WORKING PAPER / 2014.09

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Pedro **Moncarz**
Sergio **Barone**
Germán **Calfat**
Ricardo **Descalzi**

IOB
Institute of Development Policy and Management
University of Antwerp

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This paper has been vetted by Danny Cassimon, coordinator of the
Research Line International Markets for the poor.

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Please contact the author at german.calfat@uantwerpen.be.

Instituut voor Ontwikkelingsbeleid en -Beheer
Institute of Development Policy and Management
Institut de Politique et de Gestion du Développement
Instituto de Política y Gestión del Desarrollo

Postal address:
Prinsstraat 13
B-2000 Antwerpen
Belgium

Visiting address:
Lange Sint-Annastraat 7
B-2000 Antwerpen
Belgium

Tel: +32 (0)3 265 57 70
Fax: +32 (0)3 265 57 71
e-mail: iob@uantwerp.be
http://www.uantwerp.be/iob

WORKING PAPER / 2014.09

ISSN 2294-8643

Poverty impacts of changes in the price of agricultural commodities: recent evidence for Argentina (an ex-ante analysis)+

Pedro **Moncarz***

Sergio **Barone***

Germán **Calfat****

Ricardo **Descalzi***

November 2014

* Universidad Nacional de Córdoba - Facultad de Ciencias Económicas

** University of Antwerp - Institute of Development Policy and Management

IOB
Institute of Development Policy and Management
University of Antwerp

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Abstract

Argentina, like other land abundant country, benefited greatly from the increase in the prices of agricultural commodities. However, and in despite of the benefits at the macro level, with a large share of the population with low and medium-low incomes, the increase in agricultural commodity prices has the potential to hurt an important part of the population through a raise in the prices of the consumption basket of households, especially those that constitute the food-basket. The ex-ante evidence shows that this is expected to be the case. A less obvious channel, through changes in factor incomes would be more beneficial to the middle income households. Overall, losses range between 5.5 and 10% of initial household expenditure, with poorer households being the most negatively affected.

JEL Codes: F10, F13, F14, F16, I30.

Keywords: trade, commodity prices, poverty, Argentina.

This document is part of the project "Impactos redistributivos y de bienestar de cambios en los precios de los commodities agropecuarios. Posibles respuestas de política económica. Evidencia para países seleccionados de América Latina", supported by the Fondo para la Investigación Científica y Tecnológica (FONCyT) through the research grant PICT 2012-1807. Pedro Moncarz is grateful to the IOB at the University of Antwerp in Belgium, for providing an ideal setting for research and writing at the occasion of his stay as Visiting Scholar. We appreciate comments received at the XVI European Trade Study Group (Munich, 2014), 33rd General Conference of the International Association on Income and Wealth (Rotterdam, 2014), XLVIII Reunión Anual de la Asociación Argentina de Economía Política (Rosario, 2013), XXVIII Jornadas de Economía (Montevideo, 2013) and the Argentina Chapter of the Research Network on Inequality and Poverty (La Plata, 2013). As usual all remaining errors are solely ours.

1. Introduction and motivation

Among the current research agenda of international trade there is an increasing interest on the study of how the deepening of international relations may affect social welfare, employment, inequality and poverty, with the aim of being able to provide policy recommendations to minimize undesirable effects. This new interest has adopted mostly a micro perspective eased by the increasing availability of statistics at the household level, especially for developing and less developed countries.

Due to the increasing integration in world trade markets, Argentina, a typical relatively land abundant country, has benefited greatly from the increase in the prices of agricultural commodities that took place during the last decade. For instance, for the main agricultural products exported by the country (soybeans, soybean meal, soybean oil, sunflower oil, maize and wheat), average prices in the 2002-2012 period have increased between 42% and 84% compared to the average of the preceding ten years. As it is shown in Figure 1, this increase in world prices of agricultural commodities has been part of a more general tendency which has been observed also in other commodity markets.

To have a clearer look of the importance of these changes in prices for Argentina's exports, in Table 1 we decompose the change in export values between the change in prices and the change in quantities. As shown in the Table, during the period 1992-2002 the price index of exports fell by a 9%, while quantities increased by 130%. On the other hand, in the period 2002-2012 instead, the increase in the value of exports was mainly driven by the change in prices with a 100% rise, while quantities increased only 58%. This change in the source of growth is also present, to a greater extent, in the cases of agricultural commodities and manufacturers intensive in their use, and even more for fuel and energy.[1]

Despite of the benefits, at the macro level, that followed the increase in the price of agricultural commodities, such as the important increase in exports which helped to easy the external restriction that in the past has conditioned the country long-run growth possibilities[2], there is a need to consider other effects that may be less desirable. One of this effects is the impact on poverty that may follow to a rise in the price of commodities that are used as intermediate inputs in the production of food goods, which explain a large share of total expenditure in poorer households (see Figure 2). As an example of the current importance of this issue, recently, UNCTAD (2013) has devoted one chapter of its Commodities and Development Report to the topic of the direct effects of the 2003-2011 commodity boom on poverty and food insecurity.

Almost at the same time that world prices of agricultural commodities started to rise, Argentina suffered one of the most important economic and social crisis in the country's history. At the end of 2001 the monetary regime, by which there was a convertibility system with the US dollar, collapsed, with the country declaring a default on its debt. After almost ten years of price stability, the country started once again to experience increasing rates of inflation[3] which affected in a greater magnitude the prices of tradable goods, especially those directly related with agricultural commodities. Other effects of the crisis were an impressive increase

[1] In the last decade, exports of fuel have been subject to important restrictions and heavy taxes, which explains that despite of a 350% price increase, quantities fell by 69%

[2] During the period 1992-2001, Argentina exported by 215.95 billion USD, during the following ten years it did by 510.83 billion. Imports, on the other hand, were 215.91 and 361.68 billion USD respectively. The increase of exports acquires a greater importance when we take into account that since 2002 the country has been almost completely excluded from international financial markets.

[3] While in 2002 the annual increase in the overall CPI was 25.9% and 13.4% in 2003, for food and beverages the rates were 34.6% and 19.1% respectively.

in unemployment and poverty. In the case of unemployment, from an already high rate of 15% in 2000, it increased to 25% in 2001, dropping then to a 21.5% in 2002. By 2004 unemployment was at its pre-crisis level and it continued to decrease further. In terms of poverty the changes were even more impressive: from 36% of the population living below the poverty line in 2000 to a record of 51.8% in 2003.

In response to the fast and increasing deterioration in the economic conditions of an important part of the population, the government implemented a series of measures aimed at attenuating the impacts of the crisis. The main measure was the implementation of a system of cash transfers. In Table 2 we show the evolution of cash transfers as a proportion of household income according to the decile of each household in terms of its per capita income. In Figure 3 we report the relationship between household per capita income and the participation of cash transfers for the poorest households. As we can appreciate, the policy of cash transfers has not been just a temporary measure, it has become instead a permanent element of the policy of re-distribution followed during the last 10 years. For instance, as it is shown in Table 3, the amount of resources involved in the system of conditional cash transfers increased from a 0.4% of the national budget in 2001 to a 4.9% in 2011, with a maximum of 6.6% in 2003.

