



ASOCIACION ARGENTINA
DE ECONOMIA POLITICA

ANALES | ASOCIACION ARGENTINA DE ECONOMIA POLITICA

LII Reunión Anual

Noviembre de 2017

ISSN 1852-0022

ISBN 978-987-28590-5-3

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Garriga, Santiago
Lugo, María Ana
Jorge Pablo, Puig

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The case of Paraguay, a food exporter and a non-fully urbanized country

Santiago Garriga ^{*} María Ana Lugo [†] Jorge Puig [‡]

August 29, 2017

Abstract

A vast proportion of households in developing countries like Paraguay are both consumers and producers of food, and thus the effects of food price fluctuations on well-being are not obvious. Historically, the agricultural sector in Paraguay has played a fundamental role in economic development and has contributed significantly and increasingly to economic growth. In recent years, the sharp movements in commodity prices had added to the inherent volatility of the sector related to climate conditions. This work uses the 2011/12 expenditure and income survey as well as monthly price data at item level for 2007-15 that allows tracking 127 food items to simulate the effect of a potential hike in food prices on welfare. Our main results suggest that the expenditure effect is negative and regressive everywhere, but larger in rural than urban areas. The income effect is positive and progressive in rural areas and negligible in urban areas. Therefore, we find that the potential overall impact of an unexpected increase in food prices in Paraguay is a very flat U-shaped curve. We conclude with a simple simulation exercise of the potential effects of the introduction of a policy response to help those affected by an increase in food prices.

JEL CODES: D31, I38, Q12

KEYWORDS: food prices, distribution, poverty, policy response, Paraguay

^{*}Paris School of Economics, 48 Boulevard Jourdan, 75014 Paris. Email address: garrigasantiago@gmail.com

[†]World Bank - Poverty and Equity Global Practice. Email address: mlugo1@worldbank.org

[‡]Department of Economics (UNLP-Argentina). Email address: jorge.puig@econo.unlp.edu.ar
The authors wish to thank the participants of the SirPig (Summer Initiative on Research on Poverty, Inequality and Gender, World Bank) and ECINEQ (Society for the Study of Economic Inequality) as well as earlier discussions with Lea Gimenez Duarte and María Emilia Cucagna. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent

1 Introduction

When commodity prices spiked in 2007/08 and then again in late 2010, the development community turned their concerned eyes to impact that the staples' price fluctuations can have on the poorest. Yet, in countries where a large proportion of the households are both consumers and producers of food, the effect of food price fluctuation on their welfare –and ultimately, on poverty– could be ambiguous. On the one hand, higher prices lowers individuals' purchasing power and thus restricts the goods and services that they can acquire, given their budget. On the other, as producers, to the extent that they can sell the food items at this higher price, their budget set expands and thus can achieve a higher welfare point. While the theoretical point is not new (Hicks (1939), Singh *et al.* (1986), Deaton (1989)), the empirical literature analyzing the distributional consequences of food price changes for specific countries in such contexts remains thin.

The objective of this paper is to evaluate a potential effect of an unexpected food price spike on poverty and distribution in Paraguay. Historically, the agricultural sector in Paraguay has played a fundamental role in economic development and has contributed significantly to economic growth (World Bank, 1995). Approximately 65 percent of households in rural areas relies on some sort of agricultural-related income (either working in his own land or as wage employee), and even 17 percent of households in urban areas relies does so.

During the past decade, Paraguay's extreme poverty rates have been quite stubbornly stable around 18 percent, despite the sizable growth in average individuals' incomes and high (though fluctuating) rates of economic growth. Part of the explanation of the pervasive high extreme poverty rates relates to the fact that prices of basic food items have soared, especially between 2005 and 2007, outpacing the overall rate of inflation, rendering the basic food basket more expensive than in the past. Therefore, while real income of the poorest quintile was growing, it was not sufficient to compensate for the increased value of the food basket.¹

The analytical framework used to analyze the potential effect of a food price hike on households' welfare is based on the compensating variation. Three effects are considered: the *expenditure effect*, as consumers face more expensive prices; the *income effects*, as producers as either farm holders or wage employees in agricultural activities; and finally, the *government policy response*, simulating as an increase in the cash transfer to current beneficiaries of the existing social program Tekoporã. The main source of information that we use in this paper is the 2011/12 Income and Expenditure Survey (*Encuesta de Ingresos y Gastos y Condiciones de Vida* - EIG-CV hereafter), carried out during 52 weeks from August 2011 to July 2012, covering both urban and rural areas. In addition, we use the monthly price data collected in Greater Asuncion (Central Bank of Paraguay) and the 2015 Permanent Household Survey (*Encuesta de Ingresos y Gastos y Condiciones de Vida* – EPH henceforth) to simulate the potential effect of a policy response.

We simulated an increase in food prices similar to that observed between September 2010 and August 2011, reaching 17% in the whole year while overall inflation

¹The extreme poverty line is set according to the value of a basket of basic food items as determined using the 1997/98 household income and expenditure survey.

was around 9%. The simulation considers heterogeneous price movements across 9 sub-categories of food items (for instance, the price change of cereals was assumed to be lower than that of poultry). Our main results suggest that the expenditure effect is negative and obviously regressive everywhere, but larger in rural than urban areas. The income effect is positive and progressive in rural areas and negligibly in urban areas. Therefore, we find that the potential overall impact of an unexpectedly increase in food prices in Paraguay is U-shaped, similar to what [Ferreira *et al.* \(2013\)](#) found for Brazil. Doubling the amount of the existing monthly cash transfer would compensate the loss due to higher food prices but also improve poverty and inequality. At the national level, extreme poverty would decrease from 14.4% to 13.8%, mainly driven by the reduction in rural areas (from 25.3% to 24%).

The paper is structured as follows. Section 2 introduces several stylized facts of the Paraguayan economy, while Section 3 presents the various sources of information used. Given that prices are regularly observed only in urban areas, Section 4 discusses whether these prices are indeed a good approximation of prices faced in rural areas. Section 5 brings together the analytical framework to assess the effect of a price increase on families' welfare as well as a brief literature review. Section 6 presents the main results of the simulations and Section 7 the potential effects of different policy responses. Finally, the last section concludes.

2 Context

Paraguay is a small country with approximately 8 million inhabitants, located in South America. Its economy depends increasingly and significantly on agriculture and, as a consequence, has become more volatile ([World Bank, 2014b](#)). Historically, the agricultural sector in Paraguay has played a fundamental role in economic development and has contributed significantly to economic growth ([World Bank, 1995](#)). Growth in this sector has explained over 80 percent of the variation of real GDP growth since the early 90s. In the period 2003-13, per capita GDP (in constant 1994 U.S. dollars) grew by 33 percent, but experienced a major dip during the 2009 drought and global financial crisis, when it fell by 5.2 percent with respect to previous year. Yet, the record growth of 11.2 percent in 2010, driven by a 50 percent surge in agriculture, more than compensated that previous loss. In 2014, the agriculture sector represents 25 percent of total GDP; when adding the agro-industrial it accounts for the 50 percent of Paraguayan real GDP (2014). In addition, the agricultural sector represents 40 percent of national exports ([World Bank \(2014b\)](#) and [World Bank \(2014a\)](#))

Since 2005, the prices of many food items have risen considerably. The international food price index experienced a hike in the middle of 2008, at 80 percent higher than in 2005, though dropping massively by the end of the year (**Figure 1**). A second hike was observed in early 2011, reaching 90 percent of the 2005 value. "Price increases of this magnitude for basic foodstuffs, over a relatively short period, led to widespread concern about possible impacts on hunger and deprivation" ([Ferreira *et al.*, 2013](#)) and various countries put in place various instruments to help vulnerable families cope with these sudden price fluctuations – such as restricting exports (Argentina, Bolivia and Ecuador), imposing price restrictions in the domestic

markets (Argentina, Bolivia, Honduras, Mexico, and Panama), and compensating households purchasing power losses with increased cash transfers (most countries in the Latin American region).²

In countries such as Paraguay, who are large producers and exporters of food-stuff, the hike in prices lead to both a lost for net buyers of food items (mostly, urban households) and a gain for new sellers. “While the welfare of these households [net food buyers] will tend to decline with the price increases, those aggregate income gains must accrue to someone, and where the gainers are in the initial income distribution is likely to matter for the overall poverty and distributional consequences of the price shock” (Ferreira *et al.*, 2013).

