available only in few of the included countries; and a parsimonious model had to be considered, for the fact that we are including 6 food security indicators, 5 trade measurements and 2 controls called for the need to keep things simple.

Table 1 Diagram of multi-method approach with a first level of dependent food nutrition variable, explanatory trade measures and control variables



For the purpose of this paper, "[m]alnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients" (WHO. 2016) and covers two broad conditions: "undernutrition" (WHO. 2016) which includes Stunting, Wasting, and Underweight, which will be described in Section IV.c of this paper, and micronutrient deficiencies or insufficiencies; and overweight, obesity and diet-related non-communicable diseases. Hence, the term malnutrition will be used to address the general problem, and indices associated to it will be called upon when detailing the discussion. Also, the terminology established by the WHO (1986) will be used, namely: measurements considered are age, weight and height; indices are a combination of measurements, for the values of them alone tend to be meaningless; and indicator relates to the use or application of indices, and are constructed from them.

Indices have two functions: interpretation and grouping of measurements. It must be noted that index and indicators may sometimes be the same, as it is the case of infant mortality rate, which is the ratio of deaths to births- thus and index- but also an indicator of the state of public health. Furthermore, and index may be thought of as a biological concept, while an indicator is a social one and its value can be discussed on a case to case basis (WHO 1986).

This paper is divided in the following manner: Section II describes the current trade, health, food security and economic situation in the Latin American countries included in this research; Section III describes the general concept of trade, its relevance in this research paper, current world situation and the history that brought it to today´s status, manners in which it can be measured and assessed, and state policies regarding trade within the countries included in this study. Section IV describes the concept of food security, its determinants, measurements and state of affairs; Section V describes the methodology that will be used to conduct this research; Section VI explains the findings; Section VII provides a discussion; and Section VIII will conclude.

II. Latin American State of Affairs

This research is to be conducted in 19 Latin American countries, excluding the Small Caribbean States, Cuba and Haiti. The reasons behind this choice of countries are data availability and similar demographic and socioeconomic progressions in recent history. These are also the motivations to exclude those left out, namely: faulty and non-transparent official information, socio-political unrest or near-failed States. Additionally, these are the countries that have been influenced by the Chilean experience, thus implemented similar food security programmes, and aimed to tackle comparable hunger determinants.

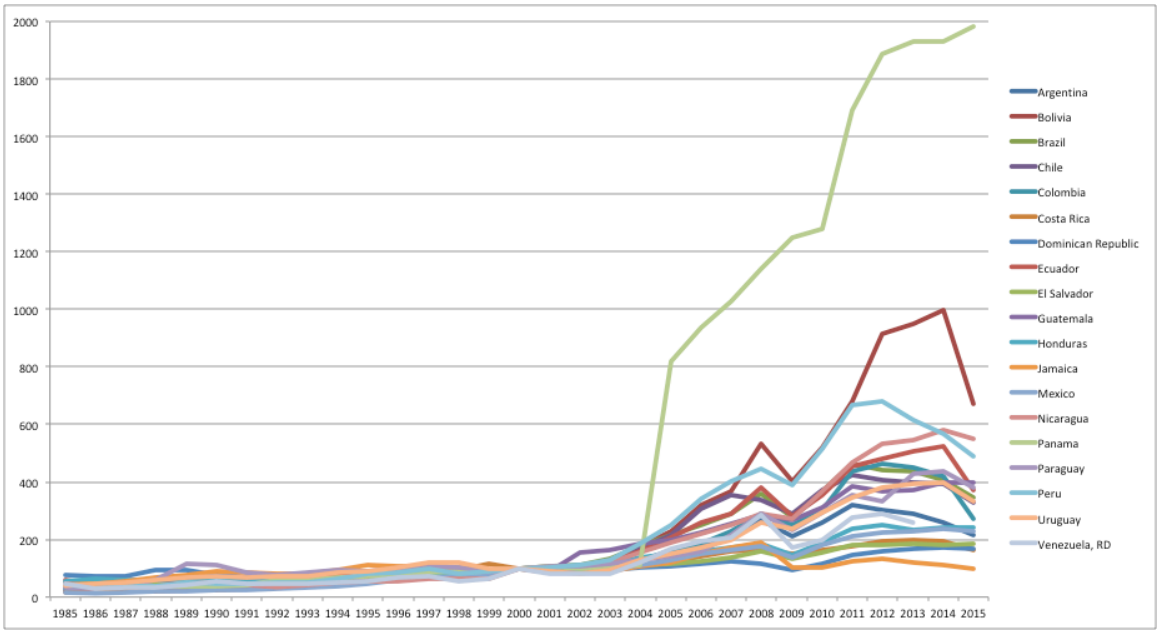
These motives establish a common baseline or starting point. The following section seeks to explain such common grounds on what are considered the determinants of undernutrition, as will be further explain in section IV of this paper.

II.a Trade State of Affairs in Latin America

According to Lima et al. (2008) the most open countries, according to goods exports, were Paraguay, Suriname, Guyana, Trinidad and Tobago, Panamá, Chile, Costa Rica and Belize. On the other, the most closed countries were Granada, Cuba, Jamaica, Antigua and Barbuda, Saint Vincent and the Grenadines and Haiti, which are not included in this research. Chile, Bolivia, Costa Rica, Honduras, Nicaragua, Panama and Paraguay show remarkable changes in the trade openness indicators in the 1990-2007 period.

The two graphs below show the progress of Export and Import Value Index (2000=100) for the countries included in this research. Value Indexes are current values converted to US dollars and expressed as a percentage of the average for the base period, which for this case is the year 2000. In both graphs, and in general terms, there is a stable but low growth rate until the 1990s decade, and then a boost in trade levels influenced by the entry into force of the Marrakech Agreement, and the subsequent decision of many governments in the region to switch to open economies, replacing the hitherto mainstream import substitution policies.

Figure 1: Export Value Index (2000=100) in USD for the Countries included in this research, from 1985 to 2015

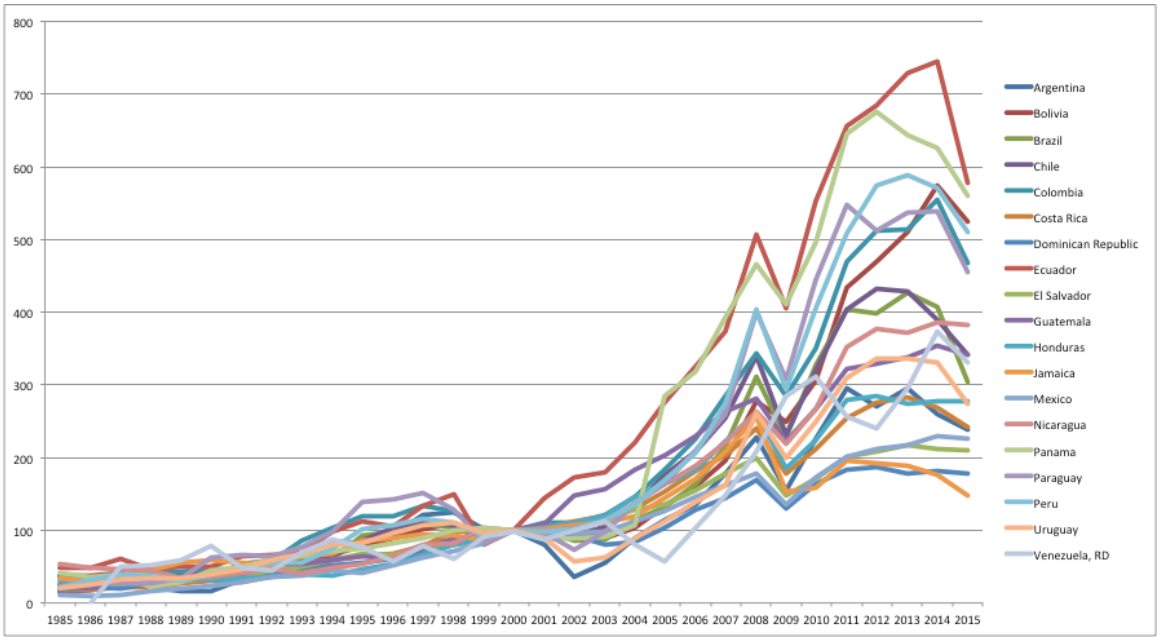


Source: author's elaboration with WDI data (last updated January 18, 2017)

Export Value Indexes as shown in the graph are in line with the previously described theoretical background. There is an increasing trend in exports for all countries starting in the year 2005, that is, the third cycle of the economy in the period under study. The outlier of this trend is Panama, which is the most open country in the Central American region with exports at 70% of GDP, with a significant part comprised of transportation services related to the Panama Canal (Medina Cas et al. 2012)of which the country took back control in 1999 and changed its toll system in 2002 (Montero Llácer 2005).

Figure 2 shows the trend in Import Value Index for the same countries in the same period of time.

Figure 2: Import Value Index (2000=100) in USD for the Countries included in this research, from 1985 to 2015



Source: author's elaboration with WDI data (last updated January 18, 2017)

Import values- hence consumption of imported goods- show a similar trend, being Ecuador and Panama the countries that show the highest level of growth of their import values; and Jamaica and the Dominican Republic the countries with the lowest rates of growth. The Panamanian trend follows the same theoretical framework above explained, given by the regain of Canal control and subsequent increase in trade. Ecuador embarked during the 1990s and 2000s in relevant trade openness policies, including tariff reforms, simplification of import procedures, and the establishment of export-promotion institutions. Nevertheless, the country still has sectors that are highly protected, such as agriculture (J. D. Lima et al. 2011).

II.b Nutritional & Public Health status in the Americas

"The Latin American region has experienced a major demographic, epidemiologic, and nutritional transition over the past 3 decades" (Albala et al. 2001: 170), there have been significant improvements regarding human development, socio economic situation, political stability, and in indicators such as literacy, infant mortality and life expectancy (Albala et al. 2001). Mortality trends have improved significantly in all countries within the Americas in the same time period; such figures have evolved along with the demographic and epidemiological variations in the region, hence there are more chronic diseases that respond to increase in urban population which entails a sedentary lifestyle, longer life expectancies, changes in food practices and foods included in daily diets.

The main cause of food insecurity in Central America is poverty, which is mainly a rural phenomenon in the Region. The Region has also been subject to many natural disasters that have aggravated the food insecurity situation and has had a decrease in welfare due to warfare. The problem is recognized at international level, and acknowledged as not only a consequence but also a cause for poverty, extreme poverty, and local and international migration; thus, many international organisms have sought to cooperate with local governments in the implementation of food security programmes. Such projects have drawn positive experience, knowledge *´spillovers´* and have set initial lines of demarcation for the path to be followed independently by each government.

Nevertheless, figures of child undernourishment are still alarming in the region, and there are some countries that have even shown setbacks in the original progress made. This is a multidimensional dilemma led mainly by high inequality, for the region produces the entire caloric intake it needs, but access to such food is unequal. It also reflects on the fact that the aforementioned programmes have not been efficient and in some cases one too many, with a high variability of results, that do not acknowledge local differences, and thus until the 2010 decade have had negative results in most cases[3].

According to CEPAL (as cited by Jara Navarro 2008: 9) hunger during the last decades up to 2004 generated a cost of almost USD 6,700 millions only in Central America and the Dominican Republic, equivalent to an overall average of 6% of GDP, and ranging from 1,7% to 11,4%. These costs derive from health treatments, educational inefficiencies and loss of productivity. Like this report there are many others that have calculated the cost of hunger and that make it clear that there is a benefit from reducing or eradicating child undernourishment, not only by means of reducing each country´s health spending but also how much it will be able to grow considering limitations from cutbacks in labour force.

In Bolivia it is not possible to identify a unique food security policy when looking from the year 1985 on, but rather a series of programmes and projects targeting production and commercialization of food products, and some academic nutritional and health studies have been in place, none of them following a common strategy. None of these have been focused in an improvement of nutritional and health status. It was only in 1993 that the Bolivian government

[3] Information of Central America based on the author´s Research in partial fulfilment of the requirements for obtaining the degree of Master of Public Policy "*La Erradicación de la Desnutrición Infantil: factores de éxito y fracaso en Latinoamérica*" of the year 2013.

initiated a new generation of public policies that had a mild but positive influence in nutritional wellbeing and health status (Sánchez et al. 2005).

Colombia is also part of the negative statistics regarding nourishment, being the prevalence of nutritional anaemia one of the most serious issues: 40,6% of Colombian households are classified as living under food insecurity; 12,6% of children between the ages of 5 and 9 years old are stunted and 1,1% of them are wasted, being stunting higher in boys and in the poorest decile of the population (Jara Navarro 2008). Nevertheless, there has been a clear progress in the reduction of chronic and global malnutrition in the last 40 years, and average height of Colombians has increased along the 20th century, amongst other reasons, because of nutritional improvement (Viloria de la Hoz, J. 2007).

Infant mortality rates remain relatively high for both Nicaragua and Ecuador (Albala et al. 2001). In Ecuador, the main problem blocking the achievement of food security is that 8,7% of Ecuadorian households fail to acquire a basic food basket, and almost 3 out of 10 families are unable to cover their food costs (Calero León 2011). This happens despite the fact that, throughout the 2000s, food supply was much higher than population volume, and there was an increase of GDP coming from the agricultural sector that was higher that the rise in population (Calero León 2011).

According to the 2002 report prepared for the follow-up World Food Summit Meeting, the Government of **Nicaragua** established that there were one too many efforts towards accomplishment of food security, without any quantitative or qualitative impact information available or performance analysis, in which the public and private sectors, along with civil society, have participated through different channels (MAGFOR 2002). Other factors were the incapacity of 15% of the population to access a basic food basket, and a misuse of food resources (INEC and MINSA 2002). This reflects on Nicaraguan food insecurity figures: these are higher than the average of Latin America and the Caribbean, ranking the country in the fourth place of Central America. Weight deficit affects almost one of every 10 children under five years of age, and one fifth of this population has low height-for-age measurements (Martínez and Fernández 2007).

Another World Food Summit report, this time by the Government of Venezuela (2002) describes what could be defined as a horizontal problem for many Latin American countries: that besides the deficit of energy and other nutrients, due to lack of national production and the consequent dependence of imports, one of the main conditioning factor is the limited economic access to food and nutrients of the general population. A similar problem occurs in El Salvador, where low economic growth has led to unemployment and thus increased food insecurity due to insufficient income. When combined to slow growth of the agricultural and livestock sectors,

high food prices and low international prices to Salvadorian export products, it has led to impairment of food security situation (de Brauw 2011, Oficina de Dirección Estratégica 2002).

Prevalence of Hunger measured by its indicators

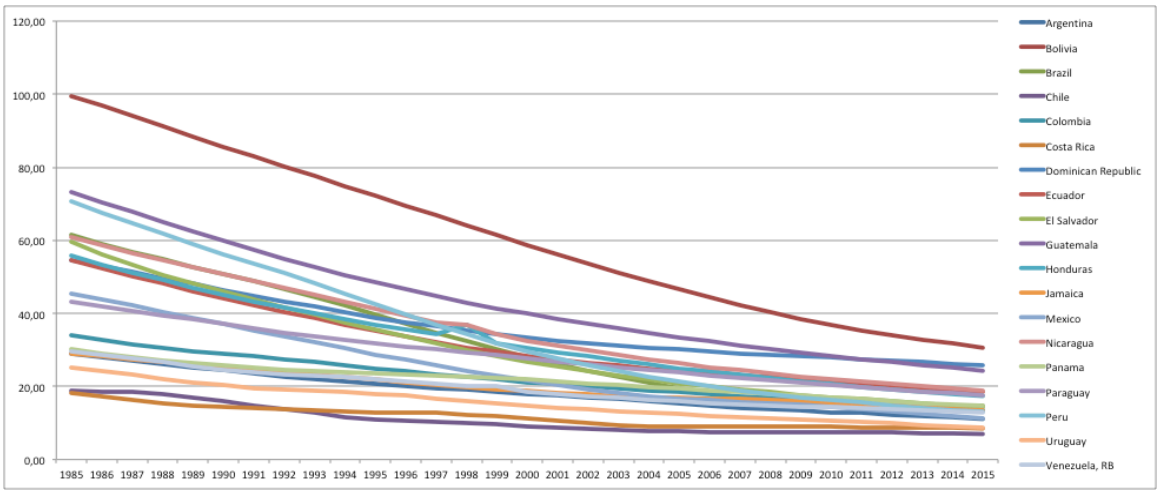
Appendix 2 of this paper presents tables with the evolution by country and by year of all the indicators that will be used further on in the regression analysis, constructed with data from the WDI (2017), namely prevalences of undernourishment, wasting, severe wasting, underweight and stunting and the Depth of the Food Deficit. In average, all indicators show improvements along the years and Latin American countries understudy: undernourishment is reduced almost in half, going from 20,62 to 11,1% of the general population; wasting and severe wasting are reduced in 1% and 0,5% of children under 5 years of age, respectively; underweight is reduced from 8,65 to 2,87% of children under 5 years of age; and stunting is reduced from 25,45 to 10,13% of children under 5[4].

Average infant mortality rate (IMR)

IMR is a general measure of population health, considered useful when comparing health status of given populations over time, and it is defined as "the number of deaths in children under 1 year of age per 1000 live births in the same year" (Reidpath and Allotey 2003: 344). It used to be considered as a highly sensitive measure of population health, but nowadays it has been deemed problematic for its "narrowly based and likely to focus the attention of health policy on a small port of the population to the exclusion of the rest" (Reidpath and Allotey 2003: 344). Nevertheless, it is simple, easy to construct, hence cost-efficient, for which data is available in resource poor countries and therefore it suits the purpose of this chapter, which is to provide a general idea of the health situation in Latin America. The following graph measures the evolution of average IMR per 1.000 live births in the countries and years understudy, constructed using the WDI data.

[4] For both stunting and underweight, data for the year 2016 is not included for there is only one observation, for the country of Guatemala, which is overall one that shows very high levels of malnutrition.

Figure 3 Infant Mortality Rate (number of deaths in children under 1 year of age per 1.000 live births) for the Latin American countries included in this research between the years 1985 and 2015



Source: author's elaboration with WDI data (last updated January 18, 2017)

There is a clear evolution of the average infant mortality rate in the countries under study, and it follows a trend that, regardless of minor changes, has been tracked by all countries. In such a manner, Bolivia started in 1985 with a figure of 99,5 deaths per 1.000 live births, and has reduced it to 30,6 in 2015. The lower end of the group is held by Chile and Costa Rica, with starting numbers of 18,9 and 18,2 respectively in 1985, and further reduced them to 7 and 8,5 in 2015, respectively. Again, the overall figures show a clear and positive evolution of an indicator that is considered key when assessing public health state of affairs.

Public Health Status: Vaccination Plans in Latin American Countries

The percentage of population that is vaccinated against certain diseases is a markup or measure of population health and public health services. Some vaccines that are universally recommended are: measles, mumps, diphtheria, poliomyelitis, pertussis, varicella and rubella for young children; hepatitis B for adolescents; and influenza for adults over 65 years old. Thus, there is a universal tendency to increase the rate of covered people, and in order to do so, the most common recommendation is to assess local context regarding local problems, preferences and priorities of the community, assess activities that are already being performed and determine the current level of vaccination coverage regarding disease rates (Briss et al. 2000, Task Force on Community Preventive Services 2000). Based on that, a decision should be made over risk level: "the lower the vaccination coverages and the higher the burden of vaccine-preventable diseases in a population or subgroup, the greater the need to improve coverage" (Task Force on Community Preventive Services 2000: 92).

Hence, vaccination plans status is information included in this research with the purpose of providing information to assess the state of public health along the years included in this study. It relates with nutrition effective vaccination plans- along with sanitation- help in the reduction of transmittable diseases that reduce nutrient absorption thus undernutrition in its different forms. For the case of Latin American countries, for years included in this study, the graphs in Box 1 show the percentage of children of ages 12 to 23 months covered by measles vaccination. The countries are divided in three groups for clarity purposes.

Countries of the southernmost part of the Continent show a clear evolution in their measles vaccination coverage. Chile started the period as the country with the highest vaccination coverage, having already in 1985 a 92% of covered target population. Meanwhile Bolivia at the same time had 21% of its target population covered and finished the period with a coverage of in the 90% level.

The second group of countries show again a clear positive evolution, and this group is also more homogeneous in the starting points: Paraguay started in 1985 with 48% coverage and Brazil with 67%. Finally, the countries in Central America and the Caribbean again display a heterogeneous distribution in the early years of this study. Guatemala started off with only 23% of the targeted population covered, and Costa Rica with 78%.

Box 1: Average measles immunization, % of children ages 12-23 months, for the Latin American countries included in this research

Figure 4: Argentina, Bolivia, Chile, Peru and Uruguay

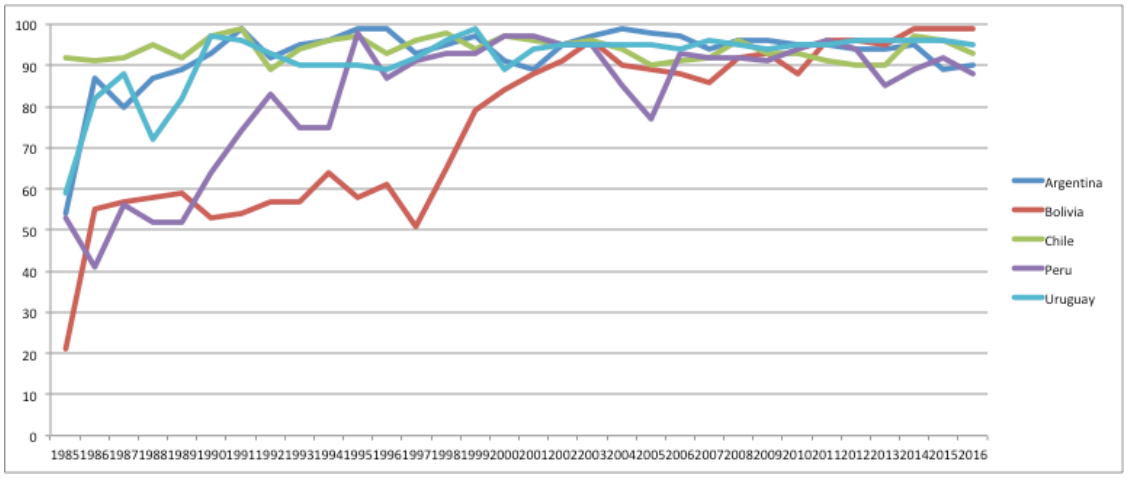


Figure 5: Brazil, Colombia, Ecuador, Paraguay and Venezuela RB

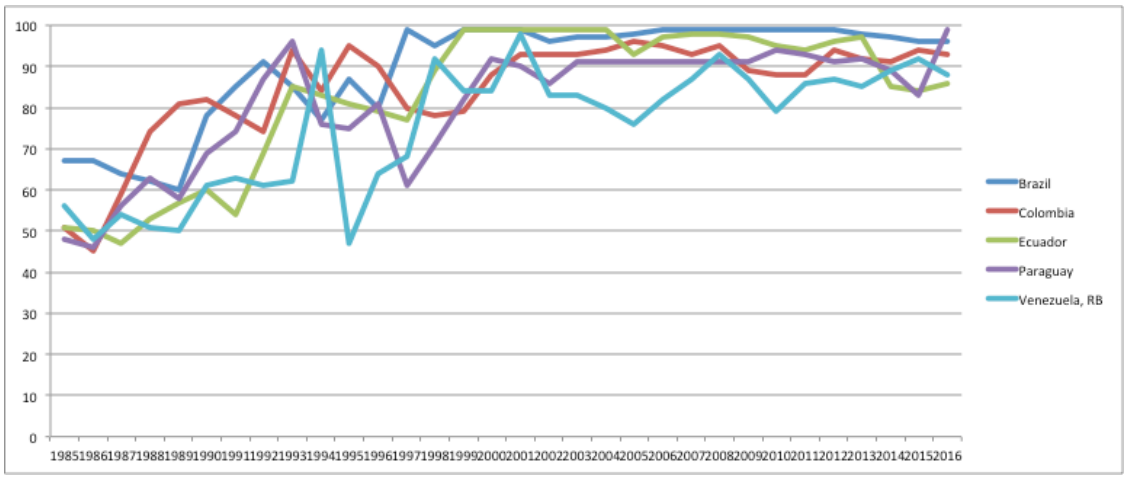
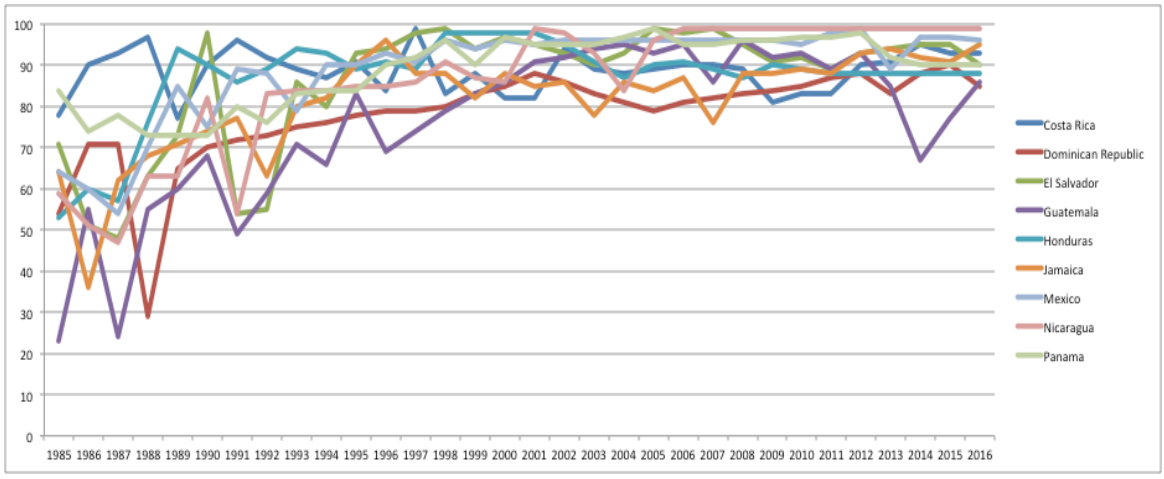


Figure 6: Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua and Panama



Source: author's elaboration with WDI data (last updated January 18, 2017)

What is relevant is that all three images show a clear positive evolution of the coverage of vaccinations in the Region, for all countries have coverages above 80% in the year 2016, being the average coverage for all countries under study 92%.