To finance these transfers, especially at the peak of the crisis when the budgetary situation of all levels of government were rapidly deteriorating, the national government implemented in 2002 a system of very high export taxes, mainly those of agricultural commodities. Table 4 reports the evolution of these taxes, which were even further increased after the country had already been through the most turbulent part of the crisis. In addition to some sort of redistributive justification for maintaining export taxes at such high levels, the aim was to avoid the effects that rising world prices could have on domestic prices. Also, and not least important, it was the fact that export taxes had become one of the main sources of revenues, and also one of the easiest to collect (see Figure 4).

In summary, at the peak of the 2002 economic crisis, when the local currency had already depreciated by almost 300%, the rise in the price of agricultural commodities contributed further to the increase in domestic prices, especially those of tradable goods. As an example, in the period 2002-2011[4], while the overall consumer price index increased by 420%, that of food and beverage increased by 638.7%, the highest among the nine consumption categories, and only matched by the 612.6% increase in clothing. In Figure 5 we can observe an apparent positive relationship between consumer prices and world prices of agricultural commodities.

In the next sections we assess the ex-ante impact on poverty at the household level, that can arise due to the increase in the prices of agricultural commodities. Before this, a short review on the existing literature on the nexus between trade policy and poverty related to the specific case of Argentina is presented.[5]

[4] Since 2007 there has been a growing distrust about price statistics carried out by the National Institute of Statistics and Census (INDEC), thus for the period 2007-2011 prices indices are obtained using inflation data calculated by the Government of the Province of San Luis. More recently the distrust has extended to other statistics, such as measures of poverty, employment, and growth.

[5] A large body of literature, to which we do not refer to here, has focused almost exclusively on less developed countries, where food security is a very important issue, especially for the poorest households.

2. Previous evidence on the Trade-Poverty nexus for Argentina

The economic literature on the links between open trade policies and its assumed positive impact on economic growth and development has reached a consensus when results are measured on average. However, given the broad set of interrelated factors affecting social welfare outcomes as a result of trade liberalisation, when dealing with the likely beneficial impact at the level of households, the so called consensus is under dispute. In fact, trade policies have strong redistributive impacts and in most cases it is possible to identify economic groups that benefit and other that are negatively affected. Given the particular importance of local institutional arrangements and market functioning in determining the transmission of border prices to local levels, if poor individuals are among the ones that lose, the long run opportunities for the development of a country or region may be compromised.

McCullloch, *et al*. (2001) and Winters, *et al*. (2004) have contributed to deepen and clarify the scope of the debate, summarizing that, the empirical evidence, both in the cases of cross-country and country-case studies, has so far not provided homogeneous results, with liberalisation episodes in which the living conditions of the poorer declined. A common feature in terms of the choice of the methodology to assess the direct impact of trade liberalisation on poverty is the preference for partial equilibrium techniques instead of general equilibrium (GE) approaches. Indeed, crucial in the choice of the partial equilibrium approach is the possibility of identifying household income and consumption effects. A similar analysis applying GE techniques to quantify distributive effects as a result of price shocks will be limited due to the lack of sufficient disaggregation to fully trace the impact of policies on poverty .

The partial equilibrium approach in the existing literature dealing with the trade liberalisation poverty nexus starts with the canonical work of Deaton (1989), and gains impetus with the important methodological contribution in Porto (2006). Porto's methodology allows the identification of two crucial transmission channels: a) the change in relative prices due to a trade reform and b) how these price variations affect households as consumption and income earners. This approach has been eased by the availability of household surveys, especially for developing and less developed countries.

The Argentine case is studied in Porto (2006 and 2010), Barraud and Calfat (2008) and Barraud (2009), all of which estimate the impact of trade openness on families using household survey data.

The evidence for Argentina (Barraud and Calfat, 2008 and Porto 2006 and 2010) has focused on measuring the effects on poverty that resulted from trade liberalisation in the nineties. Barraud and Calfat (2008) show that trade liberalisation had a pro-poor effect via the reduction in the price of tradable goods and through the effects on the labour market in the sector of non-tradable goods. In the opposite direction, Barraud (2009) obtained that in the case of households related to the manufacturing sector, trade liberalisation between 1988 and 1998 would have had a negative impact on poverty. In the path-breaking methodological work of Porto (2006), the author finds that the implementation of MERCOSUR[6] benefited the average Argentine household across the entire income distribution. As the author points out, the reason behind this result is that Argentine trade policy protected the rich over the poor, prior to the reform, and granted some protection to the poor, after the reform. Finally, Porto (2010) studies the impact of improving access to international agro-manufacture export markets on poverty in

[6] MERCOSUR is a custom union originally signed by Argentina, Brazil, Paraguay and Uruguay. Venezuela joined recently as the fifth full member, while Bolivia and Chile are associate members under a free trade agreement scheme.

Argentina through two channels, the effects caused by price changes on food expenditure and on wages. Porto's measurement of improved market access is equivalent to an increase in the international price of agro-manufacturing commodities. The main finding is that a better market access would cause poverty to decline in Argentina.

Following Porto's latter contribution, in the present study, the objective is to contribute to the understanding of how the recent increase in the price of agricultural commodities, which is expected to persist over the medium-run, can affect poverty in Argentina. None of the previous evidence for Argentina has dealt directly with the implications of increasing agricultural commodity prices on the poor.[7]

3. Theoretical framework

The theoretical framework assumes a small open economy that produces and trades S primary commodities, of which $S_A \subset S$ are agricultural commodities. Assuming the number of primary commodities is at least as large as the number of factors, then factor rewards are fully determined by commodity prices:

$$W = p\left(P_S^D\right)$$

where W is the vector of factor rewards, and P_S^D is the vector of commodity prices in local currency.

Since our economy is small, we have:

$$P_S^D = EP_S^* \left(1 + \mathrm{T}\right)$$

where E is the nominal exchange rate, P_S^* is the vector of world commodity prices, and T is the vector that reflects the ad-valorem equivalent of the country trade policy, so we obtain:

$$W = p\left(P_S^*, E, \mathrm{T}\right)$$

There are also M traded manufacturing sectors, of which $M_F \subset M$ produce food goods. The M manufacturing sectors are monopolistically competitive. In each m sector each producer, domestic or foreign, produces a differentiated variety. Manufactures are produced under increasing returns to scale (IRS), using all factors of production and primary commodities. There are also N non-traded sectors that are also monopolistically competitive, with each domestic producer producing a differentiated variety under IRS using only the production factors.

[7] de Hoyos and Medvedev (2011) analyse the poverty impact of higher food prices from a global perspective.

Assuming also that production factors are perfectly mobile across all sectors, the price, in local currency, of each domestic variety of the M and N sectors can be expressed as a function of world commodity prices, and other parameters such that nominal exchange rate, domestic taxes/subsidies, trade policy etc.

To be more specific, let us assume that there are two primary commodities, A1 and A2, whose domestic prices are given by:

$$p_{A1}^{d} = E\, p_{A1}^{*} \left(1 + \tau_{A1}\right)$$

$$p_{A2}^{d} = E\, p_{A2}^{*} \left(1 + \tau_{A2}\right)$$

where E is the nominal exchange rate, $_{A1}$ and τ_{A2} are the ad-valorem equivalents of the country trade policy on goods A1 and A2 respectively, and the superscript * makes reference to world values. Then, given the small country assumption we get:

$$w_1 = f_1\left(P^{*}, \mathrm{T}, E\right)$$

$$w_2 = f_2\left(P^{*}, \mathrm{T}, E\right)$$

where $P^{*} = \left(p_{A1}^{*}, p_{A2}^{*}\right)$ and $\mathrm{T} = \left(\tau_{A1}, \tau_{A2}\right)$.