Paraguay is a net exporter of agricultural and livestock products (including vegetable, and animal bi-products) but a net importer of foodstuffs such as prepared foods, beverages, spirits and vinegar, tobacco and manufactured tobacco substitutes (Table 1). As stated, the Paraguayan economy depends increasingly and significantly on agriculture. Yet, two-thirds of the extreme poor live in rural area and rely heavily on this volatile sector. Between 2003 and 2013, Paraguay performed substantially well in terms of poverty reduction, seeing sizeable reductions in moderate and extreme (monetary) poverty. This is the result of a period of average significant growth combined with a reduction in inequality. A significant proportion of the improvements in welfare were only experienced after 2011; before this, extreme poverty remained stable despite per capita GDP increasing by 22 percent, while between 2011 and 2013 extreme poverty almost halved (Figures 1). A key factor behind the evolution of poverty rates in this decade relates to the changes food prices throughout the period (World Bank, 2015).

While both growth and distribution were contributing to a significant increase of the income of the poor during the period 2003-2011, food prices were rising at a higher rate than general prices in the economy, mitigating to a significant extent the reduction in extreme poverty that would have otherwise resulted. In contrast, all three forces –growth, inequality reduction and decreasing food prices– have been working in the same direction since 2011 (Figure 2). Disproportionately high income growth among the less well-off and especially in rural areas is a strong factor behind the recent improvement in poverty reduction. In both periods, rising labor incomes have been the driving force both because of increased earnings and increased number of earners. Meanwhile non-labor incomes such as public transfers only started to play a significant role in the past two years –perhaps due to important increases in coverage of the main social programs (World Bank, 2015).

Extreme poverty lines (also called ‘food poverty lines’) are updated annually using the food consumer price index for the Metropolitan Area of Asunción, provided by the Central Bank of Paraguay (BCP).³ Figure 3 presents the evolution of

²Country examples from Table 1 in World Bank (2008), *El alza de precios de los alimentos y sus efectos en América Latina y el Caribe*.

³As stated in footnote 1, the extreme poverty lines were constructed on the basis of the 1997/98 expenditure survey (*Encuesta Integrada de Hogares EIH 1997/98*). These were built based on the consumption patterns of a reference population and a minimum caloric requirement. Three lines are used: Metropolitan Area of Asunción, Rest of Urban area and Rural Areas. Ideally, each line should be inflated according to the observed price movements in its areas. Unfortunately, price information are only collected in the metropolitan area of Asunción and thus the three lines are

the *real* value of the extreme poverty lines adjusted by the general price consumer index. Food prices have grown at a faster rate than general prices, as reflected by the ascending value of the food lines. Food prices, relative to overall prices, were relatively stable until 2005 but soared in 2005-07, in line with the evolution of world prices of many staple food commodities. Since 2007 the growth in food prices slowed down relative to other prices though by 2013 the extreme poverty line remained slightly higher than five years earlier.

3 Data

This paper uses three sources of data. The 2011/12 Income and Expenditure survey (*Encuesta de Ingresos y Gastos y Condiciones de Vida* EIC-CV) contains detailed data on household expenditure on food and non-food items as well as detailed income data, including an agricultural module. The survey was carried out by the National Statistical Office from Paraguay (DGEEC for its Spanish acronym) during a whole year from August 2011 to July 2012, and collected information for 5,417 households from both urban and rural areas. The survey design allows doing robust estimations for urban and rural areas, and also for the departments of Asunción, San Pedro, Caaguazú, Itapúa, Alto Paraná, Central and rest of departments (this includes all the remaining areas).⁴

Secondly, we use comprehensive monthly price data at the item level for the period 2007-2015, that feeds the CPI published by the Central Bank of Paraguay.⁵ The general CPI includes 450 items, 359 goods and 91 services. Of these, 127 are used in the food CPI. Item weights for both CPI and food CPI allow us grouping individual items into sub-groups, such as Oils and Butters, Cereals and related products, Meat, Fresh and canned vegetables, among others.

Finally, we exploited the annual household survey, *Encuesta Permanente de Hogares* (EPH) 2015, generally used to estimate official poverty and inequality figures. The survey has detailed income information including labor income, and various sources of non-labor income such as rents, interest or dividends, remittances (both internal and external), pensions, among others. In addition, unlike the EIC-CV, the EPH accounts with information related to existing social programs like *Tekoporã* (a conditional cash transfer program to families with school-aged children) and *Adultos Mayores* (non-contributory pension plan which contemplates a monthly monetary transfer equivalent to one quarter of the current minimum wage). These data is employed to simulate policy responses. These alternatives will be evaluated and discussed in section 7.

updated using the same price data.

⁴With the only exception of the departments of Alto Paraguay and Boquerón whose population represent less than 2% of total country's population.

⁵The Consumer Price data uses December 2007 as its base year and the item weight information comes from the 2005/06 Household Budget Survey (*Encuesta de Presupuestos Familiares*). Source: BCP "Metodología del Índice de Precios al Consumidor (IPC)"

4 Do rural prices move similarly to prices in Asunción

Consumer Price Index (CPI) plays an important role in a country's economic performance given that it is one of the most relevant signals to guide not only public decisions but also private actions. The Paraguayan CPI is produced by Central Bank (BCP)⁶ and, is disaggregated into several sub-components such as food, clothes, public services, health, and transport costs. Prices are only collected in the metropolitan area of Asuncion, thus it is not possible to monitor price changes neither in the spectrum rural/urban nor at the departmental level, as it is possible in various other countries in the region (such as Brazil).

The CPI is used to annually update the value of Paraguay's national extreme and moderate poverty lines using food and general CPI respectively. The assumption is that while price levels might differ across regions or areas of the country, price changes (inflation) is relatively similar across the country. This is a reasonable assumption in cases where transport costs are relatively low and distribution systems are highly developed, though less true in developing countries (Deaton, 1997). Having access to unit values (even if imperfect substitutes for prices) for different areas and over a whole year allow us to test, at least to some extent, whether the assumption holds true. Before jumping into the analysis, a few caveats are in place: First, unit values are different from prices. Unit values are the implicit prices reported by households when asked about the quantity (in kilos, or grams) and total expenditure for goods. These values are affected by the quality (a kilo of prime rib costs more than a kilo of ground beef) and type of place of purchase (small shop or large supermarket), which could vary across the country, as well as the quantity bought in each purchase. There are also measurement errors, especially when some information in the calculation (quantity or expenditure) is missing for a good. Second, the survey was not purposely designed to provide accurate price estimates for sub-periods (months, trimesters, etc) but for the whole year, therefore the representativeness by rural/urban area for these sub-periods is not assured. Nonetheless, the distribution of interviews across months (and bi-month) by urban/rural as well as by socioeconomic status is relatively smoothed across time (see Table 2 and 3).