In 1980 measles caused approximately 2,6 million yearly deaths worldwide. In the Americas, between 1971 and 1979 it caused almost 101,800 deaths. Then the WHO and PAHO started a massive vaccination initiative in the region, that finished with the eradication of measles from the Americas in 2016, being it the first one in being declared free of measles. To achieve this goal, a three-step strategy was implemented: first, a unique national campaign was established in order to catch-up with children that did not have their vaccinations up to date; then routine vaccinations were strengthened; and every four years massive follow-up vaccination campaigns were carried out (WHO and PAHO. 2016).

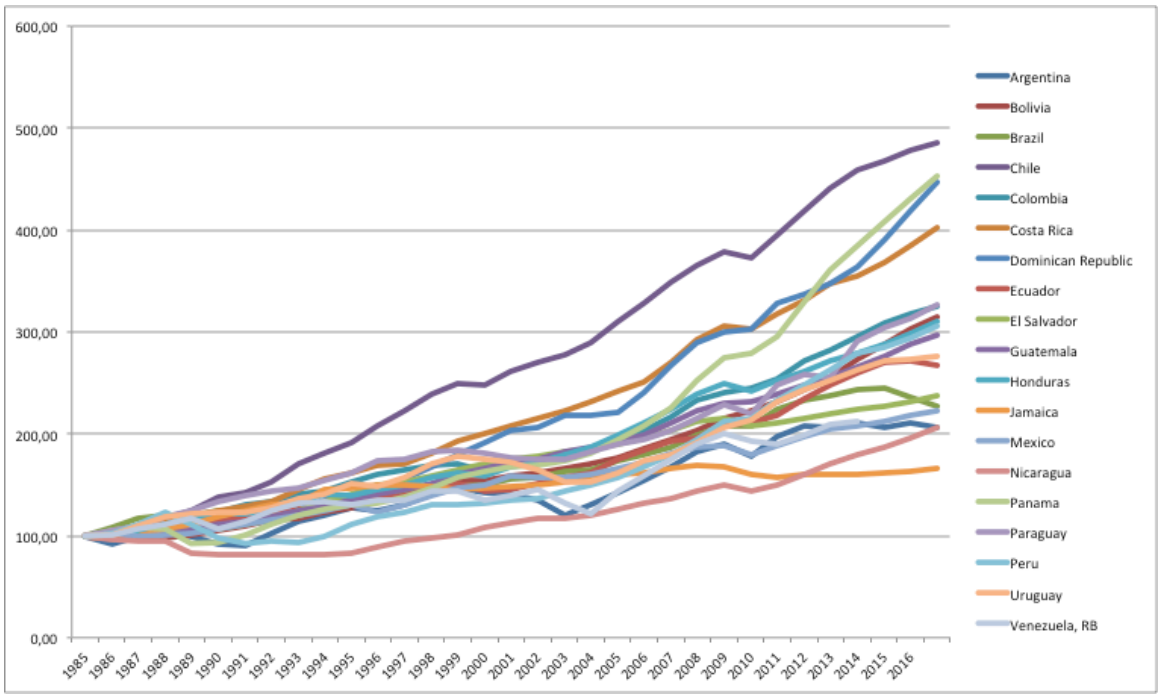
II.c Economic Progress in the Latin American Region

The time period in this study can be divided in three economic cycles: 1990 to 2001; 2002 to 2008; and 2009 to 2016 (CELAC. 2017)[5]. The dynamics of the current cycle responds to increase in private and public consumption, leaving the role of investments and exports in a secondary place. Its characteristics on the other hand follow changes in developed economies, which have had a reduction in Trend GDP growth rates and stagnation of gross investment due to the global financial crisis. Countries that are mainly producers of oil and minerals have been affected largely by the external situation, whilst the Central American countries have remained somewhat protected against them.

The graph below shows the level of GDP (1984=100) for each Latin American country included in this research, between the years 1985 and 2016, thus cumulative GDP growth rate.

[5] The period comprised of the years 2001-2008 relates to the commodity supercycle, which is the period of highest growth of the region since the 1970s. The period 1990-2001 is known as the "lost decade of Latin America and the Caribbean" (CELAC. 2017: 98). The current cycle (until 2016) entails the impact and consequences of the SubPrime financial crisis.

Figure 7: Annual growth rate of GDP (1984=100, real prices) for the Latin American countries included in this research



Source: author's elaboration with WDI data (last updated January 18, 2017)

While some have shown tremendous progress in the past three decades, significantly increasing the size of their economies; others remain stagnant, with positive and negative processes in the period that cancel out each other and keep them within a stationary process.

Chile´s economy has grown in 386% during the period under study. This country benefited greatly from the commodity super-cycle, due its copper exports; and in a way isolated form the SubPrime crisis effects due to its counter-cyclical fiscal rule implemented in the early 2000s, based on a cyclically adjusted balance (CAB) or Structural Balance. This is "an indicator that results from estimating the budget balance of the Government, for a given year, with a medium term copper price and economic activity following its trend, measured through GDP" (Author's 4231 Term 2 essay: 13 obtained from Ministerio de Hacienda de Chile. n.d.)

The benefits reaped by other countries that implemented counter-cyclical policies also appear reflected in the graph, particularly Costa Rica and Colombia, even though the latter did not have a programme per se, but rather tried to prioritize social and infrastructure spending. Mexico also benefited from an increase in remittances and a positive effect of its TOT.

The downside of this situation is given by Venezuela, Argentina and Jamaica, which are the countries that had the lowest growth trends along the period under study, ending the cycles

with 112, 107 and 65% respectively, having Venezuela available data only until 2014. Argentina has faced a series of macroeconomic adjustments since December 2015, led by newly inaugurated president Macri, which led to an increase in inflation, fiscal deficit and debt, reduction of public spending and the restatement of international credit market access. Nevertheless, the main reason for the country´s poor performance probably emerge from the military dictatorship that took power in 1976 and established an economic model of "financial valuation" (Santarcángelo 2007: 18) and was followed by a series of attempts by each governing coalition to offset economic reforms established by the previous ruler. Hence, there is no economic thread whatsoever, but rather a chain of failed and somewhat extreme setting of economic paradigms designed to fix whatever turmoil was already unleashed. With short terms, and a particular period of five presidents in eleven days in 2001, it self-evident that such is a combination destined to fail.

Venezuela saw a series of popular uprisings in 1989, which broke the lonstanding democratic stability the country held until that moment. Two failed coups and one impeached president later, former military coup leader Hugo Chávez came into power in 1998 (Heath 2009), triggering the economic crisis and social chaos that has aggravated until the current failed state situation.

Jamaica was hit by a crisis in the 1980s due to the collapse of bauxite-mining and alumina refining industries, followed by a subsequent increase in costs that led relevant industries to flee the country. Later, in the late 1990s a financial crisis was triggered by "a collapsing real-estate market and poor supervision of banks and insurance companies" (WSJ 1997: A19) that led to a series of governmental responses with different levels of success and criticism, but that were not able to prepare the country for other crises to come.

III. Trade

III.a Does Trade influence food availability and quality?

A historic overview of the relationship between trade and food: the "food globalization" (Anderson 2016)

Since the beginning of times, food has driven human migrations across different regions of the planet. The development and agricultural, and consequent modernization, led to an increase of world population of 120% between the XVI and XIX centuries (Anderson 2016: 6). Since then there was a permanent reduction of trade prices, given the technological advances of the time with this it was possible to increase food availability. Trade openness increased significantly in the past 50 years, even though there is still a far road to go before achieving it fully, particularly regarding food products. Nevertheless, still today only a dozen of basic foods account for 75% of calorie and protein consumption in the world[6] (Anderson 2016), which could only become so relevant given the advantages provided by trade in these staples and their inputs.

At present, trade is a driving force of globalization, and has ignited a series of negotiations seeking to harmonize it and ensure its fairness. 2015 was an active year for trade: negotiations culminated with the "Nairobi Package" (WTO 2016: 2) consisting on six ministerial decisions on agriculture, cotton and LDC issues; the historic decision of abolishing export subsidies for farm exports was taken; the trade Facilitation Agreement was made ready for ratification, and its objective was to "speed up global procedures for the movement of goods across borders" (WTO 2016: 2); 10 more members adhered to the TRIPS agreement regarding intellectual property; the dispute settlement system of the WTO experienced its busiest year so far (WTO 2016: 2); and Seychelles and Kazakhstan became the newest members of the WTO, reaching a total of 162.

Trade & Food Security: is there a relationship?

"Trade liberalization implies a change in the relative prices of traded and non-traded goods and factors in a previously protected sector or economy" (Panagariya 2002: 19) that induce

[6] These are wheat rice and maize for the grains; beef lamb, pork and poultry for the animal proteins; edible soy and palm oils; potatoes; milk and sugar.

changes in resource allocations and hence levels of production. On the other hand, changes in income levels are expected, and these have the potential both to reduce poverty levels and thus improve food security by increasing access of the poor to food. Individual countries rely on "food self-sufficiency" and "food self-reliance" to improve their food security status, i.e. a balance between domestic supply and policy orientations that come with it (Panagariya 2002).

During the last 40 years of the twentieth century, international food prices had a negative trend, mainly because "farm productivity growth outstripped global demand growth" (Anderson 2016: 1). Food supply was boosted by technological changes and thus it maintained its balance with demographic changes. Nevertheless, during the first decade of this century real food prices more than doubled (Anderson 2016), related to a demand that exceeds supply, given by three factors: maintained increase of food consumption of emerging economies, an accelerated process of conversion of food to fuels and speculative financial behaviours in the midst of global financial changes that led to the SubPrime crisis. Towards the end of 2008, food prices had again reduced its levels, but they did not reach the pre-2006 levels again (Anderson 2016, SANTIC Honduras 2009)

The objective of this research is to assess the impact of trade over the food security status of a given country through the channel of food access, variety and quality. As V. Smeets et al. presents it, "[u]nderstanding product quality is instrumental to understanding the welfare gains from trade. At the aggregate level, import competition or access to new inputs can increase consumer´s choice and lower price but also spur changes in the quality of goods that are offered to consumers" (2014: 2). We want to focus this quality-enhancing effect only on nutrition, isolating the impact of trade, measured in different applicable manners, over food security status due to the fact that it boosts diet diversity, food quality and safety (Anderson 2016, Panagariya 2002).

Nevertheless, "the gain from trade liberalization in the home country and its channels of transmission have not yet been adequately explained" (Hayakawa et al. 2017: 172) and can be heterogeneous in many dimensions (Hayakawa et al. 2017). But the world market has been assigned the potential of acting as a "source of food supplies, for it enables access to larger markets, opens up opportunities for specialization in production as well as the realization of dynamic efficiency" (Dithmer and Abdulai 2017:219) it may enable access to more goods, smooth out demand and supply thus increasing aggregate food availability (Anderson 2016) reducing price fluctuations (Panagariya 2002) and affect prices so that food and its production factors become accessible. Furthermore, there are even some donors that "dedicate more aid to

those countries that are more open and have better institutions in place" (Dithmer and Abdulai 2017: 219).

Different studies and sources have found a significant effect of trade liberalization over positive economic aspects, namely: increase competition and entrepreneurship (Anderson 2016); over productivity through training and increase in human capital (Anderson 2016, Liu et al. 2017); boost of quality upgrading, particularly for products closer to the technology frontier, when input tariffs are reduced (Hayakawa et al. 2017); that innovator plants (engaged in research and development) respond to import tariff reductions by "reducing product scope but increasing the average scale of production" (Choi and Hahn 2017: 210) hence trade boosts innovation (Anderson 2016); reduction in child labour (Edmonds and Pavcnik 2005) and that "tariff reduction has a positive impact on productivity, output, and probability of exit. Furthermore, the impact on output and the probability of exit depends on the level of productivity of each plant" (Anderson 2016, Hayakawa and Matsuura 2017: 247).

Hosoe (2016) examined the impact of productivity shocks over Japan´s national food security using Monte Carlo simulations of productivity shocks, on the basis that the latter is the main argument of those opposing free trade. He found that agricultural trade liberalization creates gains in expected welfare "as predicted by conventional trade theory" (2016: 35) and it would reduce welfare variations by integrating domestic and foreign markets, thus pooling risks coming from yield uncertainty in different markets. Finally, the author finds that the aforementioned liberalization would increase food security in Japan, through the stabilization of food supply.

Anderson (2016) summarizes various computable general equilibrium (CGE) models that suggest that the reforms surrounding the implementation of the WTO brought the world three-fifths of the way towards free trade, benefitted developing countries more than their high-income counterparts thus reducing international income inequality. These improvements could be further magnified by full liberalization in trade in agricultural goods, which would increase the share of farm products and stabilize prices of such products hence reducing urban-rural inequality.

The author later on (2016: 4) establishes that openness is an initiative that, through the increase of real incomes, enhances food security, for it "optimizes the use of resources devoted to producing the world´s food, maximizes real incomes globally, and minimizes fluctuations in international food prices and quantities traded" hence improving the three dimensions of food security. Furthermore, the author establishes that openness should be considered among the policies targeted at reducing poverty, hunger and malnutrition.

Pyakuryal et al. (2010) review the evidence of dynamics followed trade liberalization occurred during the 1980s and 1990s that resulted in the country having the lowest agricultural tariffs in South East Asia by the year 2002, along with market reforms and the role of the Nepal Food Corporation, and their impact over food security outcomes. They found that "at an aggregate level, the impact of liberalization on food security in Nepal is on balance favourable" (Pyakuryal et al. 2010: 21) being physical market access related to infrastructure development and spatial integration a hindering factor for a more even distribution of benefits, for it had reinforced the pre-existing economic hierarchy within regions of the country. From that point on, food security indicators such as per capita food availability and prevalence of undernourishment improved.

FAO has a set of food insecurity indicators that link the concepts of food availability and undernutrition, and "two key primary indicators are world food price stability and world food price levels. These affect both the ability to finance imports via export earnings and changes in the food import bill, themselves potential indicators of changes in food security situation" (FAO 2003: 7). At a household level, changes in trade openness at a State level could affect access of food, and nutritional quality of the food basket through the integration into the diet of different foods from various climates.

Overall, it can be said that trade would increase GDP bot at general and per capita levels. According to Anderson (2016: 26) during the 1950-1998 period countries that liberalized trade, that is raised the trade-to-GDP ratio by 5 percentage points as average, have 1,5 percentage points more of GDP growth compared to their own performance previous to the openness reforms. The author further establishes that there are no real examples of autarkic countries that have benefited from a sustained economic growth, thus concluding that there is an economic boost resulting from openness to trade.

III.c Trade measurements: tariffs, values or volumes?

Regardless of the different views on whether trade has an effect on growth, development, human capital, and nutrition; there is one matter for which apparently consensus has been reached, namely that there is a relevant difficulty when assessing trade policy or openness impact over a particular outcome (Chakraborty 2015, Dithmer and Abdulai 2017, Kis-Katos and Sparrow 2015, Pritchett 1996, Rodriguez and Rodrik 2000, Winters 2004). Trade is usually established along with other public policies, thus its isolation from them is complicated. Openness to trade and its liberalisation are concepts that are regarded different by some authors: the former is a matter of levels or a state variable mostly associated with a liberal trade regime;

and the latter is a change in its practice (Winters 2004). Additionally, methods, instruments and indicators used until today have been questioned for their efficacy and accuracy is not clear. And finally there is the issue of causality and consequent endogeneity in the measures of trade, and whether some changes in a country´s status can really be linked to a particular cause or policy.

Since trade effects respond to a combination of policies, it cannot be properly assessed with linear regression models. According to Baldwin (as cited by Winters 2004) trade is never been implemented as an isolated policy, therefore to wonder how it acts as such is pointless, and "the only useful question is how it fares as part of a package" (Winters 2004: F9). Nevertheless there is an existing need to assess its effect as an isolated policy, to the extent possible, and so this research presents the alternative of using FE, as it will be further explained in Section V.b.

In the interest of doing so, many indicators can be presented as alternatives, and tariffs may come as a simple and logical tool. But tariffs and their aggregated values are too complex, and need to comply with many assumptions if they ought to be measured: the ability to identify imports and exports of goods and services; and the correct calculation of elasticities. Average tariff rate, as opposed to the weighted value, "underweight high tariff rates because the corresponding import levels tend to be low" (Rodriguez and Rodrik 2000: 262). Another option is to measure NTBs, but each of them will have different effects on its own depending on the country´s economic profile and the trade goods basket, thus a single NTB can be of little importance in one market, but extremely relevant for another trading partner. This research will present other alternatives for the measurement of trade, as will be described in the following paragraphs.

Tariffs

Tariffs are a direct measure of trade policy (Winters 2004) and as such they can change according to the pressures different governments face and how they solve them. For example, facing pressures of decreased growth, authorities will face increased pressure for protection, and therefore they could raise the value of averages, whatever the measured form. Simple tariff averages have to be assessed together with the level or volume of corresponding imports, hence they can underweight high tariff rates; they are also poor proxies for trade restrictions if substitute with NTBs; and their use depends on their measurement technique, and "are clearly measured with some error" (Rodriguez and Rodrik 2000: 262).

At the time of the first assessment of post-Uruguay round, done in the year 2000 by the WTO and the UNCTAD Secretariat (Supper 2000) there was still a problem with transparency in Tariffs, which resulted in a forced change of methodology to the use of ad valorem estimations

and thus a lack of precision and harmonization in the conclusions to be drawn from studies that used this sort of information.

Trade Value and Volume Indexes

Goods are valued in customs using product lists and individual characteristics and volumes are derived as a ratio of the export value to the corresponding unit value indexes (World Bank Group. 2017). These indexes can be used in the long term to assess the evolution of development and trade strategies and commercial dynamics in a given country. For this, they have to be studied altogether with other indicators that disaggregate data regarding products and their destination. This revealed manner of measuring openness is usually employed in impact studies of trade liberalization, and is considered better than tariffs by some authors for the latter are not easily summarized in a single indicator (Dithmer and Abdulai 2017).

Balance of Trade (BOT)

The BOT provides the difference between the exports and imports of a given country in a specific period of time and it is the expression of the net trade flows in a country. There will be a surplus when exports overrun imports, and a deficit when exports are not enough to cover all imported goods, in which case it is considered that residents of a country are borrowing other economies production. In practical terms, a negative net balance means that imports retracted national rent, which was captured by citizens of another country (D. Lima et al. 2008). The BOT indicator is relevant for it can be calculated for different trading partners, regions, products and product groups, or in total terms; thus enabling establishment of trade dynamics under different situations.

Terms of Trade (TOT)

TOT are the "prices that countries must pay in order to exchange goods with each other" (Bowles et al. 1993: 111) or in simpler terms "the relative price of imports to exports" being the trade balance "the ratio of net exports to output" (Backus et al. 1992: 3). If TOT change in such a manner that the real price of imported goods increases, the surplus available for consumption is reduced and therefore it could be expected that there is less income that can be spent in food.

This section has demonstrated that there is sufficient evidence supporting research regarding the influence of trade over social security outcomes such as food security. We have presented in detail the evolution of trade, and how trade openness in different countries and regions has led to improvements in economic indicators, productivity, and other social

determinants. But trade is a subject of difficult measurement and the manner in which it can be quantified so as to avoid errors in measurement and endogeneity are a research field on its own. In the following section the hunger issues will be addressed in detail, so as to subsequently present how the two concepts will relate in this research in order to assess their relation and causality.

IV. Hunger: literature review on current global state of affairs; determinants; and measurements.

Food (in)security refers to whether people have access to sufficient food, in a dignified manner. Food is considered secured when all people at all times have physical, economic and social access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active, productive and healthy life (Anderson 2016, Nooghabi et al. 2017: 3). Thus food security has three dimensions: availability; access via resources; and adequacy of use (Anderson 2016, Panagariya 2002). On the contrary, malnutrition is defined as a nutritional deficit that is associated with an increase in patient morbimortality and that produces undesired changes in different body compartments (Gallardo et al. 2010).

Different strategies have been proposed for tackling each of the dimensions of food insecurity. It is clear by know that availability of arable land is a massive limitation towards increasing food production, but indiscriminate transformation of land into cultivable land poses an environmental threat. Increase in food yield is also inefficient, hence international research seeks to increase what is called "crop intensification" (Abraham 2014: 3) that aims to achieve "higher output with less use of or less expenditure on land, labor, capital and water- all by making modifications in crop management practices" (Abraham 2014: 3). Other countries have established principles of self-reliance tending to self-sufficiency, meaning that there should be enough food to meet domestic needs, and enabling a reduction in the country's dependence on primary commodity imports (Sichona 2001). The necessary increase in food production can be achieved by the inclusion of technology such as fertilizers, ploughs, irrigation, crop varieties, and more (Sichona 2001).

Proper breastfeeding programmes, promoting its exclusiveness and timely and adequate introduction of complementary foods, is "one of the most important solutions to directly address causes of childhood undernutrition" (Shankar et al. 2017: 55). Other health programmes have included nutritional factors such as maternal nutrition, micronutrient fortification strategies (Shankar et al. 2017), parasite control (King and Dangerfield-Cha 2008), and reduction of food taboos (Bentley et al. 1999).

IV.b Determinants of Hunger

There are many determinants that shape the existence of undernutrition within a determined population: "education, income, and nutritional situation of the parents, access to clean water and sanitation, and primary health care and immunization facilities" (Kandala et al.

2001: 2), environmental, political and cultural (Sichona 2001). There is also a life-cycle of undernutrition: some children are born undernourished, for others their situations worsens after the ages of 4 to 6 months when they are weaned and introduced to solid foods, and then stunting develops and can reach its peak at the age of 2 or three years, at which time "the body has, through reduced growth, adjusted to reduced nutritional intake and now needs fewer nutrients to maintain this smaller stature" (Kandala et al. 2001: 2).

IV.c Measurements of food insecurity

Anthropometric Indicators

Data on low birth weight, stunting, thinness, and overweight are obtained from measurements of height and weight. Anthropometric measurements assess body size and composition, and reflect inadequate food intake or disease, and are the single most universally applicable, inexpensive and non-invasive method available to assess the size, proportions and composition of the human body (WHO 1995). Each measurement for each individual is compared to an international reference population defined by the NCHS and accepted by the CDC. The use of such a reference population is based upon the fact that all minor children properly nurtured in all population groups with available data follow growth patterns that are very similar among each other. In this context, a reference population is a relevant comparison for anthropometric conditions, enabling assessment of changes in nutritional status over time. Thus, any population that is crowded enough has variations in weight and height that follow a normal distribution (INEC 2002, WHO 1986).

The indicators apply indices related to body size or composition; therefore they are not nutrition or health indicators, but rather an outcome indicator of food utilization. This has to be clear when analysing information resulting from their application in order to properly infer underlying conditions that lead to their presentation. The inappropriate interpretation of an indicator can lead to flawed targeting of intervention programmes.

Child nutrition can be measured with the indicators established by WHO (1986, 1995), that are the internationally accepted to classify a child as undernourished (Subramanyam MA et al. 2011) and are used to provide an estimate of the prevalence and severity of malnutrition leading to the development of health and development policies (WHO 1986). These include weight-for age, weight-for-height and height-for-age Z scores (Balk et al. 2005, Gaviria and Palau 2006, Subramanyam MA et al. 2011). Deficits in one or more of the anthropometric indices are often regarded as evidence of 'malnutrition', but they are not always the result of poor nutrient or

energy intake, it can be the result of primary lack of food, an increased rate of nutrient utilization, or impaired absorption or assimilation of nutrients. Thus, this figures must be interpreted along with health, socioeconomic, and many other factors that may affect them.