Each variety *i* produced by the manufacturing sector m is produced under IRS using the two factors of productions and the two primary commodities, with total costs equal to:

$$TC_{i,m} = C_{i,m}\left(\alpha_m + \beta_m x_{i,m}\right)$$

where α_m is the fixed input requirement, β_m is the input per unit of output produced by each firm, $x_{i,m}$, and $C_{i,m}$ is a Cobb-Douglas composite defined as:

$$C_{i,m} = w_1^{\mu_m} w_2^{\delta_m} \left(p_{A1}^{d}\right)^{\gamma_m} \left(p_{A2}^{d}\right)^{1-\mu_m-\delta_m-\gamma_m}$$

Each industry is monopolistically competitive, with each firm in sector m facing a constant elasticity of demand equal to σ_m[8], so the producer price of a domestically produced variety *i* in sector m is given by:

$$p_{i,m} = C_{i,m}\beta_m\left(\frac{\sigma_m}{\sigma_m - 1}\right)$$

Then, the consumer price, and under the simplifying assumption that there are no domestic taxes or subsidies, is:

$$p^c_{i,m} = p_{i,m}$$

For an imported variety, and defining τ^{imp}_m as the ad-valorem equivalent of trade costs on imports, the consumer price is equal to:

$$p^c_{i,m^*} = E\, p_{i,m^*}\left(1 + \tau^{imp}_m\right)$$

Finally, assuming that in each sector all firms are symmetric, and the CES function that determines the consumption of each variety of sector m, we have that the price index for all varieties (domestic and imported) of sector m is given by:

$$P_m = \left[N_m\left(p^c_{i,m}\right)^{1-\sigma_m} + N_{m^*}\left(p^c_{i,m^*}\right)^{1-\sigma_m}\right]^{\frac{1}{1-\sigma_m}}$$

where N_m and N_{m^*} are, respectively, the number of varieties produced domestically and abroad.

Working in a similar way as for the M sectors we obtain the following relationships for each non-traded sector n:

$$TC_{i,n} = C_{i,n}\left(\alpha_n + \beta_n x_{i,n}\right)$$

$$C_{i,n} = w_1^{\eta_n} w_2^{1-\eta_n}$$

$$p_{i,n} = C_{i,n}\beta_n\left(\frac{\sigma_n}{\sigma_n - 1}\right)$$

$$p^c_{i,n} = p_{i,n}$$

$$P_n = \left[N_n\left(p^c_{i,n}\right)^{1-\sigma_n}\right]^{\frac{1}{1-\sigma_n}}$$

As it emerges clearly from the price indices for the M and N sectors, they are func-

[8] The constant elasticity of demand follows from the assumption that the consumption of each variety produced by sector m is the result of a Constant Elasticity of Substitution (CES) function.

tion, among other factors, of international commodity prices. These relationships, as well as the effect on factor prices, are the ones we need to estimate in the empirical section.

4. Empirical framework

The methodology will follow that of Deaton (1989) and Benjamin and Deaton (1993), which consists of estimating two links, one that connects world commodity prices to domestic prices (goods and factors), and a second one connecting domestic prices to household welfare.

4.1. Price elasticities

Most of the existing literature on the subject relies on performing an impulse-response analysis to compute the pass-through of international prices to domestic ones. For example, Furlong and Ingenito (1996), Krichene (2008), Zoli (2009), Ferrucci, *et al*. (2010), Rigobon (2010), and Ianchovichina, *et al*. (2014), among others fit a Vector Autorregresive (VAR) model and then estimate the corresponding response of domestic prices to a given shock in international commodity prices. However, this approach fails to provide an "standard" measure of elasticity: that is, rather than providing the percentage change of a determined domestic price to a one-percentage change in the international price (i.e. the elasticity of the domestic price with respect to the international price), that "VAR approach" captures the response of the domestic price to a "shock" to the international price, with this shock usually defined as one standard deviation.

In our case, instead, we estimate the long-run elasticities by identifying a Vector Error Correction (VEC) model.[9] This allows us to obtain the elasticities according to the usual definition. Additionally, the identification of the cointegrating relationships implies adding theoretical assumptions, which provides an economic content to the analysis of the long run dynamics of the price time series.

Before presenting in the next section the results, we now briefly present the structure of the model we work with. Given a set of K time series variables representing the prices of goods, $p_t=(p_{1t},p_{2t},\ldots,p_{Kt})'$, the dynamic interactions between these variables can be captured through a Vector Autoregressive Model of order l, VAR(p), given by:

$$p_t = A_1 p_{t-1} + \ldots + A_l p_{t-l} + u_t$$

where A_j (j=1,…,l) is a KxK matrix, and u_t is assumed to represent a white noise process, with time-invariant, positive definite covariance matrix. If the process has a unit root, some or all variables are said to be integrated. Then, we are interested in analysing the cointegration relationships that appear explicitly in the VEC representation of the previous VAR process:

$$\Delta p_t = \Pi p_{t-1} + \Gamma_1 \Delta p_{t-1} + \ldots + \Gamma_{l-1} \Delta p_{t-l+1} + u_t \qquad (1)$$

[9] Anderson and Tyers (1992) is an example of the use of a an error-correction model to compute elasticities for changes in border prices relative to domestic producer prices.

If the VAR process has unit roots, the KxK matrix Π is singular. Assuming that p_t can be at most I(1), it turns out that Δp_t does not contains stochastic trends. As a consequence, the term Πp_{t-1} must also be I(0), being the only one that includes I(1) variables. This term specifies the cointegrating relationships. In particular, the number of cointegrating relationships is given by the rank of Π:

$$rk(\Pi)=r$$

where r is the cointegrating rank. Π can be written as $\Pi=\alpha\beta'$. The Kxr matrix β is called the cointegrating matrix, as the rx1 vector $ec_{t-1}=\beta' p_{t-1}$ contains the cointegration relations between prices. Note that $rk(\alpha)=rk(\beta)=r$. α is known as the Kxr loading matrix, that contains the weights attached to the cointegrating relations in the individuals equation of the model. Of course, matrices α and β are no unique if r<K. Therefore, it is necessary to gather non-sample information (associated to the economic theory) to fully identify the cointegrating relationships.

If the cointegrating rank is known, the reduced-rank maximum likelihood estimator (α_e,β_e) is available, which only estimates consistently the cointegrating space. However, to estimate α and β consistently it is necessary to add identifying (uniqueness) restrictions (given that Π is not singular, it is necessary to identify K-r variables utilizing prior information). The most widespread practice in the literature is to assume that the first part of β is an identity matrix, so it takes de form $\beta'=[I_r: \beta'_{k-r}]$, where I_r is and identity matrix of order r, while β'_{k-r} is an rx(K-r) matrix with the coefficients to be identified.[10]

For identification purposes, our assumption is that domestic prices are driven by the international ones. Then, let us define $p_t=(p_{1t},p_{2t},\ldots,p_{Kt})'=(pdfb_t, pdclo_t, pdequ_t, pdoth_t, pwa_t)'$; where the first four elements are the (log of) domestic prices of food and beverages (*pdfb*), clothing (*pdclo*), equipment (*pdequ*) and other goods[11] (*pdoth*); while *pwa* is the (log of) the international price of agricultural commodities. This ordering implies that innovations in international prices came first.