Based on the item weights used in the CPI (Banco Central de Paraguay, 2007) and unit values from EIG-CV, we generated a monthly price indices, for both urban and rural areas. A preliminary analysis suggests that (a) urban and rural price indices move quite closely across the year and, (b) that these are close to the food price index reported by the Central Bank. The implication is that the assumption used to update the poverty lines is, at least for the period under analysis, not at odds with the information coming out from unit prices gathered at household level. For our purpose, the other implication is that it would not be inappropriate for the analysis that follows to use the BCP CPI information to produce simulations using the EIG-CV (Figure 4).

⁶Available at www.bcp.gov.py

5 Analytical Framework

Traditional approaches trying to measure the distributional impact of changes in prices often involve the comparison of the Gini coefficient before and after the price changes occur. However, summarizing the effects in a single measure ignores useful information that can be learned from the data (Benjamin & Deaton, 1993). In this context, micro-simulation can be useful to explore the structure of income distribution with more detail.

The idea that we explore in this paper is the following. Households consume a set of goods (x) at given set of prices (p), and thus an increase in prices make households poorer because with the same income they can buy less goods (*expenditure effect*).⁷ In addition, households derive higher income from directly producing and selling products whose price has increased and/or from working as wage employees in activities where the remuneration has risen due to increased profits from higher prices of sold products (*income effect*).

The analytical framework followed in this paper is based on the agricultural model proposed by Singh *et al.* (1986), followed among others by Deaton (1989), and with the variation adopted by Brambilla & Porto (2009). The unit of analysis is the household indexed by h and, in equilibrium, household expenditures (including savings) e^h have to be financed with household income (including transfers).

$$e^h(p, u^h, x^h) = \sum_j w_j + \sum_i \Pi_i^h(p, \phi) + T^h + x_0^h \quad (1)$$

where i indexes goods and j household members. Household expenditure (e^h) is a function of the set of prices of consumption goods p , the utility derived from this consumption u^h and some other household characteristics x^h (i.e., household composition). Expenditure needs to equal, in equilibrium, household income, which is the sum of individual wages w that might be determined, up to some extent, by the prices of goods produced (first term), the profits derived from own production and sale of goods (second term), transfers that the household may receive (T^h), and other exogenous income (x_0^h).

Clearly, it can be seen that household's welfare can be directly affected by a change in prices both through decisions of consumption as well as production. Naturally, those effects depend on household "consumption/production" choices and endowments, so heterogeneous impacts can be expected.⁸ Following equation (1) and, considering that households consume part of their own production, profits are given by the earnings obtained from selling the remaining goods. To show that, we redefined equation (1) as follows,

$$e^h(p, u^h, x^h) = \sum_j w_j(p) + \sum_i p_i(q_i - c_i) + T^h + x_0^h \quad (2)$$

⁷Technically the *expenditure effect* consist of two effects: pure substitution effect (change in relative prices) and income effect (with the same amount of income households can buy less). For a comprehensive discussion on this refer to Mas-Colell *et al.* (1995).

⁸As it is remarked in Brambilla & Porto (2009), equation (1) assumes the principle of "separability" between consumption and production decisions. Refer to this paper for a comprehensive discussion about this.

A change in prices p will affect both expenditure i.e., the sum of p_i times c_i , as well as household income captured by the first term and the first part of the second term. Differentiating equation (2), and after some rearrangements we get the compensating variation (as a share of initial expenditure) associated with a change in the i th price:

$$cv^h \cong \sum_i \sum_j \varepsilon w_i^j \theta^j \frac{dp_i}{p_i} + \sum_i (b_i - s_i) \frac{dp_i}{p_i} \quad (3)$$

where εw_i^j is the elasticity of the wage earned by household member j with respect to the price p_i , θ^j is the share of the wage income of member j in total household income, b_i is the share of household income from production of good i and s_i is the budget share spent in good i .

The compensating variation is commonly defined as the amount of money that the household would need to receive, to compensate for the price increase in order to maintain its original utility level (Hicks, 1939). Equation (3) represents the proportional change in money-metric household welfare considering not only impacts on consumption and income but also on wages. The first term of the right hand side represents a first-order effect that an increase in prices of food items might have on wages of those employed in the sector that produced them. It is important to note that the response of labor income is captured by the elasticities εw_i^j and also by the share of income contributed by wages of different household members θ^j . From the second term of the right hand side of (3) it is clear that households that are net consumers ($b_i < s_i$) will be worse off if prices go up whereas net producers ($b_i > s_i$) will be better off; and of course the opposite is true for price declines. Also it is worth to note that the combination of both terms, represents a good approximation for the first order effects to a change in prices, only valid for small changes as we will discuss below.

In addition, as Brambilla & Porto (2009) and Lederman & Porto (2016) argue many issues associated with the first-order impacts need to be highlighted. First, the role of imperfect pass-through of international to domestic prices and therefore to households.⁹ Second, the existence of spillover effects both on the production (i.e., the expansion of a sector affects up/downstream activities) and the expenditure side (i.e., increase in income due to the expansion of a sector raises the demand for output and thus the derived demand for inputs in other sectors). Finally, the fact that the net-consumer/net-producer approach is very intuitive, it rests in a strong assumption: the presence of small price changes (first order approximation). To relax this assumption or analyze larger price changes, the incorporation of responses in demand and supply becomes crucial (second order effects). As pointed out by Brambilla & Porto (2009) the net position of the household is endogenous when households respond and therefore, for small price changes, it is a "negligible" second order effect. However, for larger price changes the approximation error becomes relevant. As we previously mentioned a consumer always loses from a price increase i.e., expenditure effect, but if he can adjust his consumption behavior, the losses

⁹For a detailed discussion, see Feenstra (1989), Rogoff (1996), Goldberg & Knetter (1997), Burstein *et al.* (2003) and Nicita (2009).

could be lowered by substituting more expensive goods for cheaper ones.¹⁰ The addition of those substitution effects in our equation (3) led us to obtain an equality as follows:

$$cv^h = \sum_i \sum_j \varepsilon w_i^j \theta^j \frac{dp_i}{p_i} + \sum_i (b_i - s_i) \frac{dp_i}{p_i} + S(\Delta p) \quad (4)$$

where the last term $S(\Delta p)$ corrects for substitution behavior, as a function of the full vector of price changes.¹¹ In addition to the analysis of second order effects, the literature have tried to quantify consumption responses through the estimation of a system of demand elasticities (own and cross price elasticities).¹² In an interesting contribution, [Friedman & Levinsohn \(2002\)](#) – while did not include wages or income responses in their model- found that incorporating substitution behavior implies substantial level differences (against the situation with no adjustment). Nonetheless, the distributional consequences are shown to be rather stable across the whole income distribution.

As discussed by [Ferreira *et al.* \(2013\)](#), there is still no evidence (that we are aware of) that has so far fully captured all terms of equation (4), and ours is not the exception. Unfortunately and regarding to our specific estimation, due to the absence of data to estimate the change in consumption following a price variation, we are not able to include second order effects, although we recognize that this may be a component to be considered. Nevertheless, not including substitution effects allow us to estimate an upper bound effect and thus households would not be as bad as in our estimations suggest.