The indicators vary for gender and age measured in months. A child that has more than two SDs below the median weight-for-age is underweight, height-for-age is stunted and weight-for-height is wasted. "Severe anthropometric failure" (Subramanyam MA et al. 2011: 4) uses the same rule but considering three SDs below the median for age and gender.

Table 2 Comparison of the characteristics of three anthropometric data-reporting systems

COMPARISON OF THE CHARACTERISTICS OF THREE ANTRHOPOMETRIC DATA-REPORTING SYSTEMS			
CHARACTERISTIC	Z-SCORE	PERCENTILE	PERCENT OF MEDIAN
Adherence to reference distribution	Yes	Yes	No
Linear scale Permitting summary statistics	Yes	No	Yes
Uniform criteria across indices	Yes	Yes	No
Useful for detecting changes at extremes of the distributions	Yes	No	Yes

Source: (WHO 1995)

The information presented in Table 1 establishes the reasons why the Z-score is the best system for analysis and presentation of anthropometric data for population-based assessments. This score is basically a standard deviation score, the deviation of the value for an individual from the median[7] value of the reference population, divided by the standard deviation for the reference population. Hence, a fixed Z-score interval implies a fixed height or weight difference for children of a given age. "Children that are more than two standard deviations below the reference median on any of the indices are considered to be undernourished, and children who fall more than three standard deviations below the reference median are considered to be severely undernourished" (Kumar 2007:1338, for similar views see Agostoni et al. 1998, Foo and Mafauzy 1999, INEC 1999, Kandala et al. 2001, WHO 1986, WHO 2018). It is relevant to mention that z-scores are lineal thus a fixed interval of the score has a fixed height difference in

[7] Z-scores calculated from the median, as opposed to the mean, might be more robust that the standard z scores because they are less influenced by outliers.

centimetres, or weight in kilos, for all children of the same age and this makes results comparable across ages groups and indicators (WHO 2018).

WHO (1995) summarizes the height and weight based anthropometric indicators as follows:

Table 3 Common terms for height- and weight- based anthropometric indicators

COMMON TERMS FOR HEIGHT- AND WEIGHT- BASED ANTRHOPOMETRIC INDICATORS			
ANTHROPOMETRIC INDICATOR	TERMS DESCRIBING OUTCOMES	TERMS DESCRIBING PROCESS	EXPLANATION
Low height-for-age	Shortness	-	Descriptive
	Stunted	Stunting (gaining insufficient height relative to age)	Implies long-term malnutrition and poor health
Low weight for height	Thinness	-	Descriptive
	Wasted	Wasting (gaining insufficient weight relative to height, or losing weight)	Implies recent or continuing current severe weight loss
High weight-for-height or high body mass index	Heaviness	-	Descriptive
	Overweight	Gaining excess weight relative to height, or gaining insufficient height relative to weight	Implies obesity
Low weight-for-age	Lightness	-	Descriptive
	Underweight	Gaining insufficient weight relative to age, or losing weight	Implies stunting and/or wasting
High weight-for-age	Heaviness	-	Descriptive
	Overweight	Gaining excess weight relative to age	Implies overweight as a result of obesity

Source (WHO 1995)

Of these indicators, Weight-for-height reflects body weight relative to height[8]. It carries the advantage of not requiring any knowledge regarding age, but it does not substitute for height-for-age or weight-for-age and so these should be used when possible.

Low weight-for-height is indicative of thinness and **wasting**, the former not necessarily implying a pathological condition. The term "'wasting' generally describes a recent and severe process that has led to significant weight loss, usually as a consequence of acute starvation and/or severe disease" (WHO 1995: 165, see for a similar view Walker et al. 1996) and it indicates a "deficit in tissue and fat mass compared with the amount expected in a child of the same height" (WHO 1986: 931). This term is also appropriate for children that are under this condition due to chronic dietary deficit or disease.

Weight-for-age is of complex interpretation, is influenced by the height and weight of a child, and, along with height-for-age they "both reflect the long-term health and nutritional experience of the individual or population. Short-term change, especially reduction in weight-for-

[8] Indicators related to heaviness will not be considered in this theoretical framework for they will not be included at all in this research.

age, reveals changes in weight-for-height" (WHO1995: 170). 'Lightness' has been proposed as a descriptive term for low measurements of this index, and '**underweight'** is the pathological process underpinning it, which combines information about linear growth retardation and weight for height (Martorell and Young 2012). Considering that weight is easier obtained that height, it makes sense to use weight-related indices and indicators in this research.

Stunting refers to low height-for-age, "signifies slowing in skeletal growth" (WHO 1986: 931) and represents "the accumulated consequences of retarded growth" that "may not be evident for some years" (WHO 1986, see for a similar view Walker et al. 1996). It is usually related to mild to moderate, chronic or repeated infections, inadequate nutrient intake or poor general economic conditions (ibid).

Wasting and stunting are frequently combined although not necessarily correlated (Walker et al. 1996, WHO 1986), but they show different patterns at different ages and populations. The former is more prevalent between the ages of 12 to 24 months, and the latter from 24 to 26 months of age, and then shows a tendency to level off (Costello AM 1989, WHO 1986), and frequency and duration of wasting can influence the appearance and duration of stunting (Costello AM 1989). Furthermore, since wasting can be established and restored rapidly, its prevalence can be a reasonable indicator of the incidence of its cause. But this is not the case for stunting for it responds to a longstanding process of retardation and therefore does not indicate a currently ongoing causal process.

Undernourishment

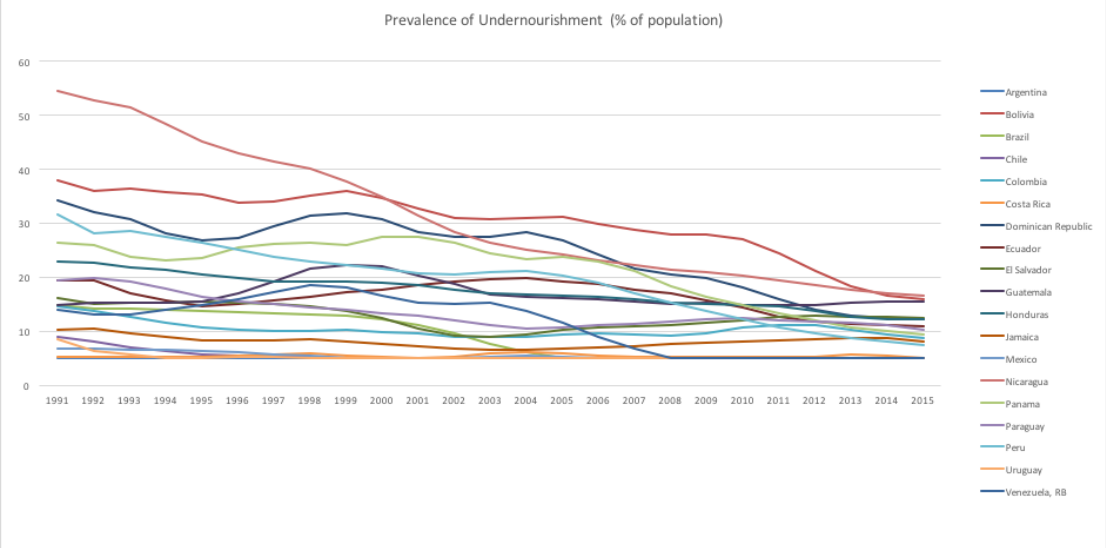
Prevalence of undernourishment measures the proportion of population whose food intake is below the minimum recommended level of dietary energy consumption, and expresses it as a percentage of the population.

Undernourishment is an outcome indicator, particularly targeting inadequate access to food (Santeramo 2015), which is not widely used in research. The FAO indicator "follows a parametric approach and is expressed as the share of people in a national population that are not meeting their minimum food energy requirements" (Chand and Jumrani 2013: 48), based on the mean quantity of calories available in a country for human consumption, minimum age-sex specific calorie requirements and inequality in accessing it. The main criticism against this indicator rely on the fact that it is too simplistic for it only considers dietary energy of available- as opposed to consumed- food, and a minimum activity level; it is not able to assess individual or household status; and it misses on short-term prices changes and economic shocks.

Therefore this measurement is usually not considered as a prime indicator of food insecurity, for it can exist even with proper food availability due to inadequate use of food, existence of health impairments of a different nature, and other circumstances that are determinants of food insecurity and do not relate directly to energy intake. Furthermore, "food insecurity is an individual or household phenomenon, and the average food available to each person, even corrected for possible effects of low income, is not a good predictor of food insecurity among the population" (World Bank Group. 2017). Nevertheless, in this research, this indicator is used among a series of measurements reflecting a detrimental food security status, in line with the international use of it as a "headline" (Timmer 2014: 74) to assess the achievement of the MDGs.

Figure 6 describes the prevalence of undernourishment for all countries under study, between the years 1991 and 2015, which are the ones with available data.

Figure 8 Prevalence of Undernourishment (% of total population) in the Latin American countries included in this research, between the years 991 and 2015



Source: author's elaboration with WDI data (last updated January 18, 2017)

A general and persistent reduction in the prevalence of Undernourishment can be observed within the countries in this research paper. Initial prevalences of course vary among countries with Nicaragua starting at 54.5% of the population while Costa Rica and Mexico have the lowest levels, with 5.2 and 6.9% of prevalence, respectively.

Depth of the Food Deficit

The use of calories as a measurement of food security responds to the fact that "increases in per capita calorie availability have been found to be closely associated with decreases in the undernourishment prevalence and to contribute substantially to reductions in malnutrition among children" and hence is expected to lead to significant nutritional improvements (Dithmer and Abdulai 2017: 220). In the case of this research this measurement is represented by the "depth of the food deficit", an outcome indicator that measures inadequate access to food (Reddy et al. 2016, Santeramo 2015) establishing how many calories would be needed to lift the undernourished from their status, *seteris paribus* (Reddy et al. 2016, World Bank Group. 2017).

This is "it is the average intensity of food deprivation of the undernourished, estimated as the difference between the average dietary energy requirement and the average dietary energy consumption of the undernourished population (food-deprived), is multiplied by the number of undernourished to provide and estimate of the total food deficit in the country" (Reddy et al. 2016: 138). This indicator measures severity of the deficit and can be used to compare different countries. For example, for Bangladesh it is of 116 kcal/capita/day, meaning and average Bangladeshi consumer is consuming 116 less kilocalories than the recommended for healthy life (Reddy et al. 2016).

In order to obtain a regional baseline, the table below describes the national averages of Depth of the Food Deficit, measured in kilocalories per person per day, per year, and the year averages for the economies in this study. It is worth noting that the year 1992- first with registries for this indicator- started with an average of 147 kilocalories, which by the year 2016 was reduced in almost half, amounting to 78 kilocalories.

Table 4 Depth of the Food Deficit Values (kilocalories per person per day) for the Latin American countries included in this research, per year (1992-2016)

DEPTH OF THE FOOD DEFICIT																									
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Argentina	15	12	11	9	8	8	8	8	7	6	7	9	12	14	14	12	11	10	10	10	10	8	6	3	2
Bolivia	261	245	249	243	240	228	232	239	247	235	221	208	207	209	210	201	193	189	190	182	164	140	120	109	104
Brazil	110	106	107	105	103	102	100	99	97	92	83	70	56	42	33	27	22	19	17	15	13	12	11	11	10
Chile	60	53	47	41	38	36	35	34	34	33	31	30	28	28	27	27	26	27	27	28	26	25	23	22	20
Colombia	101	95	88	79	73	69	68	69	70	68	66	62	61	61	65	67	65	64	67	75	79	78	73	67	62
Cuba	39	63	94	133	152	147	122	90	61	39	27	19	15	12	10	11	12	14	15	15	15	12	10	8	7
Costa Rica	33	34	34	34	35	36	38	38	36	34	34	36	39	41	41	38	36	35	36	37	37	38	40	39	35
Dominican Republic	247	230	219	199	190	194	212	228	232	222	204	198	200	206	195	174	155	146	141	129	112	98	91	88	86
Ecuador	122	122	106	98	92	95	100	105	110	114	121	126	130	131	128	125	118	113	104	94	83	76	73	72	70
El Salvador	103	96	98	98	100	99	96	94	88	79	67	59	56	60	66	70	73	75	77	81	86	88	88	86	85
Guatemala	89	92	92	91	93	104	119	135	138	137	125	115	104	101	101	100	98	95	96	94	95	95	99	101	101
Haiti	519	525	543	561	575	575	569	561	549	544	545	560	573	585	586	581	566	549	524	503	489	490	510	530	546
Honduras	154	151	146	142	136	132	129	129	128	127	124	119	115	113	113	112	109	105	104	104	102	96	89	85	85
Mexico	46	46	46	45	43	41	39	36	33	31	31	34	37	38	36	33	31	30	29	29	30	31	30	30	29
Jamaica	70	71	65	60	57	57	57	57	55	52	49	46	45	45	46	48	50	52	56	58	59	60	62	62	58
Nicaragua	420	405	395	366	339	321	309	300	281	256	229	206	192	184	179	171	164	158	155	150	144	136	130	126	122
Panama	188	184	169	164	168	185	189	192	188	200	202	191	176	169	172	165	151	131	116	104	94	83	75	69	66
Paraguay	133	136	131	123	113	106	103	99	95	91	89	83	75	71	72	76	77	81	84	84	83	81	80	76	71
Peru	222	195	199	191	184	174	163	158	153	149	142	142	144	147	140	130	117	105	93	82	71	64	58	54	50
Uruguay	58	42	38	34	33	35	34	33	30	28	26	27	29	29	29	27	25	24	24	23	22	23	25	25	24
Venezuela, RB	91	85	86	91	98	107	116	126	123	112	103	102	103	92	77	59	43	29	19	14	13	12	12	10	9
Year Average	**146,7**	**142,3**	**141,1**	**138,4**	**136,7**	**135,8**	**135,1**	**134,8**	**131,2**	**126,1**	**120,3**	**116,3**	**114,1**	**113,2**	**111,4**	**107,3**	**102,0**	**97,7**	**94,5**	**91,0**	**87,0**	**83,1**	**81,2**	**79,7**	**78,2**

Source: author's elaboration with WDI data (last updated January 18, 2017)

IV.d Number of National Food Security Programmes

Programmes that effectively target child malnutrition have to include pregnancy and the first two years of life of a child. "This period of a child´s life is thought to be the time when nutrition has the greatest effect on child health, growth, and development" and children that have small size at birth, among other deficiencies that could be measured, are prone to "childhood stunting with short adult stature, reduced lean body mass, less schooling, diminished intellectual functioning, and reduced earnings" (Hoddinott et al. 2008: 411). By doing this, programmes can "drive long-term economic growth by leading to healthier and more productive adults" (Hoddinott et al. 2008: 411). There have been many international cooperation initiatives targeted at reducing food insecurity. Despite the fact that there are, at least at first sight, good intentions behind each and every one of these programmes, in many cases they can be part of a "strategy-policy disconnect" (Timmer 2014: 74) where the policies implemented to allegedly put certain strategies in place may not be targeting the same objectives or may be accomplishing paradoxical outcomes.

The indiscriminate adoption of foreign programmes can be an incentive towards skipping the learning process that due design and implementation entail. There is a fair amount of knowledge spillover that can occur when adapting another country´s policies into the own, but special care must be placed in avoiding the consideration of mechanical programme design. Institutions must be "sought as solutions to *locally identified* problems and be *adapted to local needs and conditions*" (Winters 2004: F15, italics in the original).

For the reasons presented above, an explanatory variable indicating the number of food security programmes per country per year will be included in this research, in order to assess whether the impact of such policies is positive or not so much so, reason why a quadratic measurement of this number will also be included in this model. A summary of the number of programmes per country and the mean number of them is presented in the table below.

The manner in which the variable that will be included in this research was constructed is explained in Appendix 1, where a detailed data codebook can be found.

Table 5 Total and Mean number of Food Security Programmes per Economy for the Latin American Countries included in this research, between the years 1985 and 2016

Country	Total Number of Programes	Mean
Argentina	3	2.4
Bolivia	7	2.9
Brazil	4	2.2.
Chile	3	3
Colombia	12	7.8
Costa Rica	7	4.5
Dominican Republic	15	8
Ecuador	7	2.4
El Salvador	7	2.9
Guatemala	17	5.3
Honduras	11	5.8
Jamaica	8	6
Mexico	NA	NA
Nicaragua	12	5.8
Panama	9	4.5
Paraguay	6	2.9
Peru	13	7.7
Uruguay	8	6.8
Venezuela, RB	24	13.3

Source: author's elaboration according to methodology as described in Appendix 1

V. Methodology

V.a Empirical Specification

For this research, we regress food security indicators on trade related variables, in order to examine the effects of trade liberalization on improvement of child nourishment indicators. This will be done through panel data or cross-sectional time-series data model, using FE in order to remove the effect of time-invariant characteristics that are unobserved and constant over time (Wooldridge 2009) and isolate the impact of changes on trade policy, along with characteristics that could present unexpected variation and influence the outcome variable, namely: time; changes and progress in public health schemes; and macroeconomic characteristics; amongst others.

Harrison (as cited by Rodriguez and Rodrik 2000: 314) used FE to assess the relationship between trade policy and growth in a country-based approach, for it enables "to look for evidence of the effects of trade liberalization *within* countries". Countries included in this model are those that have implemented programmes using the Chilean scheme as a basis or input and have a State policy of openness to trade, even if such a policy is mild. They also have data availability and also are regionally adjacent and thus would be an input towards answering the question of whether "trade liberalization- or its absence- among geographically adjacent economies would lead towards convergence or divergence" given the fact that Latin American countries liberalized their trade policies around the same time period (Rodriguez and Rodrik 2000: 308-309).

Dependent variable: anthropometric indicators, undernourishment and the Depth of the Food Deficit

The dependent variable in this model is a vector containing prevalence of undernourishment; anthropometric indicators, namely wasting, severe wasting, underweight and stunting as explained in Section IV.c of this paper, for children under 5 years of age; the depth of the food deficit per person in the general population; and the prevalence of undernourishment in the general population measured as a percentage. Each one of these variables is assessed on its own, thus for each one of them, a separate model is run with all its controls, starting from the most parsimonious model and building up the inclusion of relevant controls.

Independent variable: The measurement of Trade

Trade will be the main explanatory component of this model: Export and Import Value Indexes expressed as their natural logarithm values; the balance of trade, both in value and in volume; and TOT. The first two indicators are provided by the UNCTAD and are the current value of exports (FOB) and imports (CIF) converted to US dollars and expressed as a percentage of the average for the base period, which is the year 2000 (World Bank Group. 2017). Both balance of trade indices are calculated as a simple subtraction of Import to Export Values.

Value Indexes are included as logarithms in order for them to provide coefficients that express changes in percentage terms. Hence it provides a simpler interpretation that enables a more intuitive approach in economic and trade terms. Trade indicators have been explained in detail in Section III.c of this document.

Isolating the food variety channel through macroeconomic controls

"Macro-economic growth is considered a major, and often the only, policy instrument to improving health and nutrition in developing countries" (Subramanyam MA et al. 2011: 2). Such growth affects nutrition through the increase in income in three different ways, namely: general increase of income; reduction in poverty; and public investment in programmes (Rodriguez and Rodrik 2000, Subramanyam MA et al. 2011). These changes depend on other factors, such as behavioural changes or increase in education- particularly in adult women for maternal education plays an important role in determining child survival (Anderson 2016, Hanf et al. 2013, Pongou et al. 2006)- in order to be effective; thus the issue already presents a problem in its own, for it is not clear whether economic growth leads to improvements in public health figures, or healthier people lead to increased economic performance. This is not a matter of concern for this particular research, for the inclusion of a macroeconomic control vector isolates its effects and consequences, isolating the effect achieved through the channel of increased nutritional variability.

Economic growth is a relevant variable of control in this model, for its inclusion allows for the isolation of the expected channel through which trade openness influences a positive nutritional status at an individual level (Subramanyam MA et al. 2011), that is an "increase in the total amount of food available to the national population" that provides "a greater variety of foods, contributing to food security" (Dithmer and Abdulai 2017: 219). Hence its inclusion ensures that any impact of the other explanatory variables does not respond solely to country differences in the level of economic growth or development (Dithmer and Abdulai 2017). Therefore, a positive impact of the level of GDP per capita on calorie consumption- and other

measures of food security- is expected, for it increases available resources to acquire food (Dithmer and Abdulai 2017).

Macroeconomic indicators to be included are annual percentage of GDP and GDP per capita growth. The former is a measure of economic performance that considers the values of all goods and services produced within a state in a given year, minus the cost of capital used in its production (Subramanyam MA et al. 2011). The latter is the annual percentage growth rate of GDP per capita based on constant local currency, calculated without deducting for depreciation of fabricated assets or for depletion and degradation of natural resources (World Bank Group. 2017).

Nutritional Programmes

Number of food security programmes, as explained in Section IV.d of this paper, implemented during the research period are included in a linear, quadratic and lagged manner. The quadratic expression is a nonlinear function of such number and it is included with the objective of assessing whether the influence of programmes changes in an increasing or decreasing manner, that is, whether there is a point in which there are too many programmes that could have a detrimental role over food security policies. Considering the theoretical framework already detailed above, the linear measurement is expected to have a negative effect over the measurements of food insecurity, whilst the quadratic variable is expected to have a positive sign and a clear cutting point, for an excessive number of programmes should have a detrimental effect over food security.

The lagged variable is included due to the fact that the most likely effect of policies that address matters that are of long term solutions (such as stunting) should not have an immediate effect but rather one that can be seen after one to three periods, and with different approaches we are assessing possible influence mechanisms (Blejer and Khan 1984). The number of periods was chosen on the basis of stability of the variable over different specifications (Dahlberg and Forslund 2005).

IV.b Model Specification using trade and nutrition indicators

The availability of a variety of indicators to measure trade and changes in nutritional status provide an elevated number of models to be specified in order to properly and comprehensively assess all possible outcomes of trade policies over nutrition through the channel of increased variability of foods and higher nutritional content in the food basket. This precludes the specification of highly complex models, and instead calls for the use of parsimonious models

that avoids "over-controlling" (Subramanyam MA et al. 2011: 10) and relies on the FE to cover all unobserved time-constant matters that are relevant to this research.

Variables of relevance to this model have too many missing values; therefore their inclusion entails a problem for it reduces the number of observations, up to a point where the model cannot be considered reliable. Hence, public health, demographic and educational changes that are of relevance over improving food security could not be considered in this model and are accounted as country-specific unobservable changes included in the FEs, as will be further explained later in this paper.

With all this under consideration, the model starts with a basic regression of trade variables over the food security outcome, and then includes year effects, macroeconomic changes and the measurement of number of programmes. This model is then repeated for all indicators within the food (in)security vector.

$$[Food\ Security_{ti}] = ß_1 TradeVar_{ti} + ß_2 MacroEcon_{ti} + ß_3 NumberProgrammes_{ti} + \partial_t T_t + u_{ti}$$

Where,

$[Food\ Security_{ti}]$ Food Security measurements for country i in year t

$ß_1$ Is the coefficient of a vector of Trade indicators for country i in year t

$ß_2$ Is the coefficient of a vector of Macroeconomic characteristics for country i in year t

$ß_3$ Is the coefficient for the Number of Programmes vector for country i in year t

∂_t Is the coefficient for the time control dummies (binary variables) for each year

u_{it} Idiosyncratic error

Our main interest is in coefficient $ß_1$, which captures how changes in trade openness affect the prevalence of undernourishment; anthropometric indicators, namely wasting, severe wasting, underweight and stunting as explained in Section IV.c of this paper, for children under 5 years of age; the depth of the food deficit per person in the general population; and the prevalence of undernourishment in the general population measured as a percentage

Fixed Effects Panel Data Model

We use a FE model for it is "often considered to be less biased as all the observed and unobserved characteristics of the state that are time-constant are accounted for" (Subramanyam MA et al. 2011:5). An indicator variable for year is included to account for differences in each one of them, being the first year the reference point. This also allows accounting for a "national-level unique changes occurring that year that might affect child undernutrition" (Subramanyam MA et al. 2011: 5). Country specific changes were not included so we do not control for factors that could have been a result of country-specific economic growth that resulted in changes in the food security state of affairs (Subramanyam MA et al. 2011). Errors in the model are clustered in order to control for heteroskedasticity.

V.c Data

The main target in this study should be children between the ages of zero (0) and 5 years of age. All data included in this research is described in detail in Appendix 1 of this document. Nutrition and trade data for this research is obtained from the WDI of the World Bank, and a constructed variable that describes the amount of child food security programmes in each country under study.

The WDI obtains anthropometric indicator data from the WHO Global Database on Child Growth and Malnutrition (World Bank Group. 2017), which is unadjusted, thus cannot be used to compare across countries. Data sources include a weekly literature MEDLINE search with an established search history and a wide network of national and international collaborators. In order for surveys to be included in the database they have to fulfil certain requirements, including the use of standard anthropometric measurement techniques and the presentation of the results using z-scores in relation to the NCHS/WHO international reference, or be available in raw data so that it can be standardized (De Onis and Blössner 2003).