The estimation strategy is as follows. Firstly, unit root tests are applied on each variable separately to determine the order of integration. Secondly, the optimal VAR lag is computed according different criteria. Thirdly, cointegration tests are run to determine the cointegrating rank among the group of selected variables. Finally, the VEC model is estimated (after imposing identifying restrictions) to obtain the cointegrating matrix β. This matrix is thought to contain the long run elasticities of domestic prices (*pdfb*, *pdclo*, *pdequ*, *pdoth*) with respect to the international price of agricultural commodities (*pwa*).

[10] See Lütkepohl and Krätzig (2004) for more details.

[11] Housing, transport and communication, education, leisure, and other goods and services.

4.2. Wage elasticities

For the relationship between labour income and the international price of agricultural commodities, we follow what is standard in the literature and estimate an extended Mincer-wage equation with the following general specification:

$$\ln w_{j,t} = \alpha + \sum_{edu=1,2,3} \beta_{edu} \left(d_{edu} \times \ln P^{*}_{s_A,t} \right) + \sum_{edu=1,2,3} \delta_{s,edu} \left(d_{edu} \times \ln E_t \right) + \mathrm{Z_j} \Pi + u_{j,t} \qquad (2)$$

where $w_{j,t}$ is the log of the average hourly wage for an individual *j*, d_{edu} (edu=1,2,3) are three dummy variables to distinguish between three different levels of formal education: incomplete high school or less (edu=1), complete high school or incomplete tertiary/university (edu=2) and complete tertiary/university (edu=3), $P^{*}_{s_A,t}$ is an index of world prices of Argentina's main agricultural commodities, E_t is the nominal exchange rate between the local currency and the US dollar, and **Z** is a set of additional explanatory variables.

More specifically, we estimate five alternative specifications of an extended Mincer equation, the five specifications differ from each other depending on the set of controls included in **Z**:

- *Model 1*: age and age squared; dummy variables for males, head of household, not-single status, education (incomplete tertiary/university and complete tertiary/university education - the reference group is incomplete secondary or less), formal job, firm size (6 to 50, and more than 50 employees - the reference group is 1 to 5 employees), type of firm (private sector, and other sector - the reference group is public sector), sector of activity (20 dummies - the reference sector is agriculture, hunting, forestry and fishing), place of residence (31 dummies - the reference city is Buenos Aires), year (16 dummies - the reference year is 1995), quarter (3 dummies - the reference quarter is January-March)
- *Model 2*: same as Model 1 plus the interactions of the dummy variables (except for the year and quarter dummies) with a linear trend.
- *Model 3*: same as Model 1 plus the interactions of the dummy variables (except for the year and quarter dummies) with a linear and quadratic trends.
- *Model 4*: same as Model 1 plus the interactions of the dummy variables (except for the year and quarter dummies) with two linear trends, the first starting from the beginning of the period, and the second one starting from 2004.
- *Model 5*: same as Model 1 plus the interaction of all variables (except for the year and quarter dummies) with a dummy variable equal to 1 from 2004 to 2011.

All models include a constant term.

The interaction of the variables included in the set Z with the time trends or the dummy variable for the period 2004-2011, allows for changes in wages to be explained by other variables than the price of agricultural commodities and the exchange rate, avoiding the introduction of a bias in the calculation of the wage elasticities.

4.3. Welfare effects

For the second link, the welfare effect on household *h* will be measured by the negative of the compensating variation relative to total initial expenditure:

$$\frac{dx_0^h}{e^h} = \left(- \sum_{g \in N,M} s_g^h \frac{\partial \ln P_g}{\partial \ln p_{s_A}} + \sum_j \theta_j^h \varepsilon_{w,p_{s_A}}^j \right) d \ln p_{s_A} \qquad (3)$$

where s_g^h is the budget share spent on varieties produced by sector *g*, θ_j^h is the labour income of member *j* as a share of total income of household *h*, $\varepsilon_{w,p_{s_A}}^j$ is the wage elasticity that captures the proportional change in the wage of household member *j* as a response to the change in the world price of an agricultural commodity p_{s_A}; P_g refers to the price index for sector *g*. Considering the way in which equation (3) is computed, a negative value means a welfare loss, while a positive value means a welfare gain.

In equation (3) we do not consider second-order effects that take place through changes in consumption patterns in response to changes in domestic prices. However, if we compare expenditure shares between the survey for 2004/2005 (the one we use for our simulations) and the immediate before for 1996/1997, there are important differences in expenditure shares for some goods, especially in the case of food and beverages (see Figure 2), the one we expect to be the main driving force behind the changes in welfare. A similar result emerges when looking at the sources of income, with an important reduction of labour income, at the expense of transfers, for those at the low end of the expenditure distribution (see Figure 6). While the first change would help to reduce the negative effect on those at the lower end of the expenditure distribution, the second one plays the opposite role since now any benefit derived from an increase in the retribution to labour has a lower impact.

To include the second-order effects that work through changes in the patterns of consumption in response to changes in domestic prices, we calculate the compensating variation allowing for these responses, more specifically we calculate:

$$\begin{aligned} \frac{dx_0^h}{e^h} = & \left(- \sum_{g \in N,M} s_g^h \frac{\partial \ln P_g}{\partial \ln p_{s_A}} + \sum_j \theta_j^h \varepsilon_{w,p_{s_A}}^j \right) d \ln p_{s_A} \\ & - \left(\frac{1}{2} \sum_{g \in N,M} \sum_{k \in N,M} s_g^h \sigma_{gk} \left(\frac{\partial \ln P_g}{\partial \ln p_{s_A}} d \ln p_{s_A} \right) \left(\frac{\partial \ln P_k}{\partial \ln p_{s_A}} d \ln p_{s_A} \right) \right) \end{aligned} \qquad (3')$$

where σ_{gk} is the compensated price elasticity between goods of sector *g* with respect to goods of sector *k*.[12] In (3') we do not allow for second-order effects that work through changes in labour income.

In both (3) and (3'), and due to data availability we do not take into account the effects on non-labour income. Also, because of data restrictions, we assume households do not produce for their own consumption.

Finally, once the welfare effects have been recovered, we run non-parametric regressions of the changes in welfare as a function of household expenditure per capita.

[12] Price elasticities are from Florensa and Moncarz (2014).

5. Results

5.1. Elasticities of domestic prices and wages

For equation (1), we use monthly data covering the period 1992-2011. To take into account the possibility of a structural change in the data generating process, we split the whole period into two sub periods; firstly, the VEC model is adjusted to resemble the dynamics of the prices during the so-called convertibility period (1992-2000), in which the exchange rate remained fixed by law. Secondly, we fit the model utilizing the post-convertibility period during which there was exchange rate flexibility and a loose monetary policy (2003-2011). Years 2001 and 2002 were left aside in order to discard the effect of a period of exceptional macroeconomic disturbances that could affect the measurement of the elasticity coefficients. There is another factor that justifies the division of the data into two periods. As shown in Figure 1, the series representing the international price index of agricultural commodities displays a deterministic upward trend since the beginning of the 2000's. All estimations were performed using the J-Multi software (Lütkepohl and Krätzig; 2004).