Having said that, we focused on equation (3) using a wage-price elasticity of 0.22 and 0.40 (based on [Ravallion \(1990\)](#) and [Porto 2008](#)) for the first term of the right hand side.¹³ Regarding the second term, the availability of information on household expenditures and incomes provided by the EIG-CV allow us to compute both consumption and production shares. Specifically, the calculation of production shares represents in our view a relevant contribution of this paper taking into account that some relevant studies do not calculate due to lack of information.¹⁴ We consider that this is an important contribution of this paper. Moreover, Paraguay has the greatest amount of rural population as a share of total population considering all countries in Latin America, and as a consequence own production is a key component in this country.

¹⁰Similar arguments can be made for the producer side.

¹¹See [Ferreira *et al.* \(2013\)](#) for an interesting discussion on this.

¹²The leading framework to estimate demand systems is [Deaton & Muellbauer \(1980\)](#) and further developments based on it.

¹³[Boyce & Ravallion \(1991\)](#), [Porto \(2005\)](#), [Porto \(2006\)](#), and [Nicita \(2009\)](#) provide alternative estimations of wage-price elasticity.

¹⁴For example, [Ferreira *et al.* \(2013\)](#) were not able to compute production shares due to some restrictions in Brazilian data.

6 Simulation and Results

Between September 2010 and August 2011, prices of food items in Paraguay rose 17 percent (Central Bank of Paraguay), whereas overall inflation was around 9 percent. Forty percent of Paraguayan live in rural areas (one of the highest rates in the region), and a third of their income is related to agriculture. Therefore, a potential impact of food price changes on poverty and inequality in Paraguay might be significant, and greater than in neighboring countries. Specifically, the exercise that we did, simulate an increase in prices similar to the one observed between September 2010 and August 2011, taking into account to some extent, the heterogeneity of price changes observed across foodstuff. The EIG-CV data allow us to observe the prices of 127 individual food items, which will be grouped into nine food groups, following the classification used in the construction of the Consumer Price Index.

The simulation allows us to calculate the first order effect of this price change. In other words, assuming that the quantities consumed and produced of each item remain the same as before the price change, we compute the resulting household level values of expenditure and incomes and analyze the welfare variation across the income distribution. Technically, this implies that we will estimate an upper bound given that household may have the possibility to substitute either consumption or production decisions.

Considering that prices of food items rose more than those of other goods, the expenditure effect is greatly explained by the food share of household, which as expected, vary across centiles of income per capita, and between rural and urban areas with an average of 37 percent and 47 percent respectively (Figure 5). This is a standard textbook result and is well known as the Engel curve. Our main results suggest that the expenditure effect is negative and obviously regressive everywhere, but larger in rural than urban areas (Figures 6a, 6b and 6c).

When comparing extreme poverty rates after an increase in prices, and allowing only the *expenditure effect*, we see a small increase in the number of people not able to afford a basic food basket.¹⁵ As expected, this hike in extreme poverty is greater in rural (Table 5). Specifically, extreme poverty grew half a point in urban areas and more than two points in rural areas. Something similar occurs with total or moderate poverty that rises approximately half a point in urban areas but more than two points in rural areas. Inequality rises slightly when considering the *expenditure effect*.

On the other hand, a food price hike leads to higher incomes to small farm holders and those employed in agriculture. The *income effect* that we address in this paper includes not only the effect of prices on wages, as in Ferreira *et al.* (2013), but also greater returns for agriculture entrepreneurs and self-employed. As with the *expenditure effect*, differences across areas are substantial; the probability of having agricultural related income is 17% in urban areas whereas 65 % in rural areas). To do the simulation we considered a price elasticity of wages equal to 0.2 (benchmark case) as it is a good approximation of the very short response in the labor market. Similarly, we explored another alternatives: a) no response (0), b) long run response

¹⁵For extreme and total poverty calculations we used official poverty lines published by DGEEC.

(0.5) and c) full transmission (1.0).¹⁶

Table 5 presents the overall *income effect* and the effect of each sub-component. Undoubtedly both effects lead to a reduction in poverty but while the wage effect within the *income effect* is quite small, the self-employed and own farm benefits contribute to a greater extent to poverty reduction and this is greater in the rural areas. Two results are important to highlight. First the fact that the wage effect is negligible (*income - wage*) means that the agro-industrial sector is still something not very well developed in Paraguay and it more on this sector will help to boost household income and contribute to poverty reduction. Second, not including the last term (*income - benefits*), as in Ferreira *et al.* (2013) i.e., the one that refer to self-employed and own farm benefits, omits an important component of total household income. This component may also be more important in Paraguay as compared to other neighbor countries given that the share of rural population is the greatest in the region (Table 4).

As Figures 6b and 6c suggest, the income effect is positive and progressive in rural areas and negligibly in urban areas. As we increase the elasticity that we used to simulate the income effect this effect becomes greater but, as stated, wages do not play a substantial role. Overall, and considering the national spectrum, we found that the potential impact of an unexpected increase in food prices in Paraguay on welfare is a very flat U-shaped curve (Figure 6a). Using the same logic as Higgins & Lustig (2013), Table 6 presents a mobility matrix at national level and by area. This table shows in a disaggregated way how initial composition of socioeconomic classes were before the shock and how is their final response after it (including both the *expenditure* and *income effect*). For instance, 6% of the originally poor fell into extreme poverty after the price variation.

7 Policy Responses

As it has been shown in previous section, a shock on food prices affects, as expected, poverty rates. Against this situation governments can use their social protection systems to mitigate this effect.¹⁷ In Paraguay the most important social program is Tekoporã devoted to improve the quality of life of the most deprived; warranting the access of food, health, and education, and strengthening social networks to eradicate inter-generational transmission of poverty. Its design is pretty similar to many cash conditional programs implemented in the region and it is mainly focused on families in extreme poverty and vulnerability, which have among its members children and adolescents between 0-18 years old, disabled persons and pregnant women.¹⁸

Tekoporã has been gaining relevance and coverage since 2005 and its beneficiaries have increased steadily. In 2005, 4,324 families in poverty and vulnerability conditions were covered by the program, whereas actually the it has presence in all

¹⁶These alternatives are not shown in the paper but they are available upon request.

¹⁷World Bank (Food Price Watch) identifies that policy responses can be addressed via five fronts: i) the producer side, ii) the consumer side, iii) or both; in addition to iv) foreign trade terms intended to protect national markets, and v) risk management future type of contracts. This paper will focus uniquely on the consumer side.

¹⁸A good reference on this is Stampini & Tornarolli (2012).

departments in Paraguay with 131,159 families. Each household receives a lump sum transfer of Gs. 90,000 and a flexible transfer depending on the number of children (of Gs. 40,000 for each child). So, for example, a four children household receives a total amount of Gs. 250,000.¹⁹

The existence of Tekoporã, allow us simulating a policy response from the government side to help those affected the most by the price shock.²⁰ To assess this issue, a first methodological obstacle needs to be removed. In particular, the main source of information used in this paper (EIG-CV 2011/2012) does not report a specific question whether the individuals receives or not the program, so an approximation to an hypothetical distribution of them needs to be made. For this purpose, we took advantage of the EPH 2015 where a specific question about the reception (or not) of the program is reported and we followed several steps outlined below.