A distinct feature of the database is the standardization of information collection, namely: prevalences of underweight (low weight-for-age), stunting (low height-for-age), and wasting (low weight-for-height); use of NCHS/WHO international reference population to

derive estimates; use of z-scores cut-off points of -2, -3 and +2 standard deviations; calculation of summary statistics using z-scores as a reference (De Onis and Blössner 2003).

The variable measuring the number of active food security programmes in each country understudy was built specifically for this study. In order to do so, a list of programmes and the years in which they were active was constructed for each one of the countries in this study. Then, for each country and year, the variable was coded according to the active number of programmes present. A list of the most relevant programmes per country, assembled for the construction of this variable, and a practical example, are presented in Appendix 1. It must be noted that the only country for which this variable could not be constructed is Mexico, for it was impossible to find all necessary information regarding starting and ending dates for the food security programmes.

The Balance of Trade variable was directly constructed by the author as a simple arithmetic subtraction of Export minus Imports Values and Volumes Indexes (2000=100) as presented in the WDI database. Therefore this variable is expressed in USD and as a percentage of the base period.

Table 6 presents a summary of all trade measurements used as independent variables, their units of expression, and the expected signs of their coefficients, which would indicate their influence over the food security dependent variables.

Table 6 Summary of Independent Variables expressing Trade Measurements, their units of expression and expected influence over the Independent Variables

Variable	Expressed as	Exprected Influence of the dependent variable
Import Value Index (2000=100)	Current values of imports (CIF) converted to **US dollars** and expressed as a percentage of the average for the base period (2000).	Negative sign over food security indicators
Export Value Index (2000=100)	Current value of exports (FOB) converted to **US dollars** and expressed as a percengate of the average for the base period (2000).	Negative sign over food security indicators
Import Volume Index (2000=100)	Ratio of the import value indexes to the corresponding **unit value** indexes.	Negative sign over food security indicators
Export Volume Index (2000=100)	Ratio of the export valu indexes to the corresponding **unit value** indexes.	Negative sign over food security indicators
Tariffs	Applied Tariff rate expressed as a **percentage,** weighted mean for all products.	Positive sign over food security indicators
Terms of Trade	**Percentage** ratio o the export unit value indexes to the import unit value indexes, measured relative to the base year 2000.	Not previously determined
Balance of Trade in Values and Volumes	Difference in values for Imports (CIF) and Exports (FOB) converted to **US dollars**; and in Import and Exports **unit values**.	Not previously determined
GDP pc growth	Annual **percentage** of growth rate of GDP per capita based on constant local currency.	Negative sign over food security indicators
Number of Food Security Programmes (linear)	**Number of public or private policy programmes** aimed at increasing Food Security at a national level per country per year	Negative sign over food security indicators

Source: author's elaboration with WDI metadata (last updated January 18, 2017)

VI. Results

The following pages will show the tables with detailed results of the regressions as described in the empirical specification, using Import and Export Value and Volume Indexes, organized by the dependent variable as described in Section V of this document.

Individual findings for Tariffs, TOT and BOT, and their respective discussions will be described in Appendix 2 of this document.

Prevalence of Undernourishment

Table 7 Effects of Export and Import Value Indexes (2000=100) in USD over the Prevalence of Undernourishment (% of total population)

PREVALENCE OF UNDERNOURISHMENT (% of total population)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Value Index 2000=100	-4.270***		-4.203**		-4.070**		-4.041**		-3.964**		-3.842***	
	(0.922)		-1.822		-1.793		-1.544		-1.444		-1.324	
ln of Import Value Index 2000=100		-4.339***		-4.614*		-4.363*		-4.719*		-4.556*		-4.025*
		-1.006		-2.302		-2.292		-2.297		-2.194		-2.168
GDP per capita growth (annual %)					-0.072	-0.057	-0.029	-0.001	-0.029	-0.003	-0.015	-0.007
					(0.065)	(0.064)	(0.053)	(0.055)	(0.054)	(0.057)	(0.056)	(0.059)
Number of Programmes per year							-0.553	-0.598*	-0.814	-0.858	-0.490	-0.666
							(0.335)	(0.330)	(0.689)	(0.737)	(0.610)	(0.687)
Quadratic number of programmes									0.013	0.013	0.034*	0.033
									(0.021)	(0.023)	(0.019)	(0.022)
one period lagged programmes											-0.038	0.123
											(0.106)	(0.102)
two period lagged programmes											0.073	0.068
											(0.116)	(0.126)
three period lagged programmes											-0.964***	-0.950***
											(0.305)	(0.297)
Constant	35.258***	35.536***	35.833***	36.675***	35.491***	35.870***	37.443***	39.313***	37.666***	39.224***	38.076***	38.089***
	-4.551	-4.952	-7.791	-9.320	-7.680	-9.230	-7.171	-9.616	-7.352	-9.608	-6.859	-9.501
F	21.5	18.6	.	.	.	.	.	.	.	.	.	.
N	473	473	473	473	473	473	448	448	448	448	448	448
R2	.47	.431	.486	.451	.488	.452	.549	.52	.552	.522	.579	.546
Adj R2	.469	.43	.458	.421	.458	.42	.52	.489	.522	.49	.548	.512
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 7 shows the effect of Export and Import Value Indexes in USD expressed as a percentage of the average for the base period (2000), included in logarithmic form, over the prevalence of undernourishment. There is overall a strong relation between both independent and dependent variables: an increase of one percentage point of the Value Indexes reduces the prevalence of undernourishment in 3.8 to 4.7 percentage points, and such change is consistent to the inclusion of all controls.

Table 8 Effects of Export and Import Volume (2000=100) Indexes over the Prevalence of Undernourishment (% of total population)

PREVALENCE OF UNDERNOURISHMENT (% of total population)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of export Volume Index (2000=100)	-5.547***		-3.182*		-3.027		-3.417*		-3.387**		-3.371**	
	-1.535		-1.822		-1.770		-1.621		-1.403		-1.311	
ln of import Volume Index (2000=100)		-5.264***		-1.594		-1.020		-1.556		-1.576		-1.286
		-1.317		-1.956		-2.093		-1.988		-2.033		-1.963
GDP per capita growth (annual %)					-0.108*	-0.138	-0.052	-0.081	-0.052	-0.077	-0.037	-0.076
					(0.060)	(0.094)	(0.056)	(0.076)	(0.056)	(0.075)	(0.056)	(0.076)
Number of programmes per year							-0.621*	-0.571	-0.655	-0.956	-0.335	-0.742
							(0.351)	(0.344)	(0.692)	(0.788)	(0.577)	(0.724)
Quadratic number of programmes									0.002	0.018	0.024	0.040
									(0.020)	(0.025)	(0.019)	(0.025)
one period lagged programmes											0.005	0.135
											(0.111)	(0.116)
two period lagged programmes											0.071	0.082
											(0.135)	(0.119)
three period lagged programmes											-1.034***	-1.045***
											(0.312)	(0.277)
Constant	40.646***	39.513***	32.191***	25.672***	31.832***	23.813***	35.595***	27.761***	35.543***	28.582***	36.416***	28.349***
	-7.325	-6.314	-8.253	-7.577	-8.080	-7.903	-8.343	-7.729	-7.927	-8.223	-7.485	-8.017
F	13.1	16	.	.	.	.	.	.	.	.	.	.
N	473	464	473	464	473	464	448	439	448	439	448	439
R2	.4	.368	.457	.422	.461	.427	.535	.491	.535	.496	.566	.525
Adj. R2	.398	.366	.426	.389	.429	.393	.505	.457	.504	.462	.533	.489
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 8 shows the effect of Export and Import Volume Indexes in product units according to their Standard International Trade Classification (SITC) three-digit level as weights, expressed as a percentage of the average for the base period (2000), included in logarithmic form, over the prevalence of undernourishment. There is overall a strong relation between Exported Volumes and undernourishment, for an increase of one percentage point of the former reduces in between 3.2 and 5.5 percentage points the prevalence of the latter. Imported Volume Indexes are not as clear, only the first simple specification has a strong and statistically significant coefficient over the prevalence of undernourishment, while specifications that include control variables do not provide such an influence. Nevertheless, all coefficients have a negative sign, suggesting that an increase in the level of imported goods reduce the prevalence of undernourishment.

For all regressions concerning the prevalence of undernourishment, GDP percapita growth shows a negative albeit mostly non-significant effect. This suggests that an increase of the per capita income reduces such prevalence, even it is in a very small amount, reaching a maximum of 1 percentage point, which is consistent with the theoretical framework. The number of programmes per year has a negative coefficient significant in only two specifications, thus indicating that an additional programme per year has a reduction of approximately 0.6 percentage point in the prevalence of undernourishment; the quadratic variable has a positive and small coefficient that is significant in only one specification, hence indicating that in a non-linear relation the higher number of programmes increases such prevalence of undernourishment. Lagged number of programmes have a relevant significance for the three year period, indicating

that food security programmes have effect in reducing the prevalence of undernourishment by almost one percentage point but effective after a minimum of three years past.

Prevalence of Wasting

Table 9 Effect of Export and Import Value Indexes (2000=100) in USD over the Prevalence of Wasting (% of children under 5)

PREVALENCE OF WASTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Value Index (2000=100)	-0.517**		-0.374		-0.451		-0.213		-0.249		-0.283	
	(0.234)		(0.258)		(0.299)		(0.215)		(0.183)		(0.178)	
ln of Import Value Index (2000=100)		-0.523**		-0.937***		-1.253***		-0.715**		-0.690**		-0.696**
		(0.198)		(0.269)		(0.378)		(0.334)		(0.294)		(0.276)
GDP per capita growth (annual %)					0.032	0.056*	-0.000	0.017	-0.000	0.016	-0.015	0.000
					(0.027)	(0.029)	(0.018)	(0.022)	(0.020)	(0.023)	(0.030)	(0.032)
Number of programmes per year							0.086*	0.070	-0.123	-0.131	-0.178*	-0.205*
							(0.049)	(0.048)	(0.093)	(0.093)	(0.096)	(0.104)
Quadratic number of programmes									0.009**	0.008**	0.006	0.005
									(0.003)	(0.003)	(0.005)	(0.005)
one period lagged programmes											0.164	0.174
											(0.181)	(0.183)
two period lagged programmes											-0.188***	-0.155**
											(0.057)	(0.057)
three period lagged programmes											0.163***	0.151***
											(0.046)	(0.046)
Constant	4.859***	4.869***	3.820***	5.427***	4.056***	6.348***	2.875***	4.411***	3.515***	4.820***	3.592***	4.695***
	-1.106	(0.927)	(0.935)	(0.797)	-1.041	-1.122	(0.771)	-1.146	(0.775)	-1.092	(0.815)	-1.065
F	4.88	7.01	.	.	.	.	.	.	.	.	.	.
N	137	137	137	137	137	137	131	131	131	131	131	131
R2	.126	.147	.314	.334	.321	.353	.338	.356	.383	.397	.415	.426
Adj. R2	.12	.14	.119	.146	.12	.162	.122	.145	.173	.192	.19	.206
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 9 shows the effect of Export and Import Value Indexes, included in logarithmic form, over the prevalence of wasting. There is overall a strong and significant relation between import values and wasting: an increase of one percentage point of the Import Value Indexes reduces the prevalence of undernourishment in values that range from 0.9 and 1.3 percentage points, and such change is consistent to the inclusion of all controls. This is consistent with the hypothesis that it is imports that increase food security for it enables the population to access to a wider variety of food that thus cover more nutrient requirements.

Regarding Export Values, only the coefficient for the parsimonious model is statistically significant and suggests that there is a reduction of 0.5 percentage points in the prevalence of wasting with a 1 percentage point increase in exports; coefficients in other models are not significant even though they do have a negative value, thus suggesting that exports do too reduce the prevalence of wasting, but of course this outcome cannot be stated with confidence.

Table 10 Effects of Export and Import Volume Index (2000=100) over the Prevalence of Wasting (% of children under 5)

PREVALENCE OF WASTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Volume Index (2000=100)	-0.921**		-0.930**		-0.975**		-0.576*		-0.387*		-0.411*	
	(0.323)		(0.403)		(0.393)		(0.281)		(0.212)		(0.214)	
ln of Import Volume Index (2000=100)		-0.686**		-0.998***		-1.198***		-0.675*		-0.772**		-0.741**
		(0.278)		(0.309)		(0.414)		(0.357)		(0.337)		(0.324)
GDP per capita growth (annual %)					0.033	0.043	0.005	0.001	0.001	-0.004	-0.014	-0.023
					(0.025)	(0.040)	(0.018)	(0.027)	(0.020)	(0.025)	(0.030)	(0.033)
Number of programmes per year							0.068	0.063	-0.093	-0.231**	-0.138	-0.304***
							(0.046)	(0.056)	(0.091)	(0.085)	(0.099)	(0.085)
Quadratic number of programmes									0.007**	0.012***	0.004	0.008
									(0.003)	(0.003)	(0.005)	(0.005)
one period lagged programmes											0.153	0.195
											(0.185)	(0.163)
two period lagged programmes											-0.184***	-0.163**
											(0.055)	(0.063)
three period lagged programmes											0.163***	0.148**
											(0.045)	(0.055)
Constant	6.652***	5.500***	5.856***	5.842***	5.975***	6.473***	4.268***	4.449***	3.963***	5.508***	3.983***	5.281***
	-1.484	-1.288	-1.484	-1.083	-1.435	-1.385	-1.073	-1.358	(0.863)	-1.303	(0.933)	-1.326
F	8.16	6.06	.	.	.	.	.	.	.	.	.	.
N	137	127	137	127	137	127	131	121	131	121	131	121
R2	.174	.159	.36	.343	.367	.354	.363	.335	.388	.419	.42	.452
Adj. R2	.168	.153	.178	.138	.181	.143	.155	.0936	.18	.199	.197	.218
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 10 shows the effect of Export and Import Volume Indexes, included in logarithmic form, over the prevalence of wasting. There is overall a strong relation between both independent variables over wasting, for an increase of one percentage point of the former reduces in between 0.4 and 1.2 percentage points the prevalence of the latter.

For all regressions concerning the prevalence of wasting, GDP per capita has an inconsistent sign and almost no significance. The number of programmes per year has negative coefficients in the case of the significant ones, thus indicating that an additional programme per year has a reduction of under one percentage point in the prevalence of wasting; but the quadratic variable has a positive coefficient in half the cases, though quite small in magnitude, suggesting that in a non-linear relation the higher number of programmes increases such prevalence of undernourishment. Lagged number of programmes has significant albeit contradictory coefficients for the three and two year periods.

Prevalence of Severe Wasting

Table 11 Effect of Export and Import Value Indexes (2000=100) over the Prevalence of Severe Wasting (% of children under 5)

PREVALENCE OF SEVERE WASTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Value Index (2000=100)	-0.284***		-0.722***		-0.728***		-0.613***		-0.606***		-0.597***	
	(0.085)		(0.198)		(0.206)		(0.172)		(0.144)		(0.145)	
ln of Import Value Index (2000=100)		-0.221**		-0.660**		-0.712**		-0.580**		-0.623***		-0.654***
		(0.086)		(0.243)		(0.264)		(0.241)		(0.199)		(0.166)
GDP per capita growth (annual %)					0.008	0.017	0.000	0.007	0.007	0.016	0.004	0.010
					(0.018)	(0.019)	(0.020)	(0.021)	(0.023)	(0.025)	(0.024)	(0.025)
Number of programmes per year							-0.065	-0.049	-0.192*	-0.190	-0.180	-0.249*
							(0.045)	(0.067)	(0.097)	(0.127)	(0.118)	(0.127)
Quadratic number of programmes									0.010	0.011	0.010	0.013
									(0.006)	(0.008)	(0.006)	(0.008)
one period lagged programmes											-0.001	0.094
											(0.114)	(0.114)
two period lagged programmes											-0.017	-0.043
											(0.119)	(0.109)
three period lagged programmes											0.002	-0.023
											(0.132)	(0.103)
Constant	1.976***	1.644***	3.597***	2.789***	3.610***	2.939***	3.236***	2.590***	3.544***	3.104***	3.529***	3.399***
	(0.414)	(0.411)	(0.867)	(0.805)	(0.890)	(0.876)	(0.763)	(0.763)	(0.731)	(0.745)	(0.701)	(0.543)
F	11.2	6.61	.	.	.	.	.	.	.	.	.	.
N	77	77	77	77	77	77	73	73	73	73	73	73
R2	.257	.172	.624	.522	.625	.526	.605	.504	.646	.556	.647	.566
Adj. R2	.248	.161	.392	.227	.38	.216	.307	.129	.363	.201	.313	.155
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 11 shows the effect of Export and Import Value Indexes, included in logarithmic form, over the prevalence of severe wasting. There is overall a strong and significant relation between both values and the indicator: an increase of one percentage point of the trade values reduces the prevalence of severe wasting in a range of 0.22 and 0.65 percentage points, and such change is consistent to the inclusion of all controls.

Table 12 Effect of Export and Import Volume Index (2000=100) over the Prevalence of Severe Wasting (% of children under 5)

PREVALENCE OF SEVERE WASTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Volume Index (2000=100)	-0.435***		-0.795***		-0.810***		-0.699***		-0.664***		-0.671***	
	(0.142)		(0.225)		(0.237)		(0.211)		(0.197)		(0.204)	
ln of Import Volume Index (2000=100)		-0.315**		-0.584**		-0.583**		-0.472		-0.531*		-0.609
		(0.124)		(0.214)		(0.262)		(0.274)		(0.260)		(0.378)
GDP per capita growth (annual %)					0.014	-0.000	0.005	-0.006	0.010	0.002	0.005	0.002
					(0.022)	(0.023)	(0.024)	(0.022)	(0.027)	(0.027)	(0.026)	(0.036)
Number of programmes per year							-0.073	0.010	-0.172	-0.064	-0.113	-0.144
							(0.042)	(0.056)	(0.100)	(0.063)	(0.122)	(0.171)
Quadratic number of programmes									0.008	0.006	0.007	0.008
									(0.006)	(0.005)	(0.006)	(0.005)
one period lagged programmes											-0.038	0.098
											(0.122)	(0.132)
two period lagged programmes											-0.072	-0.011
											(0.117)	(0.147)
three period lagged programmes											0.061	-0.030
											(0.111)	(0.127)
Constant	2.647***	2.068***	3.883***	2.675***	3.930***	2.671***	3.581***	2.303**	3.699***	2.710***	3.679***	3.134**
	(0.671)	(0.580)	(0.931)	(0.732)	(0.977)	(0.884)	(0.878)	(0.903)	(0.828)	(0.906)	(0.791)	-1.359
F	9.41	6.49	.	.	.	.	.	.	.	.	.	.
N	77	71	77	71	77	71	73	67	73	67	73	67
r2	.281	.214	.634	.705	.637	.705	.625	.693	.65	.706	.659	.715
r2_a	.271	.203	.408	.497	.4	.484	.342	.42	.37	.43	.337	.393
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 12 shows the effect of Export and Import Volume Indexes, included in logarithmic form, over the prevalence of severe wasting. There is a very strong relation between exports over the indicator, for an increase of one percentage point of the former reduces in between 0.44 and 0.81 percentage points the prevalence of the latter, being all coefficients significant. On the other hand, for Imports, even though not all coefficients are statistically significant, they all have a negative and large value, thus suggesting that there is a reduction of between 0.32 to 0.58 percentage points in the prevalence of severe wasting whenever import values increase in one percentage point.

For all regressions concerning the prevalence of severe wasting, GDP per capita show non-relevant and non-consistent coefficients. The number of programmes per year has results that are rather inconsistent, but overall a negative value, thus suggesting that an additional programme per year has a reduction of a small fraction of one percentage point in the prevalence of severe wasting; but the quadratic variable also has a positive consistent trend with half of the coefficients being significant, though quite small in magnitude, hence suggesting that programmes do have a reducing effect over severe wasting, but that this effect has diminishing magnitude. Lagged number of programmes has significant albeit contradictory coefficients for the three and two year periods.

Prevalence of Underweight

Table 13 Effect of Export and Import Value Indexes (2000=100) over the Prevalence of Underweight (% of children under 5)

PREVALENCE OF UNDERWEIGHT (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Value Index (2000=100)	-2.239***		-0.513		-0.464		-0.092		-0.249		-0.265	
	(0.554)		(0.656)		(0.729)		(0.619)		(0.426)		(0.426)	
ln of Import Value Index (2000=100)		-2.310***		-2.591***		-2.818**		-2.431**		-2.396***		-2.546***
		(0.465)		(0.778)		-1.042		(0.965)		(0.813)		(0.857)
GDP per capita growth (annual %)					-0.019	0.042	-0.047	0.022	-0.043	0.021	-0.042	0.026
					(0.073)	(0.077)	(0.058)	(0.062)	(0.047)	(0.052)	(0.049)	(0.053)
Number of programmes per year							0.023	-0.025	-0.717***	-0.756***	-0.677**	-0.770***
							(0.138)	(0.125)	(0.243)	(0.213)	(0.236)	(0.207)
Quadratic number of programmes									0.032***	0.032***	0.031**	0.029**
									(0.009)	(0.007)	(0.012)	(0.011)
one period lagged programmes											-0.051	-0.041
											(0.274)	(0.301)
two period lagged programmes											-0.023	0.084
											(0.185)	(0.165)
three period lagged programmes											0.060	0.031
											(0.169)	(0.160)
Constant	16.338***	16.561***	10.929***	17.240***	10.780***	17.895***	9.330***	16.783***	11.626***	18.379***	11.458***	18.256***
	-2.576	-2.140	-2.823	-2.905	-3.041	-3.686	-2.613	-3.297	-1.850	-2.781	-2.008	-2.879
F	16.3	24.7	.	.	.	.	.	.	.	.	.	.
N	151	151	151	151	151	151	145	145	145	145	145	145
R2	.406	.492	.591	.627	.592	.629	.585	.619	.664	.696	.665	.699
Adj.R2	.402	.489	.489	.534	.485	.532	.467	.51	.565	.606	.554	.599
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 13 shows the effect of Export and Import Value Indexes, included in logarithmic form, over the prevalence of Underweight. There is overall a strong and significant relation between Import Values and the indicator: an increase of one percentage point of the Import Value Indexes reduces the prevalence of severe wasting in values that range from 2.3 and 2.82 percentage points, such change being consistent to the inclusion of all controls. The case of Export Value Indexes is not so significant, although values are consistent: while the first and most parsimonious regression has a strongly significant coefficient indicating that an increase in one percentage point in the value of exports reduces the prevalence of underweight by 2.24 percentage points; the rest of the regressions have coefficients that are negative and relevant in magnitude, suggesting important reductions in the prevalence of underweight with increase in the export values, but these coefficients are not significant.

Table 14 Effect of Export and Import Volume Index (2000=100) over the Prevalence of Underweight (% of children under 5)

PREVALENCE OF UNDERWEIGHT (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Volume Index (2000=100)	-3.309***		-1.101		-1.077		-0.724		-0.023		-0.042	
	(0.799)		(0.695)		(0.748)		(0.574)		(0.418)		(0.406)	
ln of Import Volume Index (2000=100)		-2.836***		-1.863***		-1.845**		-1.537*		-2.000**		-2.054**
		(0.607)		(0.640)		(0.846)		(0.786)		(0.794)		(0.825)
GDP per capita growth (annual %)					-0.018	-0.004	-0.038	-0.037	-0.049	-0.040	-0.049	-0.033
					(0.066)	(0.092)	(0.054)	(0.073)	(0.045)	(0.056)	(0.047)	(0.054)
Number of programmes per year							0.001	-0.012	-0.711***	-0.907***	-0.677***	-0.879***
							(0.128)	(0.142)	(0.242)	(0.213)	(0.227)	(0.209)
Quadratic number of programmes									0.032***	0.037***	0.031**	0.037***
									(0.009)	(0.007)	(0.013)	(0.012)
one period lagged programmes											-0.040	-0.092
											(0.272)	(0.234)
two period lagged programmes											-0.023	0.079
											(0.185)	(0.168)
three period lagged programmes											0.057	-0.010
											(0.170)	(0.180)
Constant	20.953***	18.870***	13.069***	15.672***	13.009***	15.617***	11.701***	14.617***	10.801***	18.315***	10.651***	18.191***
	-3.630	-2.754	-3.062	-2.556	-3.188	-3.186	-2.370	-2.875	-1.709	-2.945	-1.814	-3.137
F	17.1	21.9	.	.	.	.	.	.	.	.	.	.
N	151	141	151	141	151	141	145	135	145	135	145	135
R2	.409	.478	.602	.617	.602	.617	.592	.613	.664	.723	.664	.724
Adj. R2	.405	.475	.503	.513	.499	.508	.475	.492	.564	.632	.552	.622
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 14 shows the effect of Export and Import Volume Indexes, included in logarithmic form, over the prevalence of underweight. There is a very strong relation between imported volumes over the indicator, for an increase of one percentage point of the former reduces in between 1.54 and 2.84 percentage points the prevalence of the latter, being all coefficients significant. On the other hand, for exports, only the coefficient for the first specification is large and strongly significant, suggesting that an increase of 1 percentage point in volume of exports has a reduction of the prevalence of underweight of 3.31 percentage points, the rest of the are not statistically significant but they do all have a negative value, further reinforcing that an increase in the volume of exports has a reduction effect on the prevalence of underweight.