For the first sub-period (1992-2000), the optimal lag length (in levels) is 2. The Johansen-trace test suggested that the cointegration rank (using seasonal dummies (D) and an intercept) equals 3. The estimated cointegrating relationships are:[13]

$$ec_{1,t} = pdfb_t + 0{,}171\ pdoth_t - 0{,}137\ pwa_t - 5{,}011 + D_{1',t}$$
$$\qquad\qquad (0{,}827) \qquad\quad (-2{,}823)^{***} \qquad (-5{,}933)^{***}$$

$$ec_{2,t} = pdclo_t - 0{,}253\ pdoth_t - 0{,}036\ pwa_t - 3{,}265 + D_{2',t}$$
$$\qquad\qquad (-5{,}190)^{***} \qquad (-3{,}178)^{***} \qquad (-16{,}388)^{***}$$

$$ec_{3,t} = pdequ_t - 0{,}466\ pdoth_t - 0{,}018\ pwa_t - 2{,}508 + D_{3',t}$$
$$\qquad\qquad (-9{,}279)^{***} \qquad (-1{,}518) \qquad (-12{,}235)^{***}$$

Note: t values between brackets. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

In the second sub-period (2003-2011) the optimal lag length was found to be 10; while the cointegration test were carried out by considering an intercept and a deterministic trend (T), and including also the nominal exchange rate (*E*). The null hypothesis that the cointegration order is 4 was not rejected. The estimated cointegrating relations are given by:

$$ec_{1,t} = pdfb_t - 0{,}279\ pwa_t - 1{,}754\ E_t - 1{,}850 - 0{,}004\ T$$
$$\qquad\qquad (-12{,}799)^{***} \qquad (-24{,}258)^{***} \quad (-14{,}875)^{***} \quad (-7{,}587)^{***}$$

$$ec_{2,t} = pdclo_t - 0{,}102\ pwa_t - 1{,}208\ E_t - 2{,}944 - 0{,}008\ T$$
$$\qquad\qquad (-7{,}352)^{***} \qquad (-26{,}629)^{***} \quad (-37{,}220)^{***} \quad (-21{,}387)^{***}$$

[13] Due to space availability we do not report neither discuss unit root tests, tests for selection of optimal VAR lags, and cointegration tests. They are available upon request.

$$ec_{3,t} = pdequ_t - 0{,}038\ pwa_t - 1{,}539\ E_t - 3{,}270 - 0{,}003\ T$$

(-2,372)** (-29,027)*** (-35,850)*** (-7,001)***

$$ec_{4,t} = pdoth_t - 0{,}048\ pwa_t - 1{,}271\ E_t - 3{,}548 - 0{,}004\ T$$

(-3,353)*** (-26,855)*** (-43,574)*** (-11,777)***

Note: t values between brackets. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

The long-run elasticities coefficients were measured for the whole period 1992-2011 in an attempt to compute a global representative measure. In this case the optimal lag length is 3. The cointegration test was run by considering an intercept and seasonal dummies, an including also the exchange rate in the model. The null given by $H_o: r \leq 3$ was not be rejected. The resulting estimated equations are:

$$ec_{1,t} = pdfb_t - 1{,}118\ pdoth_t - 0{,}236\ pwa_t - 0{,}128\ E_t + 1{,}888 + D_{1',t}$$

(-19,489)*** (-4,841)*** (-3,728)*** (8,440)***

$$ec_{2,t} = pdclo_t - 0{,}794\ pdoth_t - 0{,}377\ pwa_t - 0{,}328\ E_t + 1{,}311 + D_{2',t}$$

(-6,599)*** (-3,691)*** (-4,545)*** (2,794)***

$$ec_{3,t} = pdequ_t - 0{,}777\ pdoth_t - 0{,}230\ pwa_t - 0{,}279\ E_t + 0{,}153 + D_{3',t}$$

(-10,604)*** (-3,690)*** (-6,349)*** (0,536)

Note: t values between brackets. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

Given that the deterministic time trend was significantly different from zero when the estimation is carried out for the second sub period, an additional VEC model was adjusted by including a deterministic time trend for 1992-2011. In this case, the optimal lag length (in levels) was equal to 3, whereas the cointegrating test was carried out by considering an intercept, seasonal dummies and the time trend. The null hypothesis that suggests at least 3 cointegrating equations was not rejected. The estimated cointegrating equations that describe the long-run relationships between domestic prices and the international price of agricultural commodities are:

$$ec_{1,t} = pdfb_t - 1{,}333\ pdoth_t - 0{,}077\ pwa_t - 0{,}073\ E_t + 2{,}102 + 0{,}001\ T + D_{1',t}$$

(-15,847)*** (-1,709)* (-2,353) ** (8,049)*** (2,870)***

$$ec_{2,t} = pdclo_t - 1{,}202\ pdoth_t - 0{,}093\ pwa_t - 0{,}227\ E_t + 1{,}786 + 0{,}003\ T + D_{2',t}$$

(-8,895) *** (-1,287) (-4,574)*** (4,259) *** (3,359)***

$$ec_{3,t} = pdequ_t - 1{,}058\ pdoth_t - 0{,}025\ pwa_t - 0{,}208\ E_t + 0{,}445 + 0{,}002\ T + D_{3',t}$$

(-33,934) *** (-1,514) (-18,095) *** (4,602)*** (10,103)***

Note: t values between brackets. *** p<0.01, ** p<0.05, * p<0.1.

Source: Own calculations.

By comparing the two estimations for the whole period 1992-2011, it can be seen that the results remain quite sensitive to the existence of a time trend.

All in all, the different estimates suggest that the pattern of transmission of international prices into domestic prices depends upon the period under review. The differences are explained not only by changes in the applied macroeconomic policies but also by the variations in the data generating process. In the simulations below, and since our interest is to analyse the effects of the recent increase in world commodity prices, we will use the elasticities obtained for the sub-period 2003-2011. Another reason, in this case more technical one, is that the sub-period 2003-2011 is the only one for which we cannot reject the null of four cointegrating relationships, so that the order in which domestic prices enter into the vector p_t is irrelevant for the estimation of their elasticities with respect to *paw*.

With regards to the elasticities of wages with respect to world prices of agricultural commodities, equation (2) was estimated using a pool of cross-section household surveys. Table 5 reports the results. As we can appreciate from the reading of the Table there is a positive and significant relationship between the world price of agricultural commodities and the wage rate of the least skilled workers (incomplete high school or less). The same is true for those with an intermediate education, but in this case the elasticities are less than a half of those obtained for the previous group. Finally, for the group with a complete tertiary or university education the estimates are in all cases not significant.

We also test if the wage elasticities are statistically different among the three groups. In all cases we can reject the null that the elasticities for the least skilled are the same as for the other two groups. When we compare those with an intermediate and upper levels of education, in three out of five cases we also reject the null that the coefficients are the same. In the simulations carried out in the next section we use the estimates from model 4.

5.2. Simulation of Welfare effects

Using the elasticities obtained before, budget shares from the National Survey of Household Expenditures (ENGH0) of 2004/2005, and assuming a 100% increase in the international price of agricultural commodities, applying equations (3) and (3') we can calculate the effect on welfare for each household under different behavioural assumptions about consumption adjustments. Then, we run non-parametric regressions of the welfare effects as a function of household per capita expenditure.[14] Figures 7 to 10 show these simulations.