First, we identified the current number of households receiving Tekoporã in EPH 2015. Second, we proposed a probabilistic model to identify those simulated beneficiaries in EIG-CV 2011/2012, but based on EPH 2015. Specifically, we run a probability model (Table 7) using as dependent variable whether the household receives or not the program, and a set of characteristics associated with the household head characteristics, the household structure and dwelling characteristics, as regressors.²¹ Thus, through this model we obtain the estimated probability of being Tekoporã beneficiary.²² Third, using the previous model coefficients we computed the estimated probability in the EIG-CV 2011/2012, and we obtained a simulated distribution of hypothetical beneficiaries.²³

Using the current Tekoporã's scheme, we simulated an assistance from the government through an additional transfer to recipients of the program. The implementation of this transfer consists in an additional annual lump sum of a certain percentage relative to the actual (monthly) amount program. Regarding this percentage, we proposed three scenarios (not exhaustive, logically) of 10%, 50% and 100% respectively. So for the previous example of a household with four children that monthly receives Gs. 250,000, a compensation of an annual transfer of 25,000 Gs, 125,000 and Gs. 250,000 is respectively simulated.

The last three columns in Table 8 present the effects of each scenario (we keep the first two columns as in Table 5 for reference. The first of them, which transfer an

¹⁹The maximum number of children allowed is four. The program also grants Gs. 40,000 for a pregnant woman (up to one pregnant woman), Gs. 150,000 for disability (up to two disable persons) and 225,000 for an indigenous family.

²⁰A review conducted by the World Bank (2008) shows that a large number of Latin American countries tended to focus their policies on the consumer side, aiming increase the real income of poor households: School feeding programs and conditional cash transfer programs, like Tekopora, are among the most popular.

²¹The variables related to household head characteristics were age and marital status. Those related with household structure were are the number of members, number of siblings and two-parent home. Finally dwelling characteristics included: geographic area, geographic department, per capita household income, poverty status, number of rooms, walls materials, electricity provision, network water provision, piped gas provision, existence of drain, existence of telephone and existence of bathroom.

²²It is worthy to be remarked that our model fits relatively well, with an R-squared of 0.40.

²³The comparison between the real distribution (both by deciles of per capita household income and by poverty status) of Tekopora beneficiaries, both obtained through EPH 2015 and simulated with EIG-CV 2011/2012 is shown in the Appendix.

amount equal to a 10% of the current monthly transfer, generates an almost imperceptible decline on poverty rates both in extreme and moderate and also in inequality resulting after the price shock (column g versus f). This effect is also found in both rural and urban areas. The second scenario generates more pronounced declines. At national level, extreme poverty is reduced by 2.64% (from 14.39% to 14.01%) and moderate poverty by 1.04% (from 26.36% to 26.08%). In addition, this effect is greater in rural areas than urban ones, where reductions in extreme are around 3.07% (from 25.36% to 24.59%) and 1.54% (from 6.84% to 6.74%) respectively. Finally, and logically, the last scenario, that is equivalent to a *bonus* or an *aguinaldo* given that the amount transferred is 100% of the existing monthly amount, substantially improves poverty and inequality conditions and even in some cases compared to the initial situation before the price shock. At the national level extreme poverty decreased by 4.3% (from 14.39% to 14.01%), mainly explained by the reduction in rural areas where the reduction is approximately 5.14% (from 25.36% to 24.06%). Regarding the reduction of moderate poverty is 1.8% (from 26.36% to 25.88%), also explained by the rural area where falls 2.35% (from 41.44% to 40.46%). It is important to note too that as a result of price shock extreme and moderate poverty rates had increased 3% and 0.8% respectively, but the policy response effects more than offset that situation by the reductions of 4.3% and 1.8% achieved in the latter scenario.²⁴

8 Conclusions

This paper simulated a food price hike similar to the one experienced in Paraguay between September 2010 and August 2011 of approximately 17 percent. Using microlevel data, we estimated the impact of such increase in households' welfare, considering both the effect on families' purchasing power and their potential effects on incomes through increase sale of their food products and rise in wages for those employed in the agricultural sector. The effects on poverty and inequality could be non-trivial, particularly for those in rural areas. Specifically, we find that the potential overall impact of an unexpected increase in food prices in Paraguay is a very flat U-shaped curve, meaning that the poorest and richest are the one more affected though the differences throughout the distribution are not huge. Yet, governments such as Paraguay, that have in place a relative extensive social assistance system could take measures to react quickly to such shocks, and thus protect the most vulnerable. The paper simulated such policy response, with varying degrees of generosity of the transfer.

²⁴In this setting, the government should make 13 "monthly" payments per year instead of the 12 (one per month) that performs under regular conditions.

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Table 1: Exports and Imports by sub-category for Paraguay, year 2012

Category	Value (USD in millions)		Share of total (%)	
	Exports	Imports	Exports	Imports
Animal Products	825	60	15.8	0.5
Vegetable Products	2,709	139	52.0	1.2
Animal and Vegetable Bi-Products	183	24	3.5	0.2
Foodstuffs	507	716	9.7	6.4
Mineral Products	45	1,400	0.9	12.5
Chemical Products	122	1,499	2.3	13.4
Plastics and Rubbers	96	567	1.8	5.1
Animal Hides	125	46	2.4	0.4
Wood Products	98	17	1.9	0.1
Paper Goods	15	274	0.3	2.4
Textiles	155	418	3.0	3.7
Footwear and Headwear	33	121	0.6	1.1
Stone And Glass	11	134	0.2	1.2
Precious Metals	115	6	2.2	0.1
Metals	66	582	1.3	5.2
Machines	71	3,321	1.4	29.7
Transportation	7	1,203	0.1	10.7
Instruments	4	146	0.1	1.3
Weapons	0	12	0.0	0.1
Miscellaneous	19	509	0.4	4.5
Arts and Antiques	0	1	0.0	0.0
Total	5,207	11,198	100.0	100.0

Source: AJG Simoes, CA Hidalgo. The Economic Complexity Observatory: An Analytical Tool for Understanding the Dynamics of Economic Development. Workshops at the Twenty-Fifth AAAI Conference on Artificial Intelligence. (2011)

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Table 2: Monthly distribution of household interviews

Date	% household per area	
	Rural	Urban
Aug-11	6.2	8.4
Sep-11	9.8	7.8
Oct-11	7.3	8.9
Nov-11	7.6	10.2
Dec-11	8.2	6.4
Jan-12	7.4	9.4
Feb-12	9.0	8.3
Mar-12	8.6	7.3
Apr-12	8.6	6.4
May-12	12.8	8.9
Jun-12	7.3	8.1
Jul-12	7.3	9.8
Total	100.0	100.0

Source: Source: Own calculations based on EIG CV 2011/12.

Notes: Each cell presents the corresponding share of households that have been interviewed in a given time period and area, as a function of the total interviews in that area.

Table 3: Bi-monthly distribution of household interviews

Date	% household per area	
	Rural	Urban
Aug Sept - 11	16.1	16.3
Oct Nov - 11	14.9	19.1
Dec Jan - 12	15.6	15.8
Feb Mar - 12	17.6	15.7
Apr May - 12	21.4	15.4
Jun Jul - 12	14.6	17.8
Total	100.0	100.0

Source: Source: Own calculations based on EIG CV 2011/12.

Notes: Each cell presents the corresponding share of households that have been interviewed in a given time period and area, as a function of the total interviews in that area.

Table 4: Employment distribution in Paraguay, year 2012

Quintil	Employee		Self Employed	
	Agro	Other	Agro	Other
I	0.7%	2.6%	6.4%	3.8%
II	0.6%	7.7%	4.6%	5.0%
III	0.5%	11.6%	2.4%	5.7%
IV	0.4%	14.3%	1.5%	6.8%
V	0.5%	16.8%	1.1%	7.0%
Total	2.7%	53.1%	15.9%	28.3%

Source: Source: Own calculations based on EIG CV 2011/12.