For all regressions concerning the prevalence of underweight, GDP per capita has inconsistent and non-significant coefficients. The number of programmes per year has a negative coefficient, strongly significant in eight specifications, thus indicating that an additional programme per year has a reduction of almost one percentage point in the prevalence of underweight; but the quadratic variable has a positive and strongly significant coefficient in all specifications, though quite small in magnitude suggesting that in a non-linear relation the higher number of programmes increases such prevalence of undernourishment. Lagged number of programmes do not have any relevant significance for this study.

Prevalence of Stunting

Table 15 Effect of Export and Import Value Indexes (2000=100) over the Prevalence of Stunting (% of children under 5)

PREVALENCE OF STUNTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Value Index (2000=100)	-5.284***		-0.595		-0.559		-0.236		-0.337		-0.368	
	(0.968)		-1.416		-1.488		-1.443		-1.258		-1.345	
ln of Import Value Index (2000=100)		-5.626***		-6.121***		-7.057***		-6.294***		-6.188***		-5.949***
		(0.742)		-1.593		-2.153		-1.906		-1.879		-1.958
GDP per capita growth (annual %)					-0.015	0.165	-0.088	0.106	-0.084	0.105	-0.137	0.049
					(0.114)	(0.128)	(0.077)	(0.084)	(0.069)	(0.078)	(0.094)	(0.096)
Number of programmes per year							0.168	0.035	-0.576	-0.667	-0.640	-0.812
							(0.268)	(0.234)	(0.595)	(0.462)	(0.652)	(0.516)
Quadratic number of programmes									0.032*	0.030**	0.025	0.020
									(0.018)	(0.014)	(0.026)	(0.022)
one period lagged programmes											0.588	0.552
											(0.548)	(0.500)
two period lagged programmes											-0.869	-0.604
											(0.515)	(0.430)
three period lagged programmes											0.548	0.481
											(0.447)	(0.424)
Constant	44.301***	45.662***	30.797***	48.006***	30.687***	50.729***	28.715***	48.117***	30.856***	49.456***	31.891***	48.672***
	-4.565	-3.466	-5.121	-5.213	-5.323	-6.916	-5.191	-5.937	-4.700	-5.759	-5.053	-5.806
F	29.8	57.5	.	.	.	.	.	.	.	.	.	.
N	140	140	140	140	140	140	134	134	134	134	134	134
R2	.483	.626	.688	.735	.688	.741	.716	.765	.733	.78	.748	.788
Adj. R2	.479	.623	.602	.661	.599	.666	.627	.69	.646	.707	.655	.71
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 15 shows the effect of Export and Import Value Indexes, included in logarithmic form, over the prevalence of Stunting. There is overall a strongly significant and relevant relation between Import Values and the indicator: an increase of one percentage point of the Import Value Indexes reduces the prevalence of severe wasting in values that range from 5.63 and 7.1 percentage points, such change being consistent to the inclusion of all controls. The case of Export Value Indexes is not so consistent: while the first and most parsimonious regression has a strongly significant coefficient indicating that an increase in one percentage point in the value of exports reduces the prevalence of stunting by 5.28 percentage points; the rest of the regressions have coefficients that are negative and relevant in magnitude, suggesting important reductions in the prevalence of stunting with increase in the export values, but are not significant.

Table 16 Effect of Export and Import Volume Indexes (2000=100) over the Prevalence of Stunting (% of children under 5)

PREVALENCE OF STUNTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Volume Index (2000=100)	-7.410***		-1.555		-1.541		-1.023		-0.234		-0.198	
	-1.413		-1.048		-1.096		(0.973)		-1.038		-1.165	
ln of Import Volume Index (2000=100)		-6.954***		-4.110**		-4.708*		-4.441**		-4.722**		-4.280*
		(0.994)		-1.926		-2.346		-2.047		-2.115		-2.059
GDP per capita growth (annual %)					-0.011	0.134	-0.077	0.054	-0.088	0.049	-0.143	-0.019
					(0.102)	(0.135)	(0.064)	(0.090)	(0.061)	(0.086)	(0.091)	(0.100)
Number of programmes per year							0.139	0.102	-0.558	-0.730	-0.627	-0.824
							(0.265)	(0.259)	(0.583)	(0.517)	(0.632)	(0.624)
Quadratic number of programmes									0.031	0.034**	0.024	0.025
									(0.018)	(0.015)	(0.026)	(0.025)
one period lagged programmes											0.592	0.587
											(0.567)	(0.568)
two period lagged programmes											-0.866	-0.681
											(0.515)	(0.474)
three period lagged programmes											0.545	0.458
											(0.445)	(0.467)
Constant	53.400***	52.087***	34.310***	43.873***	34.276***	45.739***	31.692***	44.362***	30.452***	47.321***	31.254***	46.218***
	-6.486	-4.580	-3.925	-6.764	-4.039	-8.076	-3.801	-6.827	-4.208	-7.184	-4.683	-6.939
F	27.5	48.9	.	.	.	.	.	.	.	.	.	.
N	140	130	140	130	140	130	134	124	134	124	134	124
R2	.426	.592	.693	.715	.693	.718	.719	.744	.733	.763	.748	.773
Adj. R2	.422	.589	.609	.628	.605	.629	.63	.654	.645	.677	.654	.679
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 16 shows the effect of Export and Import Volume Indexes, included in logarithmic form, over the prevalence of stunting. There is a very strong relation between imports over the indicator, for an increase of one percentage point of the former reduces in between 4.11 and 6.95 percentage points the prevalence of the latter, being all coefficients statistically significant. On the other hand, for exports, only the coefficient for the first most parsimonious specification is large and strongly significant, suggesting that an increase of 1 percentage point in volume of exports has a reduction of the prevalence of stunting of 7.41 percentage points; the rest of the specifications for this trade measurement are not statistically significant but they do all have a negative value which is also relevant in terms of magnitude, further reinforcing that an increase in the volume of exports has a reduction effect on the prevalence of stunting.

For all regressions concerning the prevalence of stunting, GDP per capita has inconsistent and non-significant coefficients. The number of programmes per year has inconsistent results, though mostly negative albeit all insignificant; but the quadratic variable has a positive coefficient though quite small in magnitude, significant in three cases, hence indicating that in a non-linear relation the higher number of programmes increases such prevalence of stunting.

Depth of the Food Deficit

Table 17 Effect of Import and Export Value Indexes (2000=100) over the Depth of the Food Deficit (kcal per person per day)

DEPTH OF THE FOOD DEFICIT (kilocalories per person per day)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Value Index (2000=100)	-31.155***		-30.875**		-31.509**		-30.941**		-30.763**		-30.072**	
	-7.328		-13.863		-13.885		-12.176		-11.347		-10.578	
ln of Import Value Index (2000=100)		-32.004***		-31.225*		-32.792*		-33.935*		-33.532*		-30.150*
		-7.926		-17.890		-18.216		-18.356		-16.903		-16.798
GDP per capita growth (annual %)					0.317	0.359	0.613*	0.718	0.609*	0.708	0.720**	0.697
					(0.338)	(0.348)	(0.322)	(0.426)	(0.323)	(0.416)	(0.332)	(0.434)
Number of programmes per year							-3.522	-3.820	-4.083	-4.430	-1.348	-2.695
							-2.635	-2.691	-5.865	-6.236	-5.249	-5.809
Quadratic number of programmes									0.027	0.029	0.171	0.165
									(0.177)	(0.190)	(0.174)	(0.194)
one period lagged programmes											-1.827	-0.662
											-1.236	-1.147
two period lagged programmes											0.853	0.995
											-1.118	-1.090
three period lagged programmes											-5.784**	-5.820**
											-2.075	-2.234
Constant	251.653***	255.623***	254.835***	256.031***	256.326***	261.060***	268.437***	280.133***	268.959***	279.893***	272.064***	272.471***
	-36.479	-39.393	-60.223	-76.015	-60.420	-77.034	-58.437	-82.090	-61.035	-81.258	-58.110	-80.362
F	18.1	16.3	.	.	.	.	.	.	.	.	.	.
N	454	454	454	454	454	454	430	430	430	430	430	430
R2	.442	.4	.459	.42	.46	.421	.504	.47	.504	.47	.525	.487
Adj. R2	.441	.399	.429	.387	.428	.387	.472	.435	.471	.434	.489	.448
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 17 shows the effect of Export and Import Value Indexes, included in logarithmic form, over the DFD measured as kilocalories per person per day. There is overall a strongly significant relation between both values and the indicator: an increase of one percentage point of the Import Value Indexes reduces the depth of the food deficit in approximately 31 kilocalories, such change being consistent to the inclusion of all controls; and an increase in one percentage point in the value of exports reduces the depth by a range of 30.15 and 34 kilocalories.

Table 18 Effect of Export and Import Volume Indexes (2000=100) over the Depth of the Food Deficit (kcal per person per day)

DEPTH OF THE FOOD DEFICIT (kilocalories per person per day)												
	1	2	3	4	5	6	7	8	9	10	11	12
ln of Export Volume Index	-40.280***		-22.619		-22.566		-24.539*		-25.605**		-25.507**	
	-12.533		-14.288		-14.209		-13.430		-11.689		-11.047	
ln of Import Volume Index		-39.258***		-10.526		-9.642		-11.704		-11.649		-9.636
		-10.417		-14.416		-15.309		-15.221		-15.419		-15.178
GDP per capita growth (annual %)					-0.037	-0.207	0.344	0.172	0.365	0.169	0.482	0.187
					(0.356)	(0.565)	(0.406)	(0.512)	(0.400)	(0.520)	(0.383)	(0.514)
Number of programmes per year							-4.022	-3.664	-2.858	-5.180	-0.222	-3.304
							-2.872	-2.799	-5.815	-6.736	-5.009	-6.157
Quadratic number of programmes									-0.056	0.072	0.097	0.219
									(0.168)	(0.211)	(0.170)	(0.220)
one period lagged programmes											-1.445	-0.595
											-1.071	-1.113
two period lagged programmes											0.884	1.145
											-1.202	-1.009
three period lagged programmes											-6.366***	-6.547***
											-2.184	-2.072
Constant	289.959***	286.920***	225.209***	176.891***	225.110***	174.055**	248.479***	195.647***	250.282***	198.628***	256.167***	196.662***
	-60.174	-50.344	-65.675	-59.024	-65.557	-61.102	-70.047	-63.788	-66.904	-68.225	-64.163	-67.340
F	10.3	14.2	.	.	.	.	.	.	.	.	.	.
N	454	446	454	446	454	446	430	422	430	422	430	422
R2	.367	.338	.428	.394	.428	.395	.483	.442	.483	.443	.507	.465
Adj. R2	.366	.337	.396	.36	.394	.359	.449	.405	.449	.405	.47	.424
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Table 18 shows the effect of Export and Import Volume Indexes, included in logarithmic form, over the DFD measured as kilocalories per person per day. There is a strong relation between exports over the indicator, for an increase of one percentage point of the former reduces the latter in between 22.62 and 40.28, kilocalories, but only four coefficients are significant. On the other hand, for imports, only the coefficient for the first and most parsimonious specification is large and strongly significant, suggesting that an increase of 1 percentage point in volume of exports has a reduction of the prevalence of stunting of 39.23 kilocalories, the rest of the are not statistically significant but they do all have a negative value which is also highly relevant in terms of magnitude, further reinforcing that an increase in the volume of exports has a reduction effect on the depth of the food deficit per person per day.

For all regressions concerning the Depth of the Food Deficit, GDP per capita has small and inconsistent coefficients suggesting no relevant influence over the DFD. Number of Programmes and its squared values show non-significant coefficients. Lagged number of programmes have a relevant significance for the three year period, indicating that food security programmes have effect in reducing the prevalence of undernourishment by almost one percentage point but effective after a minimum of three years past.

Overview

Table 19 Overview of Export and Import Value Indexes and Export and Import Volume Indexes over the dependent variables measuring Food Security (results of the most parsimonious specifications for each food security indicator)

	PREVALENCE OF UNDERNOURISHMENT		PREVALENCE OF UNDERWEIGHT		DEPTH OF THE FOOD DEFICIT		PREVALENCE OF WASTING		PREVALENCE OF SEVERE WASTING		PREVALENCE OF STUNTING	
	% of total population		% of children under 5		Kilocalories per person per day		% of children under 5		% of children under 5		% of children under 5	
ln of Export Value Index (2000=100)	-4.270***		-2.239***		-30.734***		-0.517**		-0.284***		-5.284***	
	(0.922)		(0.554)		(7. 022)		(0.234)		(0.085)		(0.968)	
ln of Import Value Index (2000=100)		-4.339***		-2.310***		-31.607***		-0.523**		-0.221**		-5.626***
		-1006		(0.465)		(7. 823)		(0.198)		(0.086)		(0.742)
ln of Export Volume Index (2000=100)	-5.547***		-3.309***		-39.723***		-0.921**		-0.435***		-7.410***	
	-1535		(0.799)		(12. 074)		(0.323)		(0.142)		-1413	
ln of Import Volume Index (2000=100)		-5.264***		-2.836***		-39.168***		-0.686**		-0.315**		-6.954***
		-1317		(0.607)		(10. 471)		(0.278)		(0.124)		(0.994)

SE in parentheses
* p<0.10, ** p<0.05, *** p<0.010

Table 19 shows a summary of the effects of trade, measured by export and import value and volume indexes over the different food security indicators in this research. When analysing the results for all indicators under study, and thoroughly assessing the consistency of results amongst them, certain preliminary conclusions can be drawn: there is a strong and consistent influence of trade over prevalence of undernutrition, in its different measurements included in this research paper, for an increase of the former reduces the latter- even if an initial "hiatus" of decreased food security (Panagariya 2002: 20); results tend to attribute slight differences in the relevance of either imports or exports in this reduction, depending on which food security indicator is under consideration, suggesting a priori a difference in the effect of exports and imports on short or long term food security changes; per capita income does not seem to have a relevant influence over the prevalences of undernutrition; and even though programmes established by the government have an effect reducing the prevalences of undernutrition, that effect is small and there is a point in which too many programmes have a detrimental outcome instead of further increasing beneficial effects, and they seem to have an effect only after a minimum of three years have passed.

All seven trade indicators assessed in this research show strong significant coefficients of high magnitudes over the six food security indicators included, thus suggesting that an increase in trade reduces the prevalences of undernourishment, wasting, severe wasting, underweight and stunting, and reduces the magnitude of the depth of the food deficit. Some of these models go as far as indicating that an increase of a single percentage point in trade- may it be values or volumes- reduces in more than 7 percentage points the prevalence of different forms of undernutrition. In the case of the Depth of the Food Deficit, there is a reduction ranging from 22 to 40 kilocalories per person per day. Considering that the annual average values per country presented in Table 4 range from 140 to 78 kilocalories, the aforementioned reductions are highly relevant, representing a decline of one seventh to half of the total values.

VII. Discussion

There is a strong and consistent influence of trade over prevalence of undernutrition, and several conclusions can be drawn when analysing anthropometric and food security indicators one by one.

Undernourishment presents a general picture of the situation, as it was already explained in Section IV.c and our results show strong reductions with both imports and exports, which range from 1 to 5.5 percentage point reductions, providing an overall idea of the consistent and significant results of this research, which will be further explained in the following paragraphs.

Export values and volumes do not show as many strong and consistent significance in their coefficients as imports do, and our results tend to give more relevance in impact to imports than exports, but it must be noted that such difference is very small for both imports and exports have at least one significant coefficient per food security indicator. This could suggest that changes in exports might not boost quality upgrading (Hayakawa et al. 2017), even though they can increase labour productivity, product innovation and adoption of new technologies, thus increasing total factor productivity (Anderson 2016), and exports could account for an income effect being this small difference would explain our variation in significance of coefficients.

Underweight, Wasting and Stunting, meaning low weight-for-age, weight-for-height and height for age, figures respond strongly to imports and less so to exports. Additionally, stunting responds with much higher values of reduction of its prevalence, reaching a remarkable 7.4 percentage point reduction. Determinants of wasting vary in different environments, and can respond to seasonal episodes related to variations in food or prevalence of certain diseases. One of the main characteristics of wasting is that it develops quickly being more prevalent between the ages of 12 to 24 months. and, under favourable conditions, it can be reverted likewise (WHO 1986). The fact that these indicators respond more to imports than exports (albeit both are significant), could result from both the stabilization in food supply due to the presence of imports that offset seasonal food shortages, and to a richer variety of foods with higher nutrient content.

These findings are in line with research that suggests that imports lead to quality upgrading (Hayakawa et al. 2017) and thus food security would be improved by an enhancement of nutritional status- hence of welfare- that could be explained through the channel of an increase in the nutritional variety and quality of foods available to the general population in countries that open their markets to foreign foodstuffs (Anderson 2016, Dithmer and Abdulai 2017, Hosoe 2016, Martorell and Young 2012, Panagariya 2002, Pyakuryal et al. 2010, V. Smeets,

et al. 2014). The fact that imports have bigger and stronger coefficients indicating the reduction of prevalences of undernutrition, thus improvement of food security, could be also related to the fact that opening an economy puts pressure over local suppliers, who then raise their productivity, and stimulates the exit of suppliers whose productivity is below best practices. This leads to "better exploitation of comparative advantage in terms not only of industries but also of firms within each industry"(Anderson 2016: 27).

Stunting is usually considered a chronic form of malnutrition[9] associated with poor overall economic conditions, reiterated infections and longstanding inadequate nutrient intake, and is more prevalent between the ages of 24 to 36 months. Height is stable over time, it may not be gained easily but it cannot be lost; it is slower than changes in body mass; and catching-up takes much more time than body mass changes and needs a favourable environment. Therefore, changes observed in our results are relevant for they suggest long-term improvements in overall food security conditions, for as it is a process responding to deficiencies maintained over time (Martorell and Young 2012, Pongou et al. 2006). A wasted child will respond to proper nutrition first by putting on weight and then by catching up in height, thus changes in wasting will be seen before- and by far- stunting prevalence improvements (WHO 1995). Overall, the observed impact of trade over stunting accounts for a relevant, significant and sustainable outcome of the latter over the former, rendering trade openness as a worthy State level policy in the pursue of social welfare enhancement.

Severe Wasting and the Depth of the Food Deficit respond strongly to exports and mildly to imports, even though both show a relevant number of significant coefficients. There are several biological differences between wasting and severe wasting that account for different patterns of change, each one of them representing "different processes of malnutrition" (WHO 1986: 931). Higher effects from exports might respond to income effects derived from them, in line with what is presented by Edmonds and Pavcnik (2005) who find that an increase of rice prices after internal and external barriers to rice trade were lifted in Vietnam in 1997, leads to income effects that result in declines in child labour, with households that are net producers of rice experiencing larger reductions in child labour.

[9] It must be noted that the terms "acute", "chronic" and "acute-on-chronic" are deductions and not direct observations and as so, they might not always be correct. Particular attention must be paid to the use of "chronic" for it can be both "long continuing" and "a residue of the past". For this research, particularly these discussions, it will be use as 'longstanding', that is, the result of "accumulated consequences of retarded growth" (WHO 1986: 931)

In an analogous mechanism, households that produce exported goods could experience an increase in income that would lead to a substitution of lower quality to high quality foods, in such a manner that would reduce the general average of severe malnutrition figures. The results are also in line with the studies conducted in Oman (Mohamed et al. 2004), Cameroon (Pongou et al. 2006), Ghana (Owusu et al. 2004) and India (Bahl et al. 2002) that found relation between increased family income and maternal and paternal education with reduced malnutrition, thus suggesting that wealthier families were better-off in nutritional aspects. Therefore it could be inferred that income effect resulting from exports alleviates extreme forms of undernutrition, helping in the stabilization of public health emergencies and enabling subsequent steps towards definite food security establishment.

Exports also have a slightly higher influence than imports over the Depth of the Food Deficit, suggesting that income would provide for more nutritious food, which tend to be more expensive but are not necessarily imported products that would only become available through international trade. This is in line with a study that determined that in Mexico during the economic crisis of the 80s, households of low income reduced their food expenditure and sought to maintain nutrient intake by an increase of foods of vegetable origin at the expense of more costly animal-origin foods (Ortiz-Hernández 2006); and the fact that "the relation between energy density and food price per 100g [is] positive" (Drewnowski 2010: 1186).

Weight-for-height is and index that is particularly important for the description of current health status, whilst height-for age reflect overall social conditions (WHO 1986). Therefore, the **access to food of quality provided by imports improves overall health status of a country,** enabling the recovery of lost weight due to seasonal fluctuations of food and prevalence of infectious diseases, and the catching-up of average population height. On the other hand, the **long-term income effect due to an increase in exports allows for advances on the severe forms of undernutrition by stabilizing them** thus alleviating the extreme conditions and providing a basis for a permanent and sustainable solution.

Economic progress has an influence over the improvement of social policies, for if an increase of income per capita is consistently achieved, the general population has more money (Chakraborty 2015) that can be spent in improving their welfare mainly through nutrition, children education, health, sanitation and housing. It must be noted at this point that there is potential endogeneity in the inclusion of economic indicators, for trade leads to economic growth but can also derive of it (Winters 2004). Nevertheless, in this research, economic indicators are not our main explanatory variables but are rather controls intended to isolate the food quality and nutrition channel through which trade is expected to increase food security.

There has been relevant improvement in health status across Latin America in the years included in this research. These respond to a variety of factors such as aid, economic growth, institutions (Winters 2004), improvement in education (Winters 2004) and a better coordination among stakeholders regarding public health policies. Nevertheless, we have witnessed that there is such a thing as too much intervention, for food security programmes apparently have an effectiveness ceiling after which they will start generating detrimental results.

As expected, the more programmes governments have established are not necessarily the merrier in the sense that they do not always imply stronger results. There is a lineal significant relation where programmes reduce the prevalence of undernutrition; but when the quadratic variable is applied it shows that such effect only goes so far, and after a breaking point these programmes show detrimental results. This is consistent with the theoretical framework previously presented in this paper indicating that more programmes are usually a sign of lack of coordination amongst different stakeholders, lack of continuity in governmental strategies and an inefficient expenditure of available resources; and that "part of the benefits of trade liberalisation depends on other policies and institutions being supportive" (Winters 2004: F18) and hence not necessarily in an fill-up of food security programmes. This partly suggests that there is so much that trade can do without a strong institutional background.

The lagged measurements of the aforementioned programmes do not have strong or cohesive results (Dithmer and Abdulai 2017), even though there is some proof in our findings that programmes would show results only after three or more years from implemented. Considering all information on the matter of food policy programmes, and the historic background of countries considered in this study, it would appear that the more stable the food security and nutrition institutionality, the better the results that are obtained.

Chile poses as a proper example for this statement, for it has had the same three programmes since the beginning of the 1900s and they have successfully adapted to historic and demographic changes, without breaking continuity in social provisions or changing the ruling paradigms. As a matter of fact, CONIN that was founded in 1974, currently works as a medical facility treating medical conditions derived from malnutrition, but it has not ceased to exist, and national authorities fully recognize their contribution to the Chilean health system (CONIN n.d.). According to Fernando Mönckeberg, founder of CONIN and INTA in Chile, the key to success

was precisely, the "development of a State policy (…) that crossed different governments and entailed an investment of over USD$22 billions"[10] (Ayuso 2017).

[10] This is a translation from the original interview, reading "la clave del éxito fue el desarrollo de una política de Estado (…), que atravesó los diferentes gobiernos desde 1970 e implicó una inversión de más de 22 mil millones de dólares" (Ayuso 2017).

VIII. Concluding Remarks

Using a FE panel data regression model this study assessed the impact of trade openness on child (0 to 5 years of age) food security, measured by six indicators of prevalence of undernutrition, namely: undernourishment, wasting, severe wasting, underweight, stunting, and the depth of the food deficit; and five indicators of trade, namely export and import value and volume indexes, Tariffs, BOT and TOT. Our results suggest that there is a strong influence of trade over the reduction of undernutrition in its different measurements.

Overall, trade has shown to consistently improve the nutritional status for general population and children under 5 years of age in Latin America. At length, imports have improved weight-for-height and height-for-age indicators due to improvements in food availability, both in nutritional variety and quality. This suggests a stabilization of seasonal fluctuations in food access and a consequent prevalence of infectious diseases, but also that it enables long-term improvements in nutritional status of the population. On the other hand, exports seem to have produced a relevant income effect, which in turn has enabled the improvement in extreme forms of undernutrition, namely severe wasting, and calorie availability.

This paper certainly leaves room for improvement: further research could be conducted with a higher number of countries in different regions, in order to include other variables of different nature into the study, such as culture, conflict and war, and migration; robustness checks with different databases and sources of information could provide light on the consistency of different collection mechanisms and research techniques applied by scholars within diverse schools of thought; and more effort should be put into the improvement of means of measurement of trade variables, which are already of high complexity and in contradiction under different schools of thought.