Given that for all consumption categories we obtain positive elasticities of domestic prices with respect to agricultural commodity prices, it is not a surprise that all households lose with an increase in the prices of agricultural commodities. From Figure 7 we have that on the consumption side households at the lowest end of the expenditure distribution are the ones that are most affected through the increase in prices of food and beverages, while for non-food and beverages goods the opposite result arises, but the magnitude of the effects is much smaller than for food and beverages. Allowing for second order effects, as expected reduce the welfare loss, in about a 10%. There is almost no difference when we consider only own-price elasticities or both own- and cross-price elasticities. The improvement when allowing for consumption adjustments comes almost completely from food and beverages. In the aggregate (see Figure 8), are the poorer households the ones most affected by the increase in agricultural commodity prices, with losses of up to almost 12% of the household initial expenditure when no consump-

[14] The sample sizes used in the regressions are 26431 observations. Each observation is weighted by the inverse of the probability of the household to be included into the sample.

tion adjustment is assumed, and up to 10% when we allow for households to change their consumption basket.

To obtain the income labour effects, we use the wage elasticities reported in Table 5. Then, using the income share of each member of the household, and once again assuming a 100% increase in the price of agricultural commodities, we calculate the welfare effect coming through changes in wages. As it is shown in Figure 9, there is a positive effect working through the increase in labour income, with this effect benefiting the most to middle income households, and the least to the richest households. This result could be explained due to the pattern of factor intensity of Argentina's production, especially those of food exports which are relatively intensive in the use of agricultural commodities, and most likely also relatively intensive in semi-skilled labour. However, the increase in labour income is not enough to compensate for the welfare loss that works through the consumption of goods.[15]

Once we add the effects that work through consumption and labour income, poorest households are the most affected (see Figure 10). However, all households lose with the increase of agricultural commodity prices, the losses range from as much as 6.5% to around a 10% of the initial expenditure if no consumption adjustment is allowed, and between 6% and 9% when we allow for households to change their consumption patterns. The distribution of losses along the per capita expenditure of households is, a priori, in line with what could a priori be expected, an increase in the price of agricultural commodities hurting more to poorer households due to the higher weight of food and beverages into household consumption, which are goods intensive in the use of agricultural commodities.

5.3. Simulating the effect on poverty

To grasp an approximate idea of how important is the impact on poverty of an increase in world commodity prices, in Table 6 we report the indigence and poverty rates that would follow after a 100% increase in world prices of agricultural commodities, as well as two additional measures: the indigence/poverty gap and severity.[16] To get the new indigence rate, we calculate the new indigence line under the assumption that the extra amount of expenditure a household needs in order to avoid to be classified as indigent is given by the effect that works through the increase in the domestic prices of food and beverages. In the case of the poverty rate, the extra amount of money a household needs to avoid to be poor is given by the effects of changes in the domestic prices of four categories of goods: food and beverages, clothing, housing and transport and communications.[17] New household incomes are calculated taking into account only the effect on labour income of salaried household members. From the results

[15] The fact that we are not considering non-labour income may bias our results against the richer households, since the increase in the world prices of agricultural commodities meant an important improvement in the rent of land used in agricultural production. Also, the use of this rent by land-owners meant an important contributions to others sectors of the economy, especially the building sector.

[16] The rate, gap and severity of indigence and poverty are measured following Foster *et al*. (1984), using the following formula: $$R = \frac{1}{N}\sum_{h=1}^{N}\left(\frac{z_h - y_h}{z_h}\right)^{\alpha} I^*\left(y_h < z_h\right)$$, where N is the total number of households, z_h is the indigence/poverty threshold for household *h* (these thresholds are household-specific, depending on the structure of the household in terms of the age and gender of its members), y_h is total income of household *h*, and $I^*(y_h < z_h)$ is a latent variable equal to 1 if $y_h < z_h$. When $\alpha = 0$ we obtain the rates of indigence/poverty, if $\alpha = 1$ we have the indigence/poverty gap, and when $\alpha = 2$ we have the indigence/poverty severity.

[17] Ideally, it would be more appropriate to work with the changes in the consumption prices of the goods that constitute the baskets of indigence and poverty. However we do not have access to price indices with that level of detail.

reported in Table 6, we obtain that in absolute values there is an increase in indigence of 2.4 pp., while in the case of poverty it is of 3.5 pp., however while for the case of poverty the relative increase is about 13.4%, for indigence the new value is almost 34% higher than the original figure. These changes means that about 250 thousand new households would have fallen into indigence, while 365 thousand into poverty. When we allow for households to adjust their consumption patterns, the increases in indigence and poverty rates are, respectively, 0.3 pp. and 0.5 pp. less than when there is no adjustment.

If instead of using a headcount measure we look at the deepness of indigence and poverty, we obtain that in relative terms, the gap and severity of poverty increase more than their corresponding rate, whilst in the case of indigence the opposite outcome arises. This result means that in the case of poverty, there is not only an increase in response to the raise in the price of agricultural commodities, but also that those who were already poor as well as those who become poor, move in average further away from the poverty threshold. These results mean also that poor and indigent households become a less heterogeneous group.

6. Summary and conclusions

The increase in the price of agricultural commodities benefited greatly to Argentina, especially in a period when the country was almost completely excluded (forcibly and/or voluntarily) from international financial markets. On the other hand, with a large share of the population with low and medium-low incomes, the increase in agricultural commodities prices has the potential to hurt an important part of the population through a raise in the price of goods that explain an important share of households expenditures, especially those that constitute the food-basket. The evidence shows that this can be expected to be the case. A less obvious channel works through changes in factor incomes. In the case of labour income, this effect would be more beneficial to the middle income households, but its magnitude is not large enough to compensate for the negative effects working through the changes in the prices of consumption goods.

Table 1: Decomposition of Argentina's export growth

		1992-2002	2002-2012
All sectors	Price	-9%	100%
	Quantity	130%	58%
Agricultural primary products	Price	-9%	139%
	Quantity	66%	55%
Manufactures of agricultural origin	Price	-19%	154%
	Quantity	107%	33%
Manufactures of industrial origin	Price	-12%	48%
	Quantity	207%	146%
Fuel and energy	Price	18%	350%
	Quantity	262%	-69%
Change in Terms of Trade		8%	42%

Source: own based on National Institute of Statistics and Census

Table 2: Transfers (*) as a proportion of Household Income

	Decile (household per capita income)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2004	6.2	3.6	2.8	1.2	0.6	0.4	0.2	0.1	0.1	0.1
2005	9.8	4.5	2.2	1.2	0.5	0.4	0.2	0.1	0.1	0.0
2006	11.9	3.8	1.7	1.0	0.4	0.3	0.1	0.1	0.1	0.0
2007	12.5	3.3	1.7	0.9	0.5	0.3	0.1	0.1	0.0	0.1
2008	10.7	2.7	1.2	0.6	0.3	0.2	0.1	0.0	0.1	0.1
2009	11.3	2.8	1.2	0.7	0.4	0.2	0.1	0.1	0.1	0.1
2010	15.0	4.4	2.2	1.0	0.5	0.5	0.2	0.1	0.1	0.1
2011	15.0	4.2	1.8	0.9	0.5	0.3	0.2	0.1	0.1	0.0

(*) Social cash transfers by governments, churches and other NOGs. It excludes retirement and unemployment benefits.
Source: own based on Permanent Household Survey.