Notes: Each cell is the ratio of the numbers of workers for a given category, sector and quintil, over the total number of workers in the country. Quintiles were calculated over the per capita income distribution.

Table 5: Extreme and moderate poverty, and inequality (price elasticity = 0.2)

	Baseline	Expenditure	Income			Net (exp + inc)
			All	Wages	Benefits	
National						
Extreme	13.97 (0.47)	15.31 (0.49)	13.23 (0.46)	13.91 (0.47)	13.28 (0.46)	14.39 (0.48)
Moderate	26.14 (0.60)	27.19 (0.60)	25.07 (0.59)	26.14 (0.60)	25.07 (0.59)	26.36 (0.60)
Inequality	0.527	0.534	0.527	0.527	0.527	0.533
Urban						
Extreme	6.25 (0.41)	6.92 (0.43)	6.14 (0.41)	6.19 (0.41)	6.19 (0.41)	6.84 (0.43)
Moderate	15.44 (0.62)	16.18 (0.63)	15.33 (0.61)	15.44 (0.62)	15.33 (0.61)	15.99 (0.62)
Inequality	0.489	0.494	0.490	0.489	0.490	0.494
Rural						
Extreme	25.19 (0.98)	27.50 (1.01)	23.55 (0.96)	25.14 (0.98)	23.59 (0.96)	25.36 (0.98)
Moderate	41.71 (1.11)	43.20 (1.12)	39.22 (1.10)	41.71 (1.11)	39.22 (1.10)	41.44 (1.11)
Inequality	0.523	0.534	0.528	0.523	0.528	0.539

Source: Source: Own calculations based on EIG CV 2011/12.

Notes: Standard errors in parenthesis. In this table we are using a price elasticity of 0.2 and a full pass-through of benefits linked to self-employed earnings.

Table 6: Mobility Matrix – Before and after the shock (simulation)

		Net - Post Shock (expenditure + income)				Total
National		Ext. Poor	Mod. Poor	Vulnerable	Non Poor	
Pre Shock	Ext. Poor	97%	3%	0%	0%	13.97%
	Mod. Poor	6%	90%	3%	0%	12.17%
	Vulnerable	0%	2%	98%	1%	37.69%
	Non Poor	0%	0%	2%	98%	36.17%
		Net - Post Shock (expenditure + income)				Total
Urban		Ext. Poor	Mod. Poor	Vulnerable	Non Poor	
Pre Shock	Ext. Poor	100%	0%	0%	0%	6.25%
	Mod. Poor	7%	93%	0%	0%	9.19%
	Vulnerable	0%	2%	98%	0%	35.79%
	Non Poor	0%	0%	2%	98%	48.77%
		Net - Post Shock (expenditure + income)				Total
Rural		Ext. Poor	Mod. Poor	Vulnerable	Non Poor	
Pre Shock	Ext. Poor	97%	3%	0%	0%	25.19%
	Mod. Poor	6%	88%	6%	0%	16.52%
	Vulnerable	0%	2%	97%	1%	40.45%
	Non Poor	0%	0%	1%	99%	17.84%

Source: Source: Own calculations based on EIG CV 2011/12.

Notes: The table should be read from left to right. For instance, for those individuals that were in an extreme poverty status in the pre-shock situation, after the shock (simulation) some of them ended up in the same situation (extreme poverty), while others move to moderate, vulnerable or non poor status. The simulation uses a price elasticity of 0.2 and a full pass-through of benefits linked to self-employed earnings.

Table 7: Probit model to estimate the probability to be an eligible household. EPH 2015

Explanatory Variables	
<i>Household Head Characteristics</i>	
Age	-0.005** (0.002)
Marital Status (=1 if married)	0.137** (0.068)
<i>Household Structure</i>	
Total number of members	-0.088*** (0.033)
Total number of children [0;18]	0.282*** (0.040)
Household with both parents	0.106 (0.080)
<i>Dwelling Characteristics</i>	
Type of dwelling (=1 if house)	0.855 (0.563)
Rooms (=1 if less than 2)	0.166** (0.069)
Bedroom (=1 if bedroom =1)	-0.262*** (0.080)
Walls (=1 if brick made)	-0.365*** (0.065)
Water	0.191*** (0.062)
Electricity	0.492* (0.282)
Telephone	-0.340 (0.257)
Bath	1.202** (0.481)
Gas	-0.564*** (0.090)
Owner	0.174** (0.081)
Sewage	-0.374*** (0.073)
<i>Other variables</i>	
Area (=1 if urban)	-0.309*** (0.072)
San Pedro	0.165 (0.233)
Caaguazú	-0.263 (0.231)
Itapúa	-0.599** (0.249)
Alto Paraná	-0.731*** (0.247)
Central	-0.823*** (0.298)
Rest	-0.188 (0.220)
Per capita income	-0.000*** (0.000)
Moderate poor	0.124 (0.086)
Non poor	0.094 (0.101)
Constant	-2.932*** (0.815)
Number of observations	8,229
Adjusted R2	0.40

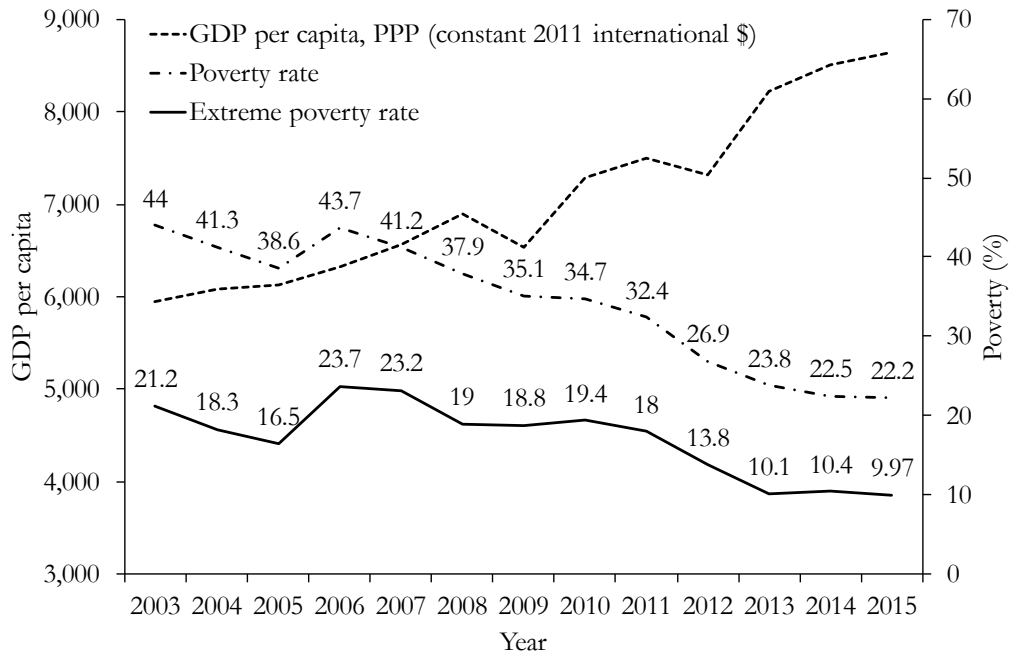
Table 8: Policy response simulations

	Baseline	Net (exp + inc)	Policy Response		
			10%	50%	100%
National					
Extreme	13.97 (0.47)	14.39 (0.48)	14.31 (0.48)	14.01 (0.47)	13.77 (0.47)
Moderate	26.14 (0.60)	26.36 (0.60)	26.30 (0.60)	26.08 (0.60)	25.88 (0.60)
Inequality	0.527	0.533	0.533	0.532	0.530
Urban					
Extreme	6.25 (0.41)	6.84 (0.43)	6.80 (0.43)	6.74 (0.43)	6.70 (0.43)
Moderate	15.44 (0.62)	15.99 (0.62)	15.94 (0.62)	15.85 (0.62)	15.85 (0.62)
Inequality	0.489	0.494	0.494	0.494	0.493
Rural					
Extreme	25.19 (0.98)	25.36 (0.98)	25.23 (0.98)	24.59 (0.97)	24.06 (0.96)
Moderate	41.71 (1.11)	41.44 (1.11)	41.38 (1.11)	40.97 (1.11)	40.46 (1.11)
Inequality	0.523	0.539	0.538	0.535	0.530

Source: Source: Own calculations based on EIG CV 2011/12.