But malnutrition in all its forms is a highly multidisciplinary subject matter (Panagariya 2002); as such, it has to be assessed from different approaches, such as health and medicine, but also education, geography, history and economics and the proper evaluation of public policies and programmes. There is a deep relevance of this subject for development studies, as was already explained at the beginning of this paper. Therefore trade, food security and sustainability necessarily have to be considered all at once and also (Nooghabi et al. 2017: 2), along with other practices, such as: public private partnerships; development of infrastructure for transportation and storage; and government instruments directed towards increasing food access (Ayuso 2017, Edmonds and Pavcnik 2005, Pyakuryal et al. 2010). Vulnerability of population increases in times of economic crises, thus special attention should be paid during dire times to maternal education

leading to knowledge of alternatives sources of nutrition, nutritional supplements, health care access, and access to hygiene (Pongou et al. 2006). The possibility of trade entailing detrimental effects is undeniable (Panagariya 2002), and this paper does not aim at refusing their existence, but rather to remind the reader that "supplementary policies should be implemented to address the unexpected adverse effects" (Chakraborty 2015: 167, see for a similar view Panagariya 2002) of it, instead of avoiding it altogether. What is relevant is to have sufficient knowledge and proof to choose and implement wisely.

"It can be mockery to tell someone they have the right to food when there is nobody with the duty to provide them with food. That is the risk with the rights rhetoric. What I like about choosing the counterpart, the active obligation of duties rather than the rights, you can't go on and on without addressing the question who has to do what, for whom, when" (O'Neill as cited by Pyakuryal et al. 2010)

Appendix 1: Data Index

World Development Indicators

"The primary World Bank collection of development indicators, compiled from officially-recognized international sources. It presents the most current and accurate global development data available, and includes national, regional and global estimates.

- Type: Time series
- Periodicity: Annual
- Last Updated: 15-Sep-2017
- Economy Coverage: WLD, EAP, ECA, LAC, MNA, SAS, SSA, HIC, LMY, IBRD, IDA
- Granularity: National, Regional
- Number of Economies: 217
- Topic
- Agriculture & Rural Development,
- Aid Effectiveness,
- Climate Change,
- Economy & Growth,
- Education, Energy & Mining,
- Environment,
- External Debt,
- Financial Sector,
- Gender,
- Health,
- Infrastructure,
- Labor & Social Protection,
- Poverty,
- Private Sector,
- Public Sector,
- Science & Technology,
- Social Development,

- Trade, and
- Urban Development.
- Update Frequency: Quarterly
- Update Schedule: April, July, September, December
- Contact Details: data@worldbank.org
- Access Options: API, Bulk download, Query tool
- Attribution/citation: World Development Indicators, The World Bank
- Coverage: 1960 – 2016" (WB 2017)

Codebook: Existence of National Nutritional and Food Safety Programmes

The construction of the variables related to the existence of National Food Security and Nutritional Programmes considers official information regarding existence, implementation and continuity of such programmes. Many State programmes change along history for different reasons, and this does not mean that they can be understood like different programmes but are timely and necessary adaptations to one programme, or rather a state plan or public policy.

Thus this research considers programmes active or implemented from the year 1985 as an independent entity until today, that have national coverage in both urban and rural territories, target children and focus on the access dimension of food security. It does not consider as a separate policy in this case all technological programmes targeted at farmers, seeking improvements in food production.

So for example, Chile has had only three food security programmes since the 1900s and the years included in this research, hence the value of the variable will be 3 (three for every year), as opposed to Ecuador who had- for the purpose of this study- zero programmes until 1989, year in which the "Programa de Alimentación Escolar" was established (Calero León 2011, CELAC. 2017) so the count adds up to one, until the year 2000 when the PANN Programme was implemented (Calero León 2011) and from this year the count goes to two, in 2007 to three due to the "Programa de Centros Infantiles del Buen Vivir" (CELAC. 2017, IIPE-UNESCO. 2017), and so on so forth.

The programmes counted in this research by country are presented in the following list.

- **Argentina**
    - Dirección de Maternidad e Infancia- Programa Materno Infantil (PMI) established in 1936 (Britos et al. 2003)
    - Programa de Comedores Escolares established in 1972, later called Programa de Promoción Social Nutricional (PROSONU) active up to this date (ibid)
    - Programa de Emergencia Alimentaria created in 2002 (Representación Permanente de la República Argentina ante al FAO 2002)
- **Bolivia**
    - Consejo Nacional de Alimentación y Nutrición (CONAN) established in 2003 with the objective of driving and coordinating integrated participation towards

the design and follow up of national policies of nutrition and diet. Until the year 2005 this Council had not been established (Sánchez et al. 2005).

- Programa Nacional de Alimentación y Nutrición (PRONAN) implemented in 2003 (Sánchez et al. 2005)
- Programa de Alimentación Complementaria Escolar established in 1994 (CELAC 2017)
- Programa Multisectorial Desnutrición Cero established in 2006 (CELAC 2017)
- Programa Multisectorial de Alimentación y Nutrición en el ciclo de la vida established in 2014 (CELAC 2017, Gaceta Oficial de Bolivia 2014)
- Programa de Atención a Niños y Niñas menores de 6 años (PAN) established in 1997 (OAS n.d.)
- Programa "Bono Juana Azurduy" implemente in 2009 (IIPE-UNESCO. 2017)

- **Brazil**
  - Programa Nacional de Alimentaçao Escolar (PNAE) established in 1955, nowadays operating within the framework of Plano Brasil sem Miseria (CELAC 2017, IIPE-UNESCO. 2017)
  - Programa de Aquisiçao de Alimentos Established in 2003 within the framework of Plano Brasil sem Miseria (CELAC 2017)
  - Incentive Program for the Combat against Nutrition Deficiency (ICCN) established in 1998, which has been gradually replaced by the Food Grant Program (Bolsa Alimentaçao)(Ministry of Foreign Relations 2002)
  - "Estrategia brasileritos y brasileritas saludables" implemented in 2009 (IIPE-UNESCO. 2017)
- **Chile**
  - Programa Nacional de Alimentación Complementaria (PNAC and PACAM) established in 1954 (MINSAL 2010)
  - Corporación para la Nutrición Infantil (CONIN) (Valiente and Uauy 2002) established in 1976 (MINSAL 2010)
  - Programa Nacional de Alimentación Escolar established in 1964 (CELAC 2017)
- **Colombia**
  - Estrategia de Recuperación Nutricional (ICBF 2017), which is led by the Colombian Institute for Family Welfare established in 1968 (Viloria de la Hoz, J. 2007). The first nutritional recovery centres where implemented in 2007 and the strategy with communal focus was established in 2010 (IIPE-UNESCO. 2017)

- Desayunos Infantiles con Amor implemented in 2003 (CELAC 2017, IIPE-UNESCO. 2017)
- Hogares Comunitarios de Bienestar, established in1986 (Gaviria and Palau 2006, Viloria de la Hoz, J. 2007, IIPE-UNESCO. 2017)
- Plan Nacional de Promoción, Protección y Apoyo a la Lactancia Materna for the 1992-1994 period (Viloria de la Hoz, J. 2007, Ministerio de Agricultura y Desarrollo Social 2002)
- Plan Nacional de Alimentación y Nutrición for the 1996-2005 period (Viloria de la Hoz, J. 2007)
- Política Nacional de Seguridad Alimentaria y Nutricional implemented in 2008 (IIPE-UNESCO. 2017)
- Programas de Complementación Alimentaria comprised of community childcare system, children´s homes, FAMI, nutritional assistance to schoolchildren and adolescents and juvenile clubs (Ministerio de Agricultura y Desarrollo Social 2002)
- Programa Familias en Acción implemented in the year 2000 (Viloria de la Hoz, J. 2007)
- Régimen Subsidiado en Salud (RSS) implemented in 2010 (Gaviria and Palau 2006)
- Programa de Alimentación Escolar established on 2002 (CELAC 2017, IIPE-UNESCO. 2017)

- **Costa Rica**
  - Centros de Nutrición y Desarrollo Infantil implemented in 1977 (CEN-CINAI) (Representación de FAO en Costa Rica 2006)
  - Centros de Educación y Nutrición y Comedor Escolar reformed in 2010 along with CEN and CINAI (IIPE-UNESCO. 2017)
  - Programa Provisión de Servicios de Salud ´Nutrición y Desarrollo Infantil´ implemented in 1969 (CELAC 2017)
  - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)
  - Programa de Alimentación y Nutrición del Escolar y del Adolescente (PANEA) started during the 70s and in 2007 the reform started leading to the current programme, which was implemented in 2012 (MEP 2017, IIPE-UNESCO. 2017)
  - National Food Security and Nutrition Policy 2011-2012 (IIPE-UNESCO. 2017)

- **Dominican Republic**
    - Comedores Económicos del Estado established in 1942 (CELAC 2017, J. Valdés 2005)
    - Solidaridad: Componente Comer es Primero established in 2004 (CELAC 2017, J. Valdés 2005, IIPE-UNESCO. 2017)
    - Programa Vaso de Leche escolar, the existing programme until 1997(de los Santos 2015)
    - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)
    - Programa de Alimentación Escolar (PAE) that started as local in some regions and in bordering territories, reached national coverage in 2004 (CELAC 2017, J. Valdés 2005, de los Santos 2015)
    - Programa de Alimentación Complementaria probably implemented in 2003, but whose registers are not openly accesible (J. Valdés 2005)
    - Plan de Asistencia Social de la Presidencia created in 1989 (J. Valdés 2005)
    - Programa de Distribución de Alimentos (J. Valdés 2005)
    - Programa de Ventas Populares (Comité Nacional de Seguridad Alimentaria 2002)
    - Plan Nacional de Alimentación y Nutrición (PLANAN) in force between 1998 and 2005 (Comité Nacional de Seguridad Alimentaria 2002)
    - Programa Especial de Seguridad Alimentaria (PESA) in cooperation with FAO in force between 2003 and 2010 (Comité Nacional de Seguridad Alimentaria 2002)
    - Programa nacional para la Seguridad Alimentaria (PANSA) (Comité Nacional de Seguridad Alimentaria 2002)
    - 70 agreements were signed with NGOs related to food security and nutrition, with national scope (Comité Nacional de Seguridad Alimentaria 2002)
    - Programa de Alimentación Escolar "Ración Escolar de Alimentos Locales (PAEL-REAL)" (Comité Nacional de Seguridad Alimentaria 2002)

- Programa Centros de Atención Integral a la Primera Infancia (CIAPI and CAIFI) has no available information about its implementation (IIPE-UNESCO. 2017)
- Programa Nacional de Seguridad Alimentaria y Nutrición Cero Hambre implemented in 2013(El Nacional. 2013)

- **Ecuador**
  - Programa de Alimentación Escolar established in 1989 (CELAC 2017, Calero León 2011)
  - Programa PANN 2000 (Calero León 2011)
  - Programa de Centros Infantiles del Buen Vivir implemented on 2007 (CELAC 2017, IIPE-UNESCO. 2017)
  - Programa Provisión de Alimentos established in 2008 (Calero León 2011)
  - Programa Aliméntate Ecuador that on 2012 changed its name to Proyecto Alimentario Nutricional Integral, implemented in 2009 (CELAC 2017, Calero León 2011)
  - Proyecto Alimentario Nutricional Integral implemented on 2009 (CELAC 2017)
  - Proyecto Alimentario Nutricional Integral (PANI) implemented in 2009 (IIPE-UNESCO. 2017)
  - Proyecto Desnutrición Cero that was implemented in 2010 and extended in 2012(IIPE-UNESCO. 2017, Vivero Palacios 2014)
- **El Salvador**
  - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)
  - Programa de Alimentación y Salud Escolar (PASE) implemented in 1984 (CELAC 2017, Ministerio de Educación El Salvador 2011)
  - Programa conjunto de Seguridad Alimentaria y Nutricional para la Niñez y el Hogar Salvadoreño established in 2015 (CELAC 2017)
  - Programa Especial para la Seguridad Alimentaria (PESA) implemented in 2000 (FAO. 2017)
  - Política Nacional de Protección Integral de la Niñez y la Adolescencia de el Salvador (PNPNA) implemented in 2013 (IIPE-UNESCO. 2017)
  - "Programa Vaso de Leche" implemented in 2011 (IIPE-UNESCO. 2017)
  - "Política Centros de Desarrollo Integral" implemented in 1993(IIPE-UNESCO. 2017, Gobierno de El Salvador 1993)

- **Guatemala**
    - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)
    - Mi Comedor Seguro implemented in 2012 (CELAC 2017, IIPE-UNESCO. 2017)
    - Mi Bolsa Segura implemented in 2012(CELAC 2017, IIPE-UNESCO. 2017)
    - Programa Hogares Comunitarios started in 1991 (CELAC 2017, IIPE-UNESCO. 2017)
    - Programa de Desayunos Escolares implemented in 2010 (CELAC 2017)
    - Programa Ventana de los 1000 Días implemented in 2013 (CELAC 2017, Organización Panamericana de la Salud and Organización Mundial de la Salud. n.d.)
    - Programa de Asistencia Alimentaria established in 2005 (CELAC 2017, Procurador de los Derechos Humanos 2009)
    - Programa de Alimentos por Acciones established in 2005 (CELAC 2017, Procurador de los Derechos Humanos 2009)
    - Programa Vaso de Leche Escolar implemented in 2005 (Procurador de los Derechos Humanos 2009)
    - Mi Comidita implemented in 2014 (CELAC 2017)
    - Plan Estratégico de Seguridad Alimentaria y Nutricional (PESAN) 2012-2016 (IIPE-UNESCO. 2017)
    - Programa de Seguridad Alimentaria y Nutricional (PROSAN) created in 2012 (CELAC 2017)
    - Bolsa de Alimentos of the year 2008 (CELAC 2017)
    - Programa Comedores (CELAC 2017)
    - Pacto Hambre Cero established in 2012 (CELAC 2017, IIPE-UNESCO. 2017)
    - International Cooperation from the Italian Agency for Cooperation towards Development (USAID Guatemala 2009)
    - FAO implemented a Programme of National and Regional Food Security and agricultural development between the years 2009 and 2012 (USAID Guatemala 2009)
    - Programa Especial para la Seguridad Alimentaria (PESA) implemented in the year 2000 (FAO. 2017)
    - Programa de Centros de Atención Integral implemented in 1998 (IIPE-UNESCO. 2017)

- Programa Extraordinario de Seguridad Alimentaria y Nutricional implemented with the World Food Programme and the FAO in 2009 for a period of 24 months (thus ending in June 2011) (European Union External Action. n.d.)

- **Honduras**
  - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)
  - Programa Especial para la Seguridad Alimentaria implemented in 2000 (PESA) (FAO. 2017)
  - Comedores Solidarios implemented in 1993 (CEPAL 2017, Gobierno de Honduras, Secretaría de Finanzas 2012)
  - Programa Escuelas Saludables created in 1998 (CELAC 2017)
  - Programa Vida Mejor (CELAC 2017)
  - Proyecto de Iniciativas Socio Productivas con Participación de la Mujer en los Municipios de Mayor Pobreza de Hondruas (SAG) (SANTIC Honduras 2009)
  - Asistencia Integral a Grupos Vulnerables Mujeres y Niños along with the WFP initiated in 1998 (IIPE-UNESCO. 2017, WFP- Honduras 2004)
  - Proyecto Hogares Gestores de Salud (HOGASA) implemented in 1996 (IIPE-UNESCO. 2017, CARE USA 2011)
  - Proyecto de Nutrición y Protección Social del AIN-C implemented in 2006 (IIPE-UNESCO. 2017)
  - Política Atención Integral a la Niñez Comunitario (AIN-C) implemented in 1991 (IIPE-UNESCO. 2017)
  - Programa de Asignación Familiar (PRAF) implemented in 1990 (IIPE-UNESCO. 2017)
- **Jamaica**
  - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)
  - National School Garden (CELAC 2017)
  - Jamaica Food Stamp Programme introduced in 1984(Government of Jamaica 2002, Grosh 1992)
  - Food Production Programmes (Government of Jamaica 2002)
  - School Feeding Programme with Nutribuns and milk (Grosh 1992)

- School Feeding Programmes funded by international donations and cash subsidies (Grosh 1992)
- Pre-primary school subsidy (Grosh 1992)
- Clinical supplementation programme distributed food to children exhibiting moderate and severe malnutrition (Grosh 1992)
- Food Subsidies reinstated from 1986 to 1988 (Grosh 1992)
- Community Health Aides in the Ministry of Health (Grosh 1992)

- **Mexico**
  - Programa Arranque Parejo en la Vida that includes promotion of breastfeeding (Consejo Nacional para la Infancia y la Adolescencia 2010)
  - Programa Oportunidades: componente de salud y nutrición (nutrition and health component) is complemented by Programa de Apoyo Alimentario for marginalized communities that are not reached by the Programa Oportunidades (Consejo Nacional para la Infancia y la Adolescencia 2010, CELAC 2017)
  - Programa de Abasto Social de Leche (PASL)(Consejo Nacional para la Infancia y la Adolescencia 2010, CELAC 2017, IIPE-UNESCO. 2017)
  - Desayunos Escolares (Consejo Nacional para la Infancia y la Adolescencia 2010, CELAC 2017)
  - Asistencia Alimentaria a Familias en Desamparo (Consejo Nacional para la Infancia y la Adolescencia 2010)
  - Programa de Abasto Rural (CELAC 2017)
  - Programa de Comedores Comunitarios (CELAC 2017)
  - Programa de Estancias Infantiles para Apoyar a Madres Trabajadoras (CELAC 2017)
  - Programa Albergues Escolares Indígenas (PAEI) existing for over 40 years (IIPE-UNESCO. 2017)
  - Estrategia Integral de Asistencia Social Alimentaria (EIASA) implemented in 2001 and reoriented in 2007(IIPE-UNESCO. 2017)
  - Programa de Apoyo Alimentario (PAL) implemented in 2009(IIPE-UNESCO. 2017)
- **Nicaragua**
  - Programa Usura Cero (Gobierno de Reconciliación y Unidad Nacional Nicaragua 2011)

- Programa Integral de Nutrición Escolar (PINE) (Gobierno de Reconciliación y Unidad Nacional Nicaragua 2011, CELAC 2017)
- Programa Especial para la Seguridad Alimentaria (PESA) established in 1999 and implemented in 2000 (FAO. 2017, MAGFOR 2002)
- Programmes targeted to population in food insecurity situations conducted by the WFP who conducts necessary imports in order to fulfil its objectives(MAGFOR 2002)
- Programmes based on international and NGO aid targeted to decline food insecurity; all stakeholders agree that there are many, scattered and without any quantitative impact information or qualitative results (MAGFOR 2002)
- Programa Amor (CELAC. 2017, IIPE-UNESCO. 2017)
- Programa Amor para los más Chiquitos y Chiquitas established in 2011 (CELAC. 2017, IIPE-UNESCO. 2017)
- Programa de Seguridad Alimentaria y Nutricional (PSAN) established on 2006 (CELAC. 2017, IIPE-UNESCO. 2017)
- Programa Alimentos para el Pueblo (CELAC. 2017)
- Programa Hambre Cero implemented in 2007(IIPE-UNESCO. 2017)
- Programa Nacional de Erradicación de la Desnutrición Crónica implemented in 2009(IIPE-UNESCO. 2017)
- Programa Temático de Seguridad Alimentaria: Programa de Mejora de la Asistencia Alimentaria para grupos vulnerables y fortalecimiento de sus medios de vida para una mayor seguridad alimentaria (PAMAA) (European Union External Action. n.d.)

- **Panamá**
  - Plan Nacional para la Seguridad Alimentaria Nutricional (1998-2002) (MINSA n.d.)
  - Plan Nacional de Seguridad Alimentaria y Nutricional implemented in 2009(IIPE-UNESCO. 2017)
  - Programa de Salud Nutricional (IIPE-UNESCO. 2017)
  - Programa Nacional de Nutrición y Alimentación (PRONAN) (MINSA n.d.)
  - Salvemos a los Niños (MINSA n.d.)
  - Dirección Nacional de Nutrición y Salud Escolar established in 1995 that provides snacks and school lunch (MINSAn.d.)

- Merienda Escolar (CELAC. 2017)
- Programa de Solidaridad Alimentaria (CELAC. 2017)
- Comedores Comunitarios (CELAC. 2017, IIPE-UNESCO. 2017)
- Programa para la Solidaridad Alimentaria (CELAC. 2017)

- **Paraguay**
  - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)
  - Programa Alimentario Nutricional Integral (PANI) implemented in 2005(CELAC. 2017, IIPE-UNESCO. 2017)
  - Proyecto de apoyo a Comedores de Organizaciones Comunitarias (CELAC. 2017)
  - Programas de Alimentación Escolar (CELAC. 2017)
  - Programa Hogar Educativo Comunitario Mita Róga implemented in 1999 (IIPE-UNESCO. 2017)
  - Programa Tekoporâ implemented in 2005 (IIPE-UNESCO. 2017)
- **Perú**
  - Programa de Asistencia Directa (PAD) (Gobierno del Perú 1992)
  - Programa Nacional de Asistencia Alimentaria (PRONAA) established in 1992 (Desarrollo e Inclusión Social 2012b, IIPE-UNESCO. 2017)
  - Programa Integral de Nutrición (PIN) which resulted from the union of 6 nutritional programmes managed hitherto by PRONAA and was extinguished with it(Desarrollo e Inclusión Social 2012b)
  - Programa de Complementación Alimentaria (CELAC. 2017)
  - Programa Comedores Populares(Contraloría General de la República 2008)
  - Programa Hogares y Albergues (Contraloría General de la República 2008)
  - Programa Alimentos por Trabajo (Contraloría General de la República 2008)
  - Programa de Apoyo a la Seguridad Alimentaria (PESA) of the European Union and Peru (Andrade Ciudad 2008)
  - Programa Conjunto de Infancia, Nutrición y Seguridad Alimentaria established in 2009 (FAO. n.d.a)
  - FAO and Federative Government of Brazil, Project Strengthening School Feeding Programs, implemented in 2009 (FAO. n.d.b)

- Programa Nacional Cuna Más established in 2012 (CELAC. 2017, IIPE-UNESCO. 2017)
- Programa Nacional de Alimentación Escolar Qali Warma established in 2012 (CELAC. 2017, Desarrollo e Inclusión Social 2012a, IIPE-UNESCO. 2017)
- Proyecto Nutriwawa implemented in 2014 (IIPE-UNESCO. 2017)

- **Uruguay**
  - Tarjeta Uruguay Social (CELAC. 2017)
  - Programa de Alimentación Escolar (CELAC. 2017)
  - Sistema Nacional de Comedores (CELAC. 2017)
  - Programa de Atención al Riesgo Nutricional (CELAC. 2017)
  - Programa Nacional de Nutrición (CELAC. 2017)
  - Programa Alimentario Nacional (PAN) (IIPE-UNESCO. 2017)
- **Venezuela**
  - Misión Alimentación established in 2003(CELAC. 2017)
  - Programa de Alimentación Escolar (PAE) (CELAC. 2017, República Bolivariana de Venezuela 2002)
  - Misión Madres del Barrio established in 2006(CELAC. 2017)
  - Programa Misión Niños y Niñas del Barrio implemented in 2008 (IIPE-UNESCO. 2017)
  - Gran Misión Abastecimiento Soberano established in 2016(CELAC. 2017)
  - Programa Especial de Seguridad Alimentaria (PESA) (República Bolivariana de Venezuela 2002)
  - Caja Nacional Agroalimentaria- Rubros banderas (República Bolivariana de Venezuela 2002)
  - Technical Cooperation Agreement with Asian countries, mainly PR China, regarding development of the agricultural and agrifood sectors (República Bolivariana de Venezuela 2002)
  - Programa de Alimentos Estratégicos (PROAL) (República Bolivariana de Venezuela 2002)
  - Consejo Nacional de la Alimentación handled in 2002 many food security programmes(República Bolivariana de Venezuela 2002)
  - Provision of food packages to population in need (República Bolivariana de Venezuela 2002)

- Programa del pabellón popular(República Bolivariana de Venezuela 2002)
- Programa de Comedores Comunitarios(República Bolivariana de Venezuela 2002)
- Comprehensive Cooperation Agreement Cuba-Venezuela (República Bolivariana de Venezuela 2002)
- Plan de Asistencia Alimentaria Popular that fused some existing programmes, including PROAL whose coverage was increased, with new ones focused in food provision (República Bolivariana de Venezuela 2002)
- Programa Simoncito Comunitario(IIPE-UNESCO. 2017)
- Programa Misión Hijos de Venezuela (IIPE-UNESCO. 2017)
- Programa Servicios de Educación y Recuperación Nutricional (IIPE-UNESCO. 2017)
- Programa Casas Comunales de Abrigo implemented in 2009(IIPE-UNESCO. 2017)
- Misión Niño Jesús implemented in 1999(IIPE-UNESCO. 2017)