Table 3 Conditional cash transfers Programs by the National Government. Millions at current prices

	Job support	Household Heads	Employment and Training Insurance	Social Inclusion	Universal Child Support	**Total**	**National Budget**	**% of National budget**
2001	178.8					**178.8**	**47,904.5**	**0.4**
2002		2,248.2				**2,248.2**	**46,064.8**	**4.9**
2003		3,713.7				**3,713.7**	**56,404.5**	**6.6**
2004		3,475.8				**3,475.8**	**64,275.3**	**5.4**
2005		2,996.9				**2,996.9**	**86,839.2**	**3.5**
2006		2,496.4		639.9		**3,136.3**	**105,892.9**	**3.0**
2007		1,737.0	209.2	1,171.1		**3,117.3**	**142,421.0**	**2.2**
2008		1,275.6	259.1	1,886.3		**3,421.0**	**192,974.1**	**1.8**
2009		1,011.8	477.6	1,753.7	1,700.0	**4,943.1**	**262,876.1**	**1.9**
2010		641.6	490.1	2,374.5	9,965.0	**13,471.2**	**274,779.4**	**4.9**

Source: Cogliandro, G. (2010). El programa Asignación Universal por Hijo para protección social y los cambios en los programas de transferencias condicionadas.

Table 4 Export taxes on main agricultural commodities (%)

	Wheat	Maize	Soybeans (seeds)		Soybeans (meal)		Soybeans (oil)				Sunflower (seeds)	Sunflower (oil)
NCM	1001.10.90	1005.90.10	1201.00.10	1201.00.90	2304.00.10	2304.00.90	1507.10.00	1507.90.11	1507.90.19	2306.30.10	1206.00.90	1512.11.00
1992	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0
1993	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
1994	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
1995	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
1996	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
1997	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
1998	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
1999	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
2000	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
2001	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0
2002	20.0	20.0	20.0	27.0	20.0	5.0	20.0	20.0	20.0	20.0	27.0	20.0
2003	20.0	20.0	20.0	27.0	20.0	5.0	20.0	20.0	20.0	20.0	27.0	20.0
2004	20.0	20.0	20.0	27.0	20.0	5.0	20.0	20.0	20.0	20.0	27.0	20.0
2005	20.0	20.0	20.0	27.0	20.0	5.0	20.0	20.0	20.0	20.0	27.0	20.0
2006	20.0	20.0	20.0	27.0	20.0	5.0	20.0	20.0	20.0	20.0	27.0	20.0
2007	20.0	20.0	20.0	27.5	24.0	9.0	24.0	24.0	24.0	20.0	27.0	20.0
2008	28.0	25.0	20.0	35.0	32.0	9.0	32.0	32.0	32.0	30.0	32.0	30.0
2009	23.0	20.0	20.0	35.0	32.0	9.0	32.0	32.0	32.0	30.0	32.0	30.0
2010	23.0	20.0	20.0	35.0	32.0	9.0	32.0	32.0	32.0	30.0	32.0	30.0
2011	23.0	20.0	20.0	35.0	32.0	9.0	32.0	32.0	32.0	30.0	32.0	30.0
2012	23.0	20.0	20.0	35.0	32.0	9.0	32.0	32.0	32.0	30.0	32.0	30.0

Source: own based on Rosario Stock Exchange.

Table 5 Wage elasticities

	(1)	(2)	(3)	(4)	(5)
Incomplete High School or less (a)	0.0911***	0.0859***	0.0551***	0.0945***	0.0823***
	(0.017)	(0.014)	(0.018)	(0.016)	(0.015)
Complete H. School / Incomplete Tertiary/ University (b)	0.0347**	0.0332**	0.0099	0.0353***	0.0337**
	(0.017)	(0.014)	(0.014)	(0.013)	(0.017)
Complete Tertiary/University (c)	-0.0239	-0.0157	-0.0086	0.0229	-0.0141
	(0.025)	(0.022)	(0.023)	(0.023)	(0.022)
Observations	782,039	782,039	782,039	782,039	782,039
R-squared	0.844	0.846	0.847	0.847	0.847
Test of equality of coefficients					
(P. values)					
H_0: (a) = (b)	0.0000	0.0000	0.0000	0.0000	0.0000
H_0: (a) = (c)	0.0000	0.0000	0.0024	0.0010	0.0000
H_0: (b) = (c)	0.0000	0.0004	0.3652	0.5344	0.0002

Other explanatory variables:

Model 1: age and age squared; dummy variables for males, head of household, not-single status, education (incomplete tertiary/university and complete tertiary/university education - the reference group is incomplete secondary or less), formal job, firm size (6 to 50, and more than 50 employees - the reference group is 1 to 5 employees), type of firm (private sector, and other sector - the reference group is public sector), sector of activity (20 dummies - the reference sector is agriculture, hunting, forestry and fishing), place of residence (31 dummies - the reference city is Buenos Aires), year (14 dummies - the reference year is 2012), quarter (3 dummies - the reference quarter is January-March)

Model 2: same as Model 1 plus the interactions of the dummy variables (except for the year and quarter dummies) with a linear trend.

Model 3: same as Model 1 plus the interactions of the dummy variables (except for the year and quarter dummies) with a linear and quadratic trends.

Model 4: same as Model 1 plus the interactions of the dummy variables (except for the year and quarter dummies) with two linear trends, the first starting at the beginning of the period and the second starting in 2004.

Model 5: same as Model 1 plus the interaction of all variables (except for the year and quarter dummies) with a dummy variable equal to 1 from 2004 to 2012.

All models include a constant term and the nominal exchange rate interacted with the three educational dummies.

Robust standard errors between brackets

*** p<0.01, ** p<0.05, * p<0.1.

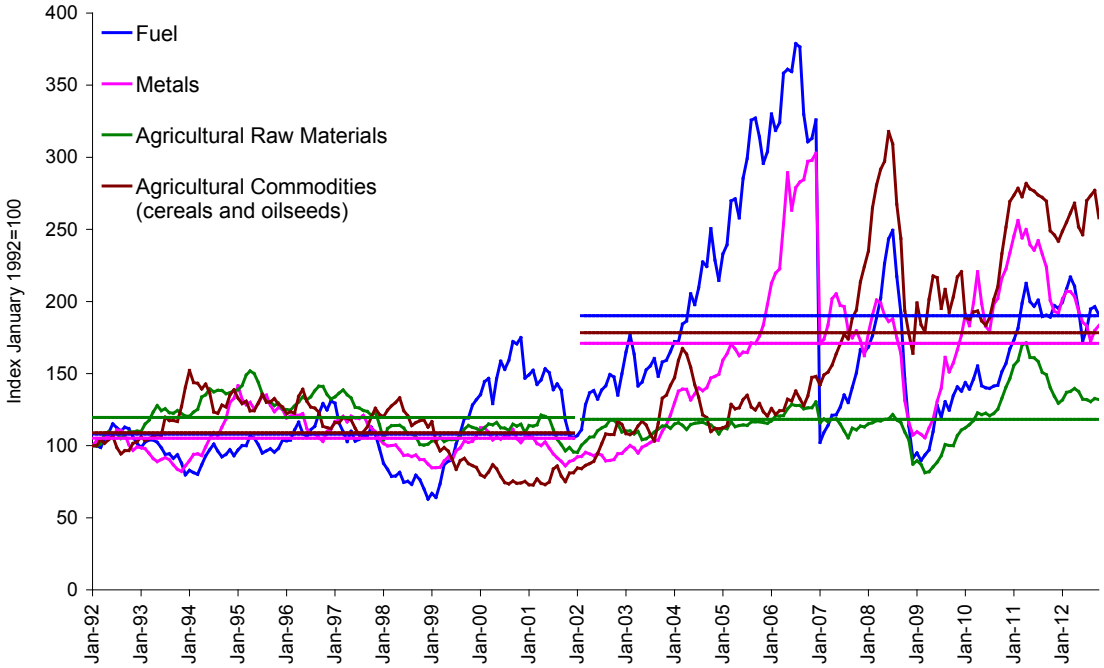
Table 6 Indigence and Poverty rates in urban areas
Pre and post a 100% increase in world prices of agricultural commodities