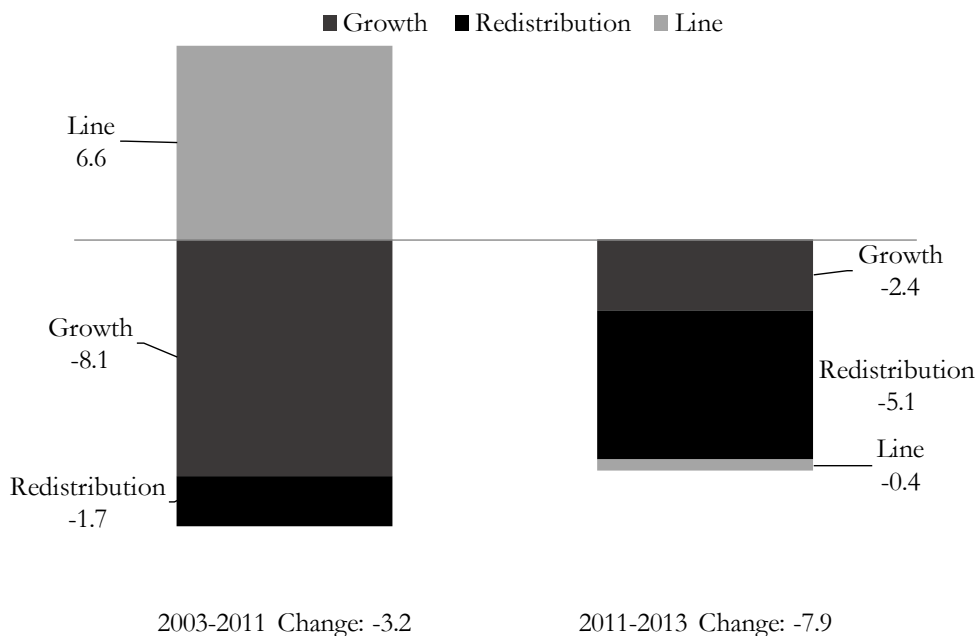
Notes: Standard errors in parenthesis. In this table we are using a price elasticity of 0.2 and a full pass-through of benefits linked to self-employed jobs. The policy response refers to an extra monthly payment of Tekoporā that comprises either 10%, 50% or 100% of the existing monthly transfer.

Figure 1: GDP and poverty rates evolution



Source: Source: DGEEC, WDI and own calculations.

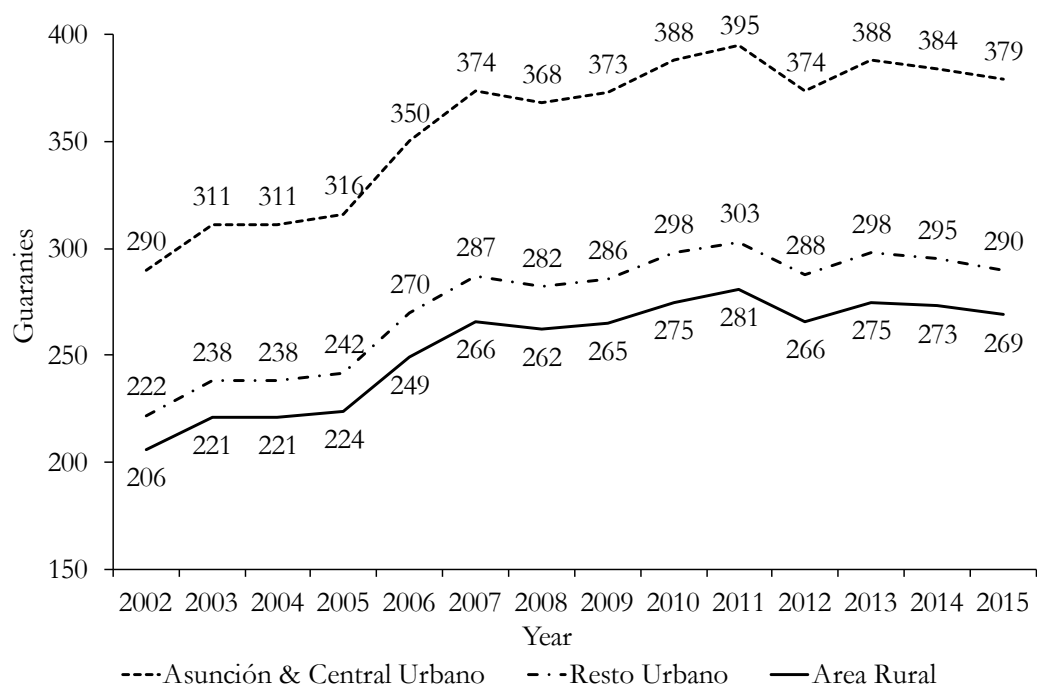
Figure 2: Decomposition of changes in extreme poverty



Source: Source: DGEEC and own calculations.

Notes: Each bar presents the contribution of each component to the changes in poverty for a given period. Those bars below the horizontal line mean that their contribution went in favor to poverty reduction while those above against poverty reduction.

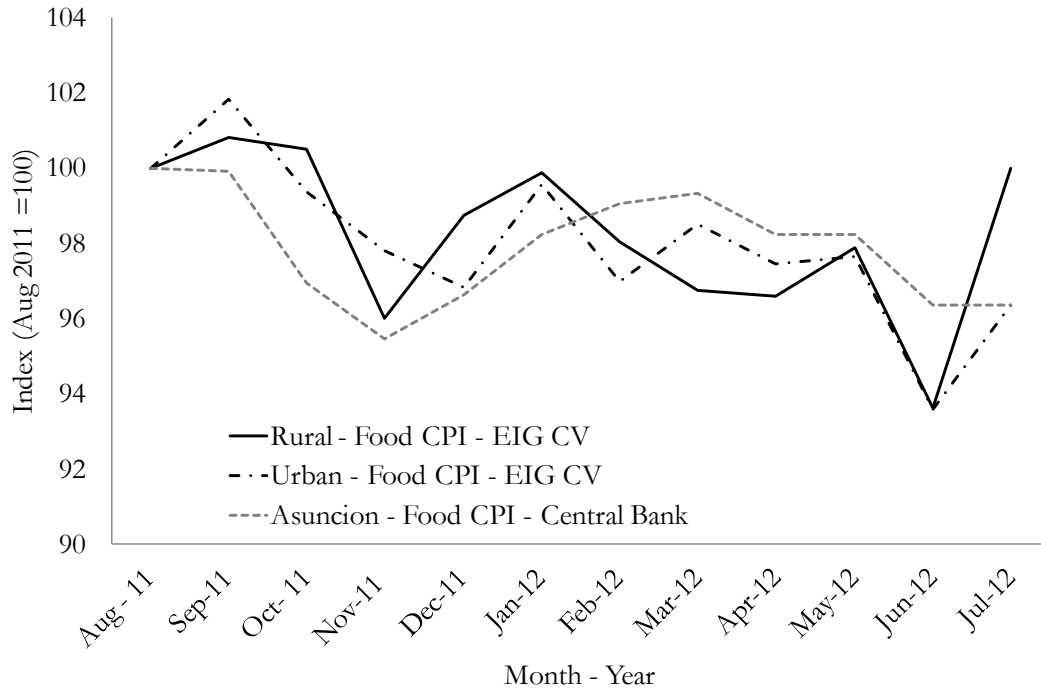
Figure 3: Evolution of extreme poverty lines



Source: Source: DGEEC and own calculations.