Appendix 2: Nutritional & Public Health Status in the Americas, Prevalence of Hunger measured by its indicators

Table 20 Prevalence of Undernourishment (% of population) for the Latin American Countries included in this research, for the years 1991 to 2015

PREVALENCE OF UNDERNOURISHMENT

Country Name	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Argentina	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00
Bolivia	38,00	35,90	36,50	35,70	35,30	33,70	34,10	35,00	36,00	34,60	32,80	31,00
Brazil	14,80	14,30	14,30	14,10	13,80	13,60	13,30	13,10	12,90	12,30	11,20	9,60
Chile	9,00	8,10	7,10	6,30	5,80	5,50	5,30	5,20	5,10	5,00	5,00	5,00
Colombia	14,60	13,80	12,80	11,70	10,70	10,20	10,00	10,10	10,20	9,90	9,60	9,00
Cuba	5,70	9,00	13,10	18,30	20,70	20,10	16,80	12,60	8,70	5,60	5,00	5,00
Costa Rica	5,20	5,40	5,40	5,40	5,40	5,60	5,80	5,90	5,60	5,20	5,10	5,40
Dominican Republic	34,30	32,10	30,70	28,10	26,90	27,30	29,40	31,40	31,90	30,70	28,40	27,40
Ecuador	19,40	19,40	17,00	15,70	14,70	15,10	15,80	16,50	17,20	17,80	18,60	19,30
El Salvador	16,20	15,10	15,40	15,40	15,60	15,40	15,00	14,60	13,80	12,50	10,60	9,30
Guatemala	14,90	15,40	15,30	15,20	15,50	17,10	19,30	21,70	22,30	22,10	20,40	18,70
Haiti	61,10	61,50	62,60	63,10	62,80	61,40	59,60	57,80	56,10	55,20	55,20	56,10
Honduras	23,00	22,70	21,90	21,30	20,50	19,80	19,30	19,30	19,20	19,00	18,50	17,80
Mexico	6,90	6,80	6,70	6,60	6,40	6,10	5,80	5,50	5,00	5,00	5,00	5,00
Jamaica	10,40	10,50	9,60	8,90	8,40	8,40	8,40	8,50	8,20	7,80	7,30	6,80
Nicaragua	54,40	52,70	51,50	48,30	45,10	42,90	41,40	40,20	37,80	34,80	31,30	28,30
Panama	26,40	25,90	23,90	23,20	23,50	25,60	26,20	26,50	26,00	27,40	27,60	26,30
Paraguay	19,50	19,90	19,20	18,00	16,50	15,60	15,00	14,50	13,90	13,30	12,90	12,10
Peru	31,60	28,10	28,60	27,50	26,50	25,10	23,70	22,90	22,30	21,60	20,70	20,60
Uruguay	8,60	6,40	5,80	5,10	5,00	5,30	5,20	5,00	5,00	5,00	5,00	5,00
Venezuela, RB	14,10	13,20	13,20	13,90	14,80	16,00	17,20	18,50	18,10	16,60	15,30	15,10
Year Average	**20,62**	**20,06**	**19,79**	**19,37**	**19,00**	**18,80**	**18,65**	**18,56**	**18,11**	**17,45**	**16,69**	**16,09**

Country Name	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Argentina	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5
Bolivia	30,80	31,00	31,10	29,90	28,70	28,00	28,00	27,00	24,50	21,10	18,30	16,60	15,9
Brazil	7,80	6,10	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5
Chile	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5
Colombia	8,90	8,90	9,50	9,70	9,40	9,20	9,60	10,70	11,20	11,10	10,30	9,50	8,8
Cuba	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5
Costa Rica	5,90	6,10	6,00	5,60	5,20	5,20	5,30	5,30	5,30	5,40	5,70	5,50	5
Dominican Republic	27,60	28,30	26,90	24,20	21,70	20,50	19,80	18,10	15,90	14,00	13,00	12,50	12,3
Ecuador	19,60	19,80	19,30	18,80	17,80	17,10	15,80	14,40	12,80	11,80	11,40	11,10	10,9
El Salvador	8,90	9,40	10,20	10,70	11,00	11,20	11,50	12,00	12,60	12,90	12,80	12,60	12,4
Guatemala	16,90	16,30	16,20	15,90	15,50	15,10	15,20	14,80	14,80	14,80	15,30	15,60	15,6
Haiti	57,00	57,70	57,60	57,10	55,80	54,40	52,30	50,60	49,30	49,30	50,70	52,30	53,4
Honduras	17,10	16,80	16,70	16,40	15,90	15,30	15,00	14,90	14,60	13,70	12,80	12,30	12,2
Mexico	5,40	5,50	5,30	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5
Jamaica	6,60	6,60	6,80	7,00	7,30	7,60	8,00	8,20	8,30	8,50	8,80	8,70	8,1
Nicaragua	26,40	25,10	24,30	23,20	22,30	21,50	21,00	20,30	19,50	18,50	17,70	17,10	16,6
Panama	24,40	23,40	23,80	22,90	21,10	18,40	16,40	14,80	13,40	12,00	10,80	10,00	9,5
Paraguay	11,10	10,50	10,70	11,20	11,40	11,90	12,30	12,40	12,10	11,80	11,60	11,10	10,4
Peru	20,90	21,20	20,30	18,90	17,00	15,40	13,70	12,20	10,70	9,60	8,80	8,10	7,5
Uruguay	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5
Venezuela, RB	15,30	13,80	11,70	9,00	6,80	5,00	5,00	5,00	5,00	5,00	5,00	5,00	5,0
Year Average	**15,74**	**15,55**	**15,30**	**14,79**	**14,14**	**13,61**	**13,28**	**12,89**	**12,38**	**11,88**	**11,57**	**11,33**	**11,1**

Table 21 Prevalence of Wasting, weight for height (% of children under 5) for the Latin American Countries included in this research, for the years 1991 to 2015

PREVALENCE OF WASTING

Country Name	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Argentina	..	..	..	..	..	..	..	..	1,60	..	4,20	..	..	..	..
Bolivia	..	..	..	2,20	..	..	..	..	5,30	..	..	..	1,60	..	..
Brazil	..	..	..	..	..	..	..	..	..	..	2,80	..	..	..	..
Chile	0,70	..	..	..	..	..	..	..	0,50	0,50	0,50	..	0,60	0,50	..
Colombia	1,30	..	..	3,80	..	..	..	..	..	1,70	..	..	..	..	1,10
Cuba	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2,40
Costa Rica	..	..	..	..	..	..	..	..	..	..	3,10	..	..	..	..
Dominican Republic	2,50	..	..	..	..	2,20	..	..	..	..	2,00	..	..	..	1,50
Ecuador	2,30	..	..	..	..	..	..	..	..	..	..	..	3,20	..	..
El Salvador	..	..	2,20	..	..	..	..	1,40	..	..	..	..	1,50	..	..
Guatemala	..	2,40	..	..	..	..	..	..	..	3,80	..	..	..	2,90	3,70
Haiti	..	..	..	..	5,90	..	..	..	9,40	..	..	..	..	..	5,60
Honduras	..	2,30	..	..	..	..	2,10	..	2,70	..	1,30	..	..	..	..
Mexico	..	..	7,40	6,10	..	..	..	..	..	..	8,50	..	2,30	..	..
Jamaica	..	..	..	4,40	..	5,30	3,20	4,50	2,90	4,50	2,50	2,30	2,90	2,50	3,00
Nicaragua	..	..	..	..	..	..	..	2,40	..	..	..	..	3,30	..	..
Panama	..	..	..	..	..	..	..	..	..	..	..	1,40	..	..	..
Paraguay	..	..	..	..	0,60	..	..	..	..	..	..	..	..	..	..
Peru	..	..	..	..	..	1,90	..	..	..	..	1,60	..	..	..	1,10
Uruguay	..	..	..	..	..	..	..	..	..	..	..	..	..	2,00	..
Venezuela, RB	..	2,20	..	..	5,70	4,50	4,30	4,00	3,80	3,80	3,80	3,80	4,40	4,00	3,90
Year Average	**1,70**	**2,30**	**4,80**	**4,13**	**4,07**	**3,48**	**3,20**	**3,08**	**3,74**	**2,86**	**3,03**	**2,50**	**2,48**	**2,38**	**2,79**

Country Name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Argentina	..	..	..	..	1,20	..	..	..	..	..	..	..	..	..	..
Bolivia	..	..	1,70	..	..	..	..	1,40	..	..	..	..	..	..	..
Brazil	..	..	..	..	..	..	1,60	..	..	..	..	..	..	..	..
Chile	0,50	0,50	0,50	0,50	..	0,50	0,30	0,30	..	..	..	..	0,30	0,30	..
Colombia	..	..	..	..	1,50	..	..	..	..	0,90	..	..	..	..	..
Cuba	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Costa Rica	..	..	..	..	..	..	..	1,00	..	..	..	..	..	..	..
Dominican Republic	..	2,20	..	..	..	1,90	2,30	..	..	..	..	..	2,40	..	..
Ecuador	..	..	..	2,30	..	..	..	..	..	..	..	2,30	..	..	..
El Salvador	..	..	1,30	..	..	..	..	1,60	..	..	..	..	..	2,00	..
Guatemala	..	1,80	..	..	..	..	..	..	1,10	..	..	..	..	..	0,7
Haiti	..	..	..	..	..	10,30	..	..	..	..	..	5,20	..	..	..
Honduras	1,20	..	..	..	..	1,40	..	..	..	..	..	1,40	..	..	..
Mexico	..	..	..	..	..	2,00	..	..	..	..	..	1,60	..	..	..
Jamaica	2,90	2,30	..	4,50	..	3,30	2,30	2,10	..	3,50	..	3,00	..	..	..
Nicaragua	2,30	..	..	0,30	..	1,50	..	..	..	..	..	..	..	..	..
Panama	..	..	..	..	..	..	..	1,20	..	..	..	..	..	..	..
Paraguay	..	..	..	..	1,10	..	..	..	..	..	..	2,60	..	..	..
Peru	..	..	..	..	1,00	..	..	0,80	0,60	0,70	0,40	0,60	..	0,60	..
Uruguay	..	2,40	2,40	3,00	..	..	2,20	..	..	..	1,10	..	..	..	..
Venezuela, RB	4,40	4,80	5,20	5,20	4,80	4,80	5,00	4,50	4,10	..	..	..	..	..	..
Year Average	**2,26**	**2,33**	**2,22**	**2,63**	**1,92**	**3,21**	**2,28**	**1,61**	**1,93**	**1,70**	**0,75**	**2,39**	**1,35**	**0,97**	**0,7**

Table 22 Prevalence of Underweight, weight for age (% of children under 5) for the Latin American Countries included in this research, for the years 1991 to 2015

PREVALENCE OF UNDERWEIGHT

Country Name	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Argentina	..	..	..	..	..	..	..	..	1,70	..	4,70	..	..	..	..	..	..	..	..	2,30	..	..	..	..	..	..	..	..	..	..
Bolivia	..	..	9,80	8,90	9,70	10,20	10,50	..	12,60	..	..	..	5,90	..	..	..	..	5,90	..	..	..	..	4,50	..	..	..	..	..	..	..
Brazil	..	..	..	5,30	..	..	..	..	..	..	4,50	..	..	..	..	..	3,70	..	..	..	..	2,20	..	..	..	..	..	..	..	..
Chile	2,20	..	..	..	..	..	..	..	0,80	0,80	0,70	..	0,70	0,70	..	0,70	0,70	0,60	0,60	..	0,60	0,60	0,50	..	..	..	..	0,50	0,50	..
Colombia	8,60	..	..	8,80	..	..	..	..	..	6,30	..	..	..	..	4,90	..	..	..	..	5,10	..	..	..	..	3,40	..	..	..	..	..
Cuba	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3,40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Costa Rica	..	..	..	2,40	2,50	2,20	2,00	2,00	1,90	..	4,50	..	..	..	..	..	..	..	..	..	..	..	1,10	..	..	..	..	..	..	..
Dominican Republic	9,30	..	..	..	..	8,40	..	..	..	..	4,70	..	..	..	3,50	..	4,20	..	..	..	4,60	3,40	..	..	..	..	..	4,00	..	..
Ecuador	14,50	..	..	..	..	..	..	..	..	..	..	..	12,50	..	..	..	..	..	6,20	..	..	..	..	..	..	..	6,40	..	..	..
El Salvador	..	..	11,10	..	..	..	..	7,20	..	..	..	..	9,60	..	..	..	..	6,10	..	..	..	..	6,60	..	..	..	..	..	5,00	..
Guatemala	..	27,80	..	..	..	..	..	..	..	21,70	..	..	..	20,30	19,60	..	17,70	..	..	..	..	..	..	13,00	..	..	..	..	..	12,6
Haiti	..	..	..	..	23,70	..	..	..	24,00	..	..	..	..	..	13,90	..	..	..	..	..	18,90	..	..	..	..	..	11,60	..	..	..
Honduras	..	18,10	..	..	..	..	15,80	..	16,10	..	19,20	..	..	..	..	12,50	..	..	..	..	8,60	..	..	..	..	..	7,10	..	..	..
Mexico	..	..	12,40	13,90	..	..	..	..	..	..	14,80	..	6,00	..	..	..	..	..	..	..	3,40	..	..	..	..	..	2,80	..	..	..
Jamaica	..	..	..	6,30	..	4,00	7,00	8,90	4,50	4,00	5,60	3,50	3,40	2,30	3,80	4,10	2,60	..	3,10	..	3,70	1,80	2,00	..	3,20	..	2,50	..	..	..
Nicaragua	..	..	..	..	..	..	..	9,60	..	..	..	..	10,30	..	..	7,80	..	..	4,30	..	5,70	..	..	..	..	..	..	..	..	..
Panama	..	..	..	..	..	..	..	..	..	..	..	6,30	..	..	..	..	..	5,10	..	..	..	..	3,90	..	..	..	..	..	..	..
Paraguay	..	..	..	..	2,80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3,40	..	..	..	..	..	..	2,60	..	..	..
Peru	..	..	..	..	..	8,80	..	..	..	..	5,70	..	..	..	5,20	..	..	..	..	5,40	..	..	4,50	4,30	4,30	4,20	3,50	..	3,10	..
Uruguay	..	6,50	..	..	..	..	..	..	..	..	..	..	..	5,20	..	..	5,40	5,70	6,00	..	..	4,70	..	..	..	4,50	..	..	..	..
Venezuela, RB	..	3,90	..	..	6,70	5,40	4,50	4,00	3,90	4,10	4,40	4,50	4,60	4,10	3,90	4,00	4,20	4,60	4,50	4,10	3,90	3,70	3,20	2,90	..	..	..	..	..	..
Year Average	**8,65**	**14,07**	**11,10**	**7,60**	**9,08**	**6,50**	**7,96**	**6,34**	**8,19**	**7,38**	**6,88**	**4,77**	**6,63**	**6,52**	**7,28**	**5,82**	**5,50**	**4,67**	**4,12**	**4,06**	**6,17**	**2,73**	**3,29**	**6,73**	**3,63**	**4,35**	**5,21**	**2,25**	**2,87**	**12,6**

Table 23 Prevalence of Stunting, height for age (% children under 5) for the Latin American Countries included in this research, for the years 1991 to 2015

PREVALENCE OF STUNTING																														
Country Name	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Argentina	..	..	..	..	..	..	..	..	7,10	..	16,90	..	..	..	..	..	..	..	..	8,20	..	..	..	..	..	..	..	..	..	..
Bolivia	..	..	..	41,70	..	..	..	..	35,20	..	..	..	33,10	..	..	..	..	32,50	..	..	..	..	27,20	..	..	..	..	..	..	..
Brazil	..	..	..	19,40	..	..	..	..	..	..	13,50	..	..	..	..	..	..	..	..	..	..	7,10	..	..	..	..	..	..	..	..
Chile	13,50	..	..	..	..	..	..	..	4,20	3,90	3,70	..	3,30	3,10	..	2,80	2,50	2,50	2,40	..	2,20	2,10	2,00	..	..	..	..	1,80	1,80	..
Colombia	25,90	..	..	21,80	..	..	..	..	..	19,70	..	..	..	..	18,10	..	..	..	..	16,20	..	..	..	..	12,70	..	..	..	..	..
Cuba	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7,00	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Costa Rica	..	..	..	..	..	..	..	..	..	..	9,00	..	..	..	..	..	..	..	..	..	..	..	5,60	..	..	..	..	..	..	..
Dominican Republic	22,20	..	..	..	..	21,20	..	..	..	..	13,90	..	..	..	8,00	..	11,70	..	..	..	10,50	10,10	..	..	..	..	..	7,10	..	..
Ecuador	40,20	..	..	..	..	..	..	..	..	..	..	..	32,50	..	..	..	..	..	29,00	..	..	..	..	..	..	..	25,20	..	..	..
El Salvador	..	..	36,70	..	..	..	..	29,50	..	..	..	..	32,30	..	..	..	..	24,60	..	..	..	..	20,60	..	..	..	..	..	14,00	..
Guatemala	..	62,10	..	..	..	..	..	..	..	55,40	..	..	..	53,10	50,00	..	54,30	..	..	..	..	..	..	48,00	..	..	..	..	..	46,5
Haiti	..	..	..	..	40,10	..	..	..	37,20	..	..	..	..	..	28,30	..	..	..	..	..	29,70	..	..	..	..	..	21,90	..	..	..
Honduras	..	43,30	..	..	..	..	42,50	..	45,70	..	43,30	..	..	..	..	34,50	..	..	..	..	29,90	..	..	..	..	..	22,70	..	..	..
Mexico	..	..	28,70	40,40	..	..	..	..	..	..	40,10	..	21,70	..	..	..	..	..	..	..	15,50	..	..	..	..	..	13,60	..	..	..
Jamaica	..	..	..	12,40	..	9,10	14,70	13,50	11,90	9,50	11,10	8,60	8,30	6,30	6,60	6,40	6,60	..	4,50	..	5,60	3,80	5,20	..	4,80	..	5,70	..	..	..
Nicaragua	..	..	..	..	..	..	..	29,60	..	..	..	..	30,50	..	..	25,20	..	..	18,80	..	23,00	..	..	..	..	..	..	..	..	..
Panama	..	..	..	..	..	..	..	..	..	..	..	21,50	..	..	..	..	..	22,20	..	..	..	..	19,10	..	..	..	..	..	..	..
Paraguay	..	..	..	..	18,30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17,50	..	..	..	..	..	..	10,90	..	..	..
Peru	..	..	..	..	..	37,30	..	..	..	..	31,60	..	..	..	31,30	..	..	..	..	29,80	..	..	28,20	23,90	23,30	19,60	18,40	..	14,60	..
Uruguay	..	21,00	..	..	..	..	..	..	..	..	..	..	..	13,90	..	..	14,70	17,20	13,90	..	..	11,80	..	..	..	11,70	..	..	..	..
Venezuela, RB	..	7,00	..	..	18,60	18,20	18,30	17,40	17,90	18,90	19,30	19,90	19,20	18,30	17,40	17,30	17,60	17,70	17,10	16,20	16,20	15,60	14,60	13,40	..	..	..	..	..	..
Year Average	**25,45**	**33,35**	**32,70**	**27,14**	**25,67**	**21,45**	**25,17**	**22,50**	**22,74**	**21,48**	**20,24**	**16,67**	**22,61**	**18,94**	**20,84**	**17,24**	**17,90**	**19,45**	**14,28**	**17,58**	**16,58**	**8,42**	**15,31**	**28,43**	**13,60**	**15,65**	**16,91**	**4,45**	**10,13**	**46,5**

Appendix 3: Results of Tariff, TOT and BOT over the Dependent Variables

Prevalence of Undernourishment

Table 24 Effect of Applied Tariffs (ln weighted mean for all products) over Prevalence of Undernourishment (% of total population)

PREVALENCE OF UNDERNOURISHMENT (% of total population)						
	1	2	3	4	5	6
ln of Tariffs Applied Rate (weighted mean for all products)	3.580***	-0.606	-0.547	-0.385	-0.392	0.061
	-1.141	-1.317	-1.308	-1.556	-1.579	-1.614
GDP per capita growth (annual %)			-0.043	-0.007	-0.007	0.007
			(0.076)	(0.077)	(0.076)	(0.083)
Number of programmes per year				-0.543*	-0.611	-0.252
				(0.297)	(0.652)	(0.510)
Quadratic number of programmes					0.003	0.028
					(0.021)	(0.024)
one period lagged programmes						-0.055
						(0.241)
two period lagged programmes						-0.178
						(0.163)
three period lagged programmes						-0.846**
						(0.296)
Constant	6.690***	19.496***	19.438***	22.060***	22.188***	22.481***
	-2.099	-3.116	-3.099	-3.556	-3.988	-4.078
F	9.84	.	.	.	.	.
N	376	376	374	354	354	354
r2	.2	.422	.416	.487	.487	.528
r2_a	.198	.38	.372	.444	.443	.483
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 25 Effect of Terms of Trade Adjustment (constant prices in local currency) over the prevalence of Undernourishment (% of total population)

PREVALENCE OF UNDERNOURISHMENT (% of total population)						
	1	2	3	4	5	6
Terms of Trade (constant LCU)	0.000	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita growth (annual %)			-0.154*	-0.111	-0.109	-0.099
			(0.086)	(0.075)	(0.075)	(0.079)
Number of programmes per year				-0.534	-0.850	-0.639
				(0.356)	(0.776)	(0.713)
Quadratic number of programmes					0.015	0.037
					(0.024)	(0.024)
one period lagged programmes						0.152
						(0.121)
two period lagged programmes						0.072
						(0.118)
three period lagged programmes						-1.069***
						(0.277)
Constant	14.390***	19.804***	20.164***	22.015***	22.620***	23.489***
	(0.000)	-1.394	-1.452	-2.073	-2.844	-2.744
F	.	.	.	.	.	.
N	457	457	457	432	432	432
r2	3.28e-07	.45	.458	.519	.523	.553
r2_a	-.0022	.418	.425	.487	.49	.518
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 26 Effect of the Balance of Trade (2000=100) in USD in Value and Volume over the prevalence of Undernourishment (% of total population)

		(0.004)		(0.003)		(0.003)		(0.003)		(0.002)		(0.002)
GDP per capita growth (annual %)					-0.136*	-0.149*	-0.089	-0.105	-0.087	-0.104	-0.071	-0.090
					(0.075)	(0.076)	(0.061)	(0.066)	(0.061)	(0.066)	(0.063)	(0.068)
Number of programmes per year							-0.588*	-0.563	-0.877	-0.781	-0.548	-0.490
							(0.338)	(0.335)	(0.768)	(0.762)	(0.689)	(0.674)
Quadratic number of programmes									0.014	0.010	0.036	0.033
									(0.024)	(0.024)	(0.023)	(0.023)
one period lagged programmes											-0.015	0.035
											(0.112)	(0.116)
two period lagged programmes											0.084	0.076
											(0.124)	(0.123)
three period lagged programmes											-1.033***	-1.050***
											(0.259)	(0.283)
Constant	14.468***	14.360***	19.370***	19.701***	19.707***	20.045***	21.701***	21.947***	22.280***	22.367***	23.213***	23.266***
	(0.071)	(0.033)	-1.300	-1.383	-1.365	-1.431	-2.043	-2.037	-2.861	-2.820	-2.737	-2.700
F	16.7	6.21	.	.	.	.	.	.	.	.	.	.
N	473	464	473	464	473	464	448	439	448	439	448	439
r2	.133	.0608	.469	.458	.475	.466	.54	.527	.543	.529	.574	.56
r2_a	.131	.0588	.439	.427	.444	.434	.51	.496	.512	.497	.542	.527
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Tables 24, 25 and 26 present results for the impact of Tariffs, TOT and BOT over the prevalence of Undernourishment in the general population. Tariffs only have a significant effect in the first and most parsimonious specification. In this case, an increase of 1 percentage point in the tariff levels increases the prevalence of undernourishment by 3.58 percentage points, suggesting that a reduction in trade would increase the prevalence of undernourishment. For the TOT, almost all specifications have a strongly significant though minor coefficient in terms of magnitude, which indicate that an increase in 1 percentage point in the TOT- hence exports- increases undernourishment in an almost inexistent fraction of prevalence percentage point. Nevertheless, it must be clarified that such coefficient positive, thus an increase in the exports would seem to have an incremental effect over the prevalence of undernourishment. There is a significant negative of the BOT over such prevalence: an increase of 1 percentage point in either value or volume in the BOT- hence, again, exports- reduces undernourishment in a scope of 0.01 to 0.009 percentage points.