Notes: All values in the figure are expressed in thousands of Guaranies and in real values of October 2015.

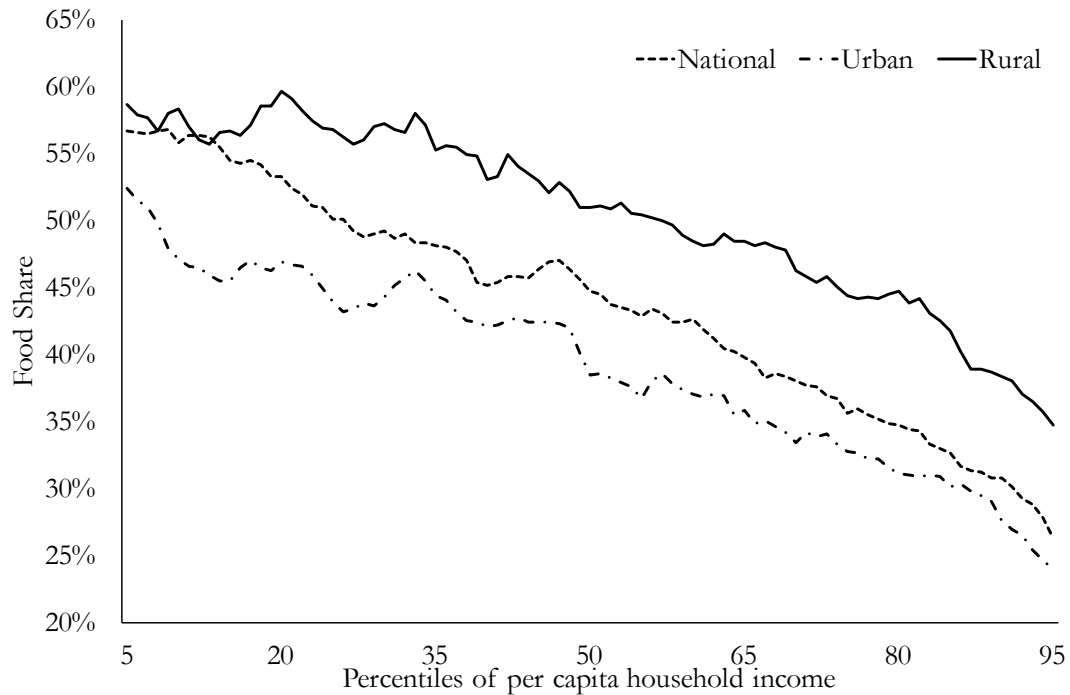
Figure 4: Evolution of urban, rural and CB indexes



Source: BCP and own calculations using EIG-CV 2011/12.

Notes: The Central Bank's Index refers to the official CPI used in Paraguay; while the other two alternatives are two indexes that try to mimic the official one using the EIG-CV 2011/2012.

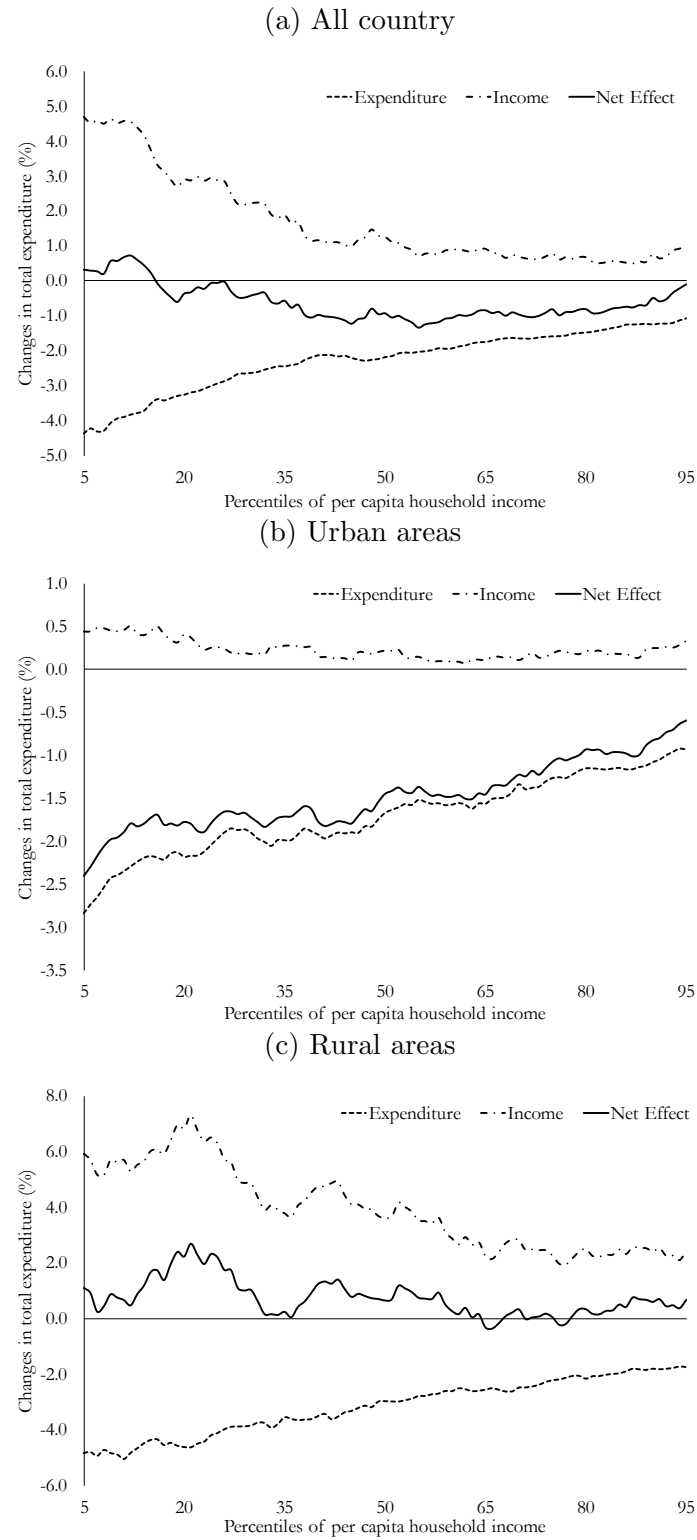
Figure 5: Food share on total expenditure by area



Source: Own calculations based on EIG CV 2011/12.

Notes: The food share presented in this figure corresponds to the moving average of each centile.

Figure 6: Expenditure, Income and net effect (price elasticity = 0.2)



Source: Own calculations based on EIG CV 2011/12.

Notes: Each effect in these figures was estimated as the moving average of each centile.