Prevalence of Wasting

Table 27 Effect of Applied Tariffs (ln weighted mean for all products) over Prevalence of Wasting (% of children under 5)

PREVALENCE OF WASTING (% of children under 5)						
	1	2	3	4	5	6
ln of Tariffs Applied Rate (weighted mean for all products)	0.395*	-0.026	-0.015	-0.140	-0.331	-0.203
	(0.221)	(0.316)	(0.340)	(0.255)	(0.257)	(0.277)
GDP per capita growth (annual %)			-0.025	-0.036	-0.045	-0.049
			(0.033)	(0.030)	(0.028)	(0.039)
Number of programmes per year				0.078	-0.298**	-0.272***
				(0.066)	(0.104)	(0.075)
Quadratic number of programmes					0.014***	0.017**
					(0.003)	(0.006)
one period lagged programmes						0.042
						(0.242)
two period lagged programmes						-0.113
						(0.211)
three period lagged programmes						-0.044
						(0.154)
Constant	1.423***	1.976**	2.064**	2.880***	3.839***	3.816***
	(0.427)	(0.740)	(0.846)	(0.488)	(0.734)	(0.816)
F	3.21	.	.	.	.	.
N	93	93	93	90	90	90
R2	.067	.367	.375	.396	.513	.527
Adj. R2	.0568	.156	.154	.161	.312	.299
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 28 Effect of Terms of Trade Adjustment (constant prices in local currency) over the prevalence of Wasting (% of children under 5)

PREVALENCE OF WASTING (% of children under 5)						
	1	2	3	4	5	6
Terms of Trade (constant LCU)	-0.000**	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita growth (annual %)			0.026	-0.009	-0.018	-0.034
			(0.039)	(0.028)	(0.023)	(0.031)
Number of programmes per year				0.103*	-0.199**	-0.246***
				(0.058)	(0.080)	(0.083)
Quadratic number of programmes					0.012***	0.010*
					(0.003)	(0.005)
one period lagged programmes						0.166
						(0.164)
two period lagged programmes						-0.181**
						(0.064)
three period lagged programmes						0.123**
						(0.055)
Constant	2.289***	2.339***	2.293***	1.897***	2.642***	2.792***
	(0.008)	(0.267)	(0.314)	(0.403)	(0.343)	(0.469)
F	.	.	.	.	.	.
N	121	121	121	115	115	115
R2	.00594	.337	.341	.382	.478	.506
Adj. R2	-.00242	.116	.112	.141	.265	.278
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 29 Effect of Balance of Trade (2000=100) in Value and Volume over the prevalence of Wasting (% of children under 5)

PREVALENCE OF WASTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
Trade balance in Value	-0.001		-0.002		-0.002		-0.001		-0.001		-0.001	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Trade balance in Volume		-0.000		-0.002*		-0.002*		-0.001		0.000		-0.000
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
GDP per capita growth (annual %)					0.022	0.006	-0.005	-0.022	-0.006	-0.029	-0.021	-0.047
					(0.022)	(0.032)	(0.017)	(0.024)	(0.018)	(0.020)	(0.028)	(0.028)
number of programmes per year							0.085*	0.073	-0.115	-0.205**	-0.171*	-0.245***
							(0.045)	(0.049)	(0.087)	(0.078)	(0.090)	(0.071)
Quadratic number of programmes									0.008**	0.011***	0.005	0.008
									(0.003)	(0.003)	(0.005)	(0.006)
one period lagged programmes											0.168	0.176
											(0.180)	(0.162)
two period lagged programmes											-0.186***	-0.195***
											(0.055)	(0.061)
three period lagged programmes											0.159***	0.164**
											(0.049)	(0.058)
Constant	2.423***	2.328***	2.526***	2.467***	2.496***	2.457***	2.149***	2.143***	2.618***	2.750***	2.590***	2.714***
	(0.009)	(0.007)	(0.232)	(0.215)	(0.252)	(0.239)	(0.331)	(0.332)	(0.283)	(0.296)	(0.378)	(0.399)
F	.899	.0195	.	.	.	.	.	.	.	.	.	.
N	137	127	137	127	137	127	131	121	131	121	131	121
R2	.0044	.0000727	.31	.32	.313	.32	.338	.32	.378	.389	.409	.426
Adj. R2	-.00298	-.00793	.114	.107	.111	.0983	.122	.0728	.166	.157	.182	.18
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Tables 27, 28 and 29 present results for Tariffs, in weighted means for all products and expressed as natural logarithm, TOT and BOT over the Prevalence of Wasting. Tariffs only have a significant effect in one of the five specifications. In this case, an increase of 1 percentage point in the tariff levels increases the prevalence of wasting in approximately 0.4 percentage points, result that is in line with our previous findings and the literature included in this research. For the TOT, the first and most parsimonious specification has a strongly significant though minor coefficient in terms of magnitude, which indicates that an increase in 1 percentage point in the TOT- hence exports- increases in a tiny fraction of percentage point the prevalence of Wasting in children under 5 years of age. Regarding BOT, overall there is not a strong or significant relation between both values; being only two of them significant. Coefficients are negative, which is consistent with other results previously detailed.

Prevalence of Severe Wasting

Table 30 Effect of Applied Tariff Rate (ln weighted mean for all products) over Prevalence of Severe Wasting (% of children under 5)

PREVALENCE OF SEVERE WASTING (% of children under 5)						
	1	2	3	4	5	6
ln of Tariffs Applied Rate (weighted mean for all products)	0.178	-0.276**	-0.353**	-0.571**	-0.549**	-0.647**
	(0.118)	(0.127)	(0.160)	(0.247)	(0.253)	(0.275)
GDP per capita growth (annual %)			-0.033	-0.054**	-0.035	-0.047
			(0.024)	(0.023)	(0.030)	(0.031)
number of programmes per year during the research period				-0.072	-0.246**	-0.227
				(0.068)	(0.101)	(0.132)
quadratic number of programmes					0.013	0.011
					(0.008)	(0.007)
one period lagged programmes						-0.009
						(0.117)
two period lagged programmes						-0.142
						(0.157)
three period lagged programmes						0.152
						(0.114)
Constant	0.230	2.726***	3.008***	3.729***	3.696***	3.967***
	(0.212)	(0.432)	(0.498)	(0.849)	(0.956)	(0.919)
F	2.28	.	.	.	.	.
N	56	56	56	53	53	53
R2	.0699	.629	.644	.672	.721	.751
Adj. R2	.0527	.382	.389	.392	.462	.461
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 31 Effect of Terms of Trade Adjustment (constant prices in local currency) over the Prevalence of Severe Wasting (% of children under 5)

PREVALENCE OF SEVERE WASTING (% of children under 5)						
	1	2	3	4	5	6
Terms of Trade (constant LCU)	-0.000***	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita growth (annual %)			0.001	-0.007	0.004	-0.005
			(0.015)	(0.013)	(0.025)	(0.026)
Number of programmes per year				-0.017	-0.086	-0.100
				(0.057)	(0.091)	(0.148)
Quadratic number of programmes					0.005	0.006
					(0.008)	(0.008)
one period lagged programmes						0.070
						(0.133)
two period lagged programmes						-0.118
						(0.097)
three period lagged programmes						0.041
						(0.092)
Constant	0.569***	0.606***	0.605***	0.624***	0.819***	0.962***
	(0.000)	(0.109)	(0.114)	(0.097)	(0.234)	(0.290)
F	.	.	.	.	.	.
N	66	66	66	62	62	62
R2	.00427	.688	.688	.686	.696	.711
Adj. R2	-.0113	.452	.436	.383	.383	.348
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 32 Effect of Balance of Trade (2000=100) in Value and Volume over the Prevalence of Severe Wasting (% of children under 5)

PREVALENCE OF SEVERE WASTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
Trade balance in Value	-0.001		-0.001*		-0.001*		-0.001**		-0.001**		-0.001**	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Trade balance in Volume		-0.000		-0.001		-0.001		-0.002		-0.001		-0.002
		(0.000)		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)
GDP per capita growth (annual %)					0.000	-0.009	-0.006	-0.012	0.001	-0.009	-0.014	-0.019
					(0.014)	(0.016)	(0.018)	(0.014)	(0.023)	(0.019)	(0.023)	(0.019)
Number of programmes per year							-0.076	-0.034	-0.206	-0.074	-0.178	-0.068
							(0.065)	(0.053)	(0.128)	(0.072)	(0.130)	(0.161)
Quadratic number of programmes									0.010	0.003	0.011	0.003
									(0.008)	(0.006)	(0.008)	(0.006)
one period lagged programmes											0.043	0.054
											(0.118)	(0.132)
two period lagged programmes											-0.145	-0.152
											(0.128)	(0.108)
three period lagged programmes											0.048	0.083
											(0.126)	(0.119)
Constant	0.609***	0.591***	0.743***	0.761***	0.742***	0.754***	0.832***	0.835***	1.174***	0.926***	1.347***	1.060***
	(0.013)	(0.002)	(0.082)	(0.151)	(0.082)	(0.149)	(0.140)	(0.209)	(0.305)	(0.216)	(0.337)	(0.260)
F	2.57	.48	.	.	.	.	.	.	.	.	.	.
N	77	71	77	71	77	71	73	67	73	67	73	67
R2	.0396	.00285	.489	.675	.489	.677	.49	.674	.533	.678	.558	.7
Adj. R2	.0268	-.0116	.174	.446	.156	.434	.104	.385	.159	.375	.14	.36
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Tables 30, 31 and 32 present results regarding Tariffs, in weighted means for all products and expressed as natural logarithm, TOT and BOT over the Prevalence of Severe Wasting. Tariffs have a significant effect in four of five specifications, being the first specification of the opposite sign to the ones that include controls. In this case, there is an effect that moves contrary to theory and to what we have seen in the previous results, for an increase of 1 percentage point in the tariff levels reduces the prevalence of severe wasting in 0.28 to 0.65 percentage points. For the TOT, only one specification has a strongly significant though minor coefficient in terms of magnitude, which indicates that an increase in 1 percentage point in the TOT reduces in a tiny fraction of one percentage point the prevalence of severe wasting. Regarding the BOT, there is a strong and significant relation between both values in five specifications, suggesting that an increase in the TOT measured in Value reduces the prevalence of severe wasting, but it is very small in magnitude.

Prevalence of Underweight

Table 33 Effect of Applied Tariff Rate (ln weighted mean for all products) over Prevalence of Underweight (% of children under 5)

PREVALENCE OF UNDERWEIGHT (% of children under 5)						
	1	2	3	4	5	6
ln of Tariffs Applied Rate (weighted mean for all products)	1.688**	-0.579	-0.569	-0.780	-1.188***	-1.120**
	(0.593)	(0.613)	(0.621)	(0.481)	(0.385)	(0.441)
GDP per capita growth (annual %)			-0.027	-0.035	-0.055	-0.063
			(0.051)	(0.040)	(0.035)	(0.055)
Number of programmes per year				0.027	-0.820***	-0.809***
				(0.148)	(0.226)	(0.210)
Quadratic number of programmes					0.032***	0.034***
					(0.007)	(0.010)
one period lagged programmes						0.072
						(0.507)
two period lagged programmes						-0.191
						(0.315)
three period lagged programmes						0.047
						(0.117)
Constant	1.670	9.183***	9.165***	9.755***	13.744***	13.670***
	-1.159	-2.132	-2.158	-2.327	-1.434	-1.370
F	8.1	.	.	.	.	.
N	96	96	96	93	93	93
R2	.247	.631	.633	.629	.747	.75
Adj. R2	.239	.506	.502	.483	.642	.629
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 34 Effect of Terms of Trade Adjustment (constant prices in local currency) over the Prevalence of Underweight (% of children under 5)

PREVALENCE OF UNDERWEIGHT (% of children under 5)						
	1	2	3	4	5	6
Terms of Trade (constant LCU)	-0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita growth (annual %)			-0.030	-0.067	-0.079	-0.074
			(0.084)	(0.075)	(0.050)	(0.049)
number of programmes per year				0.042	-0.835***	-0.763***
				(0.155)	(0.250)	(0.261)
Quadratic number of programmes					0.037***	0.038***
					(0.009)	(0.013)
one period lagged programmes						-0.112
						(0.219)
two period lagged programmes						0.011
						(0.179)
three period lagged programmes						0.001
						(0.179)
Constant	6.079***	9.255***	9.311***	9.172***	11.212***	11.186***
	(0.022)	(0.869)	(0.834)	(0.926)	(0.590)	(0.908)
F	.	.	.	.	.	.
N	135	135	135	129	129	129
R2	.0029	.612	.613	.611	.72	.72
Adj. R2	-.0046	.5	.497	.482	.623	.611
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 35 Effect of Balance of Trade (2000=100) in Value and Volume over the Prevalence of Underweight (% of children under 5)

PREVALENCE OF UNDERWEIGHT (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
Trade Balance in Value	0.000		-0.001		-0.001		-0.001		0.001		0.001	
	(0.004)		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
Trade Balance in Volume		0.003		-0.003		-0.004		-0.003		0.001		0.001
		(0.004)		(0.002)		(0.002)		(0.002)		(0.002)		(0.001)
GDP per capita growth (annual %)					-0.030	-0.054	-0.049	-0.083	-0.050	-0.096*	-0.052	-0.094*
					(0.065)	(0.073)	(0.053)	(0.063)	(0.044)	(0.048)	(0.046)	(0.046)
Number of programmes per year							0.024	0.017	-0.722***	-0.835***	-0.702***	-0.769***
							(0.137)	(0.138)	(0.241)	(0.232)	(0.236)	(0.241)
Quadratic number of programmes									0.032***	0.037***	0.031**	0.036**
									(0.009)	(0.008)	(0.013)	(0.013)
one period lagged programmes											-0.020	-0.088
											(0.281)	(0.222)
two period lagged programmes											-0.025	-0.013
											(0.184)	(0.180)
three period lagged programmes											0.057	0.040
											(0.172)	(0.185)
Constant	5.920***	6.007***	9.119***	9.362***	9.159***	9.453***	9.025***	9.354***	10.702***	11.188***	10.490***	11.035***
	(0.029)	(0.024)	(0.867)	(0.848)	(0.836)	(0.804)	(0.854)	(0.819)	(0.583)	(0.560)	(0.804)	(0.865)
F	.0027	.486	.	.	.	.	.	.	.	.	.	.
N	151	141	151	141	151	141	145	135	145	135	145	135
R2	.0000265	.00603	.589	.601	.59	.604	.586	.603	.664	.698	.665	.698
Adj. R2	-.00668	-.00112	.486	.492	.483	.491	.467	.479	.564	.599	.553	.588
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Tables 33, 34 and 35 present the results regarding Tariffs, in weighted means for all products and expressed as natural logarithm, TOT and BOT over the prevalence of Underweight for the general population. Tariffs have a significant effect in three of the five specifications, but the values are inconsistent and hence rendered irrelevant for this case study. For TOT and BOT, all specifications have non-significant and statistically zero coefficients.

Prevalence of Stunting

Table 36 Effect of Applied Tariff Rate (ln weighted mean for all products) over Prevalence of Stunting (% of children under 5)

PREVALENCE OF STUNTING (% of children under 5)						
	1	2	3	4	5	6
ln of Tariffs Applied Rate (weighted mean for all products)	4.859***	0.623	0.612	0.796	0.665	0.862
	-1.006	-1.135	-1.175	-1.295	-1.373	-1.145
GDP per capita growth (annual %)			0.035	0.060	0.053	0.039
			(0.059)	(0.055)	(0.056)	(0.083)
Number of programmes per year				-0.203	-0.474	-0.253
				(0.142)	(0.351)	(0.369)
Quadratic number of programmes					0.010	0.015
					(0.011)	(0.018)
one period lagged programmes						-0.138
						(0.574)
two period lagged programmes						-0.783**
						(0.322)
three period lagged programmes						0.540*
						(0.268)
Constant	8.002***	27.055***	27.030***	27.718***	28.996***	28.916***
	-1.962	-4.063	-4.231	-4.618	-5.373	-4.881
F	23.3	.	.	.	.	.
N	95	95	95	92	92	92
R2	.465	.804	.804	.805	.808	.822
Adj. R2	.459	.737	.734	.728	.727	.735
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 37 Effect of Terms of Trade Adjustment (constant prices in local currency) over the Prevalence of Stunting (% of children under 5)

PREVALENCE OF STUNTING (% of children under 5)						
	1	2	3	4	5	6
Terms of Trade (constant LCU)	-0.000	0.000**	0.000**	0.000*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita growth (annual %)			0.063	-0.042	-0.054	-0.119
			(0.110)	(0.066)	(0.071)	(0.101)
Number of programmes per year				0.262	-0.495	-0.566
				(0.280)	(0.614)	(0.709)
Quadratic number of programmes					0.031	0.022
					(0.019)	(0.028)
one period lagged programmes						0.655
						(0.540)
two period lagged programmes						-0.889
						(0.523)
three period lagged programmes						0.593
						(0.483)
Constant	20.564***	29.974***	29.860***	28.794***	30.597***	31.293***
	(0.052)	(0.545)	(0.649)	-1.141	-1.699	-2.079
F	.	.	.	.	.	.
N	124	124	124	118	118	118
R2	.0036	.703	.703	.732	.748	.765
Adj. R2	-.00457	.607	.604	.631	.65	.66
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 38 Effect of Balance of Trade (2000=100) in Value and Volume over the Prevalence of Stunting (% of children under 5)

PREVALENCE OF STUNTING (% of children under 5)												
	1	2	3	4	5	6	7	8	9	10	11	12
Trade Balance in Value	0.003		-0.001		-0.001		-0.001		0.001		0.001	
	(0.009)		(0.003)		(0.003)		(0.003)		(0.004)		(0.003)	
Trade Balance in Volume		0.016		-0.003		-0.003		-0.002		0.002		0.002
		(0.013)		(0.004)		(0.004)		(0.004)		(0.004)		(0.003)
GDP per capita growth (annual %)					-0.029	0.002	-0.093	-0.087	-0.092	-0.095	-0.148	-0.159
					(0.107)	(0.104)	(0.064)	(0.063)	(0.058)	(0.067)	(0.085)	(0.093)
Number of programmes per year							0.166	0.197	-0.581	-0.591	-0.669	-0.615
							(0.264)	(0.281)	(0.591)	(0.599)	(0.640)	(0.696)
Quadratic number of programmes									0.032	0.033*	0.025	0.025
									(0.018)	(0.018)	(0.026)	(0.028)
one period lagged programmes											0.623	0.597
											(0.573)	(0.591)
two period lagged programmes											-0.867	-0.883
											(0.514)	(0.528)
three period lagged programmes											0.543	0.562
											(0.450)	(0.478)
Constant	19.352***	20.163***	28.663***	29.743***	28.703***	29.739***	27.892***	28.820***	29.618***	30.551***	30.558***	31.408***
	(0.069)	(0.089)	(0.465)	(0.506)	(0.484)	(0.553)	-1.008	-1.138	-1.761	-1.906	-2.100	-2.329
F	.135	1.42	.	.	.	.	.	.	.	.	.	.
N	140	130	140	130	140	130	134	124	134	124	134	124
r2	.0016	.0373	.687	.693	.687	.693	.716	.718	.733	.734	.748	.75
r2_a	-.00563	.0297	.601	.6	.598	.596	.627	.618	.645	.636	.654	.646
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Tables 36, 37 and 38 present results regarding Tariffs, in weighted means for all products and expressed as natural logarithm, TOT and BOT over the Prevalence of Stunting. Tariffs have a significant effect relevant in magnitude in the first and most parsimonious specification: it suggests that a one percentage point increase in the level of applied tariffs increases the prevalence of stunting in 4.86 percentage points. All other coefficients, even thought not relevant in terms of significance, are consistent with theory, for they suggest a big increase in the prevalence of stunting with a one percentage point of increase in the level of applied tariffs. This result is relevant, for stunting is the indicator that expresses the existence of chronic and permanent form of malnutrition, therefore changes in its value are relevant in terms of public health, suggesting sustainable improvements of the upmost relevance.

For the TOT, all specifications but the first are significant but of value zero. The same happens for BOT with the difference that in this case all values are non-significant.

Depth of the Food Deficit

Table 39 Effect of Applied Tariff Rates (ln weighted mean for all products) over Depth of the Food Deficit (kcal per person per day)

DEPTH OF THE FOOD DEFICIT (kilocalories per person per day)						
	1	2	3	4	5	6
ln of Tariffs Applied Rate (weighted mean for all products)	25.858***	-6.622	-5.907	-5.274	-5.220	-2.005
	-7.869	-8.844	-8.852	-10.696	-10.729	-10.959
GDP per capita growth (annual %)			0.236	0.444	0.444	0.548
			(0.539)	(0.564)	(0.568)	(0.627)
Number of programmes per year				-3.218	-2.481	-0.041
				-2.299	-5.333	-4.234
Quadratic number of programmes					-0.034	0.130
					(0.170)	(0.196)
one period lagged programmes						-0.621
						-2.279
two period lagged programmes						-0.991
						-1.183
three period lagged programmes						-5.638**
						-2.084
Constant	43.558***	134.392***	131.323***	140.714***	138.345***	142.332***
	-14.422	-22.013	-22.362	-27.446	-35.731	-37.075
F	10.8	.	.	.	.	.
N	372	372	370	351	351	351
R2	.182	.418	.409	.454	.455	.487
Adj. R2	.18	.378	.366	.411	.409	.439
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 40 Effect of Terms of Trade Adjustments (constant prices in local currency) over the Depth of the Food Deficit (kcal per person per day)

DEPTH OF THE FOOD DEFICIT (kilocalories per person per day)						
	1	2	3	4	5	6
Terms of Trade (constant LCU)	-0.000	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP per capita growth (annual %)			-0.467	-0.133	-0.134	-0.043
			(0.577)	(0.512)	(0.517)	(0.527)
Number of programmes per year				-3.410	-4.604	-2.532
				-2.975	-6.689	-6.149
Quadratic number of programmes					0.057	0.203
					(0.207)	(0.217)
one period lagged programmes						-0.441
						-1.049
two period lagged programmes						0.916
						(0.976)
three period lagged programmes						-6.593***
						-1.987
Constant	96.472***	136.747***	138.266***	151.046***	153.543***	159.014***
	(0.007)	-11.074	-11.903	-17.941	-25.439	-25.168
F	.	.	.	.	.	.
N	457	457	457	432	432	432
R2	8.87e-06	.431	.432	.478	.479	.5
Adj. R2	-.00219	.398	.398	.444	.443	.461
SE in parentheses						
* p<0.10, ** p<0.05, *** p<0.010						

Table 41 Effect of Trade Balance (2000=100) in Value and Volume over the Depth of the Food Deficit (kcal per person per day)

DEPTH OF THE FOOD DEFICIT (kilocalories per person per day)												
	1	2	3	4	5	6	7	8	9	10	11	12
Trade Balance in Value	-0.091***		-0.061***		-0.060***		-0.061***		-0.061***		-0.061***	
	(0.023)		(0.020)		(0.020)		(0.019)		(0.018)		(0.018)	
Trade Balance in Volume		-0.072**		-0.059**		-0.059**		-0.059**		-0.059***		-0.060***
		(0.028)		(0.023)		(0.023)		(0.021)		(0.019)		(0.019)
GDP per capita growth (annual %)					-0.226	-0.329	0.121	-0.002	0.119	-0.004	0.240	0.104
					(0.442)	(0.471)	(0.366)	(0.424)	(0.373)	(0.431)	(0.365)	(0.422)
Number of programmes per year							-3.850	-3.645	-4.786	-4.014	-2.096	-1.572
							-2.749	-2.743	-6.572	-6.502	-5.868	-5.759
Quadratic number of programmes									0.045	0.018	0.200	0.173
									(0.204)	(0.201)	(0.209)	(0.208)
one period lagged programmes											-1.498	-1.188
											(0.951)	(0.892)
two period lagged programmes											0.937	0.916
											-1.099	-1.079
three period lagged programmes											-6.463***	-6.551***
											-1.803	-2.001
Constant	98.635***	97.752***	132.949***	135.390***	133.671***	136.452***	147.738***	149.802***	149.774***	150.582***	156.109***	156.661***
	(0.517)	(0.222)	-9.975	-10.639	-10.709	-11.296	-17.120	-17.179	-25.132	-24.859	-24.696	-24.403
F	16.1	6.5	.	.	.	.	.	.	.	.	.	.
N	454	446	454	446	454	446	430	422	430	422	430	422
R2	.122	.0569	.436	.428	.436	.429	.486	.475	.486	.475	.511	.499
Adj. R2	.12	.0548	.404	.396	.403	.395	.453	.441	.452	.44	.474	.461
SE in parentheses												
* p<0.10, ** p<0.05, *** p<0.010												

Tables 39, 40 and 41 present results regarding Tariffs, in weighted means for all products and expressed as natural logarithm, and TOT over the Depth of the Food Deficit. Tariffs have a strongly significant effect in the first and most parsimonious specification, suggesting that one percentage point in increase in applied tariffs increases the Depth of the Food Deficit in 25.8 kilocalories. This is consistent with other findings in this research that indicate that a reduction in trade increases food insecurity.

For the TOT, all specifications have coefficients of value zero. Overall, BOT and the DFD have a strong relation, though very small in magnitude: an increase in one percentage point in the balance of values and volumes reduces the depth of the food deficit in less than a kilocalorie. Which is consistent with previous findings in this research that suggest that exports reduce the depth of the food deficit for through an income effect they allow for purchase of more energy-dense foods.

Appendix 4: References

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