	Variable	Adjustment in consumption		
		No	Yes (1)	Yes (2)
Indigence (A)	Rate (pre)	7.1%	7.1%	7.1%
	Rate (post)	9.5%	9.1%	9.1%
	Gap (pre)	2.4%	2.4%	2.4%
	Gap (post)	3.2%	3.0%	3.0%
	Severity (pre)	1.3%	1.3%	1.3%
	Severity (post)	1.6%	1.5%	1.5%
Poverty (B)	Rate (pre)	26.0%	26.0%	26.0%
	Rate (post)	29.4%	28.9%	28.9%
	Gap (pre)	9.9%	9.9%	9.9%
	Gap (post)	11.6%	11.3%	11.3%
	Severity (pre)	5.3%	5.3%	5.3%
	Severity (post)	6.3%	6.1%	6.1%

(A) For the post values only includes the effects of changes in the prices of food and beverages. (B) For the post values only includes the effects of changes in the prices of food and beverages, clothing, housing, and transport and communications. (1) Considering only own-price elasticities. (2) Considering own- and cross-price elasticities.

Note: simulated (post) values for columns 2 and 3 differ between them at the second or third decimal.

Figure 1 Evolution of main primary commodity prices

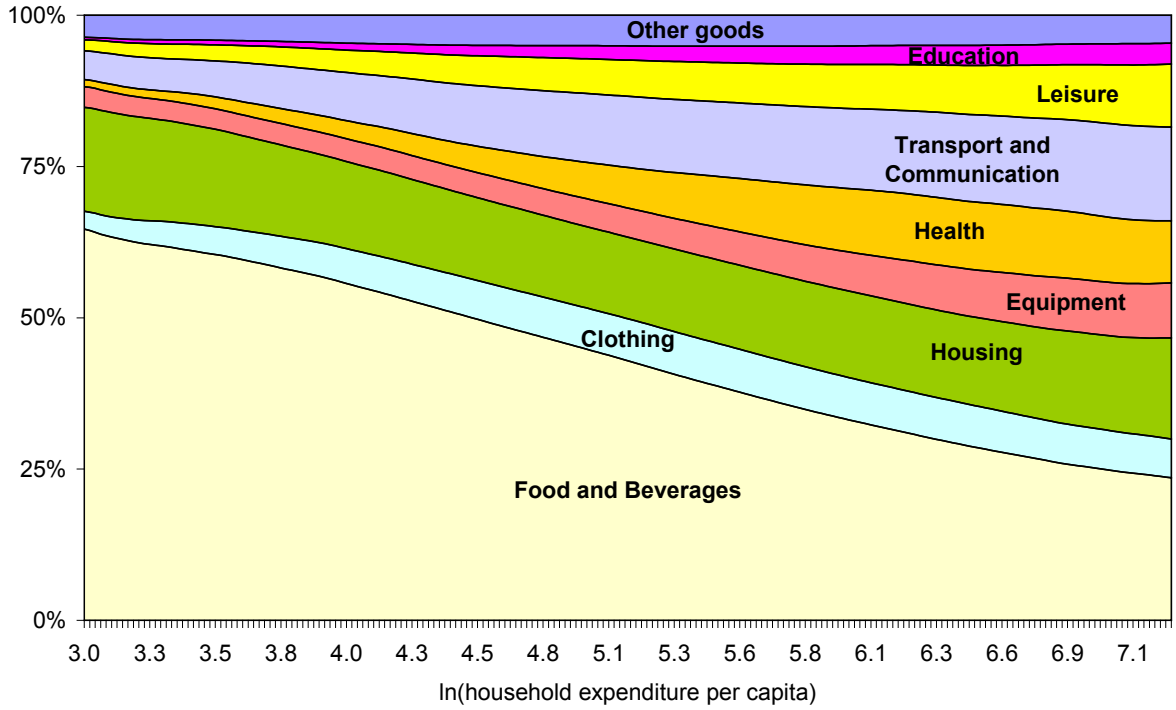


Source: own based on WITS and www.indexmundi.com (retrieved on November 12, 2012).

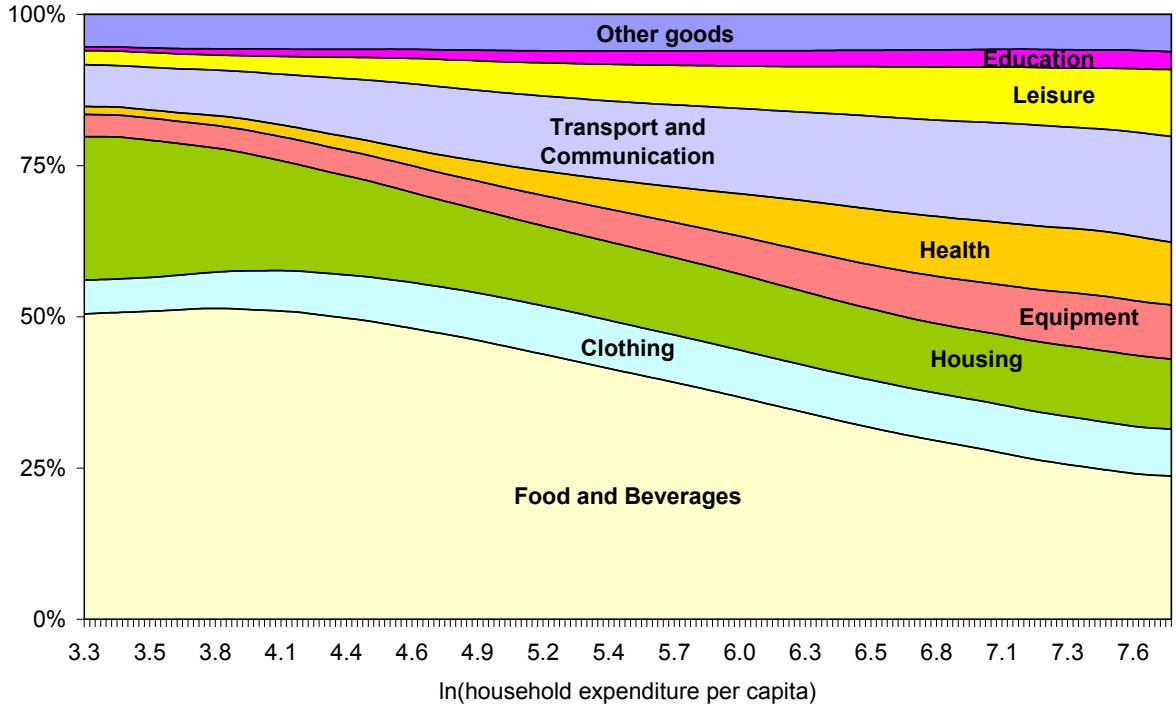
Note: for agricultural commodities is an export weighted average of the world prices of Argentina's main commodities

Figure 2 Expenditure shares and household expenditure (*)

1996/1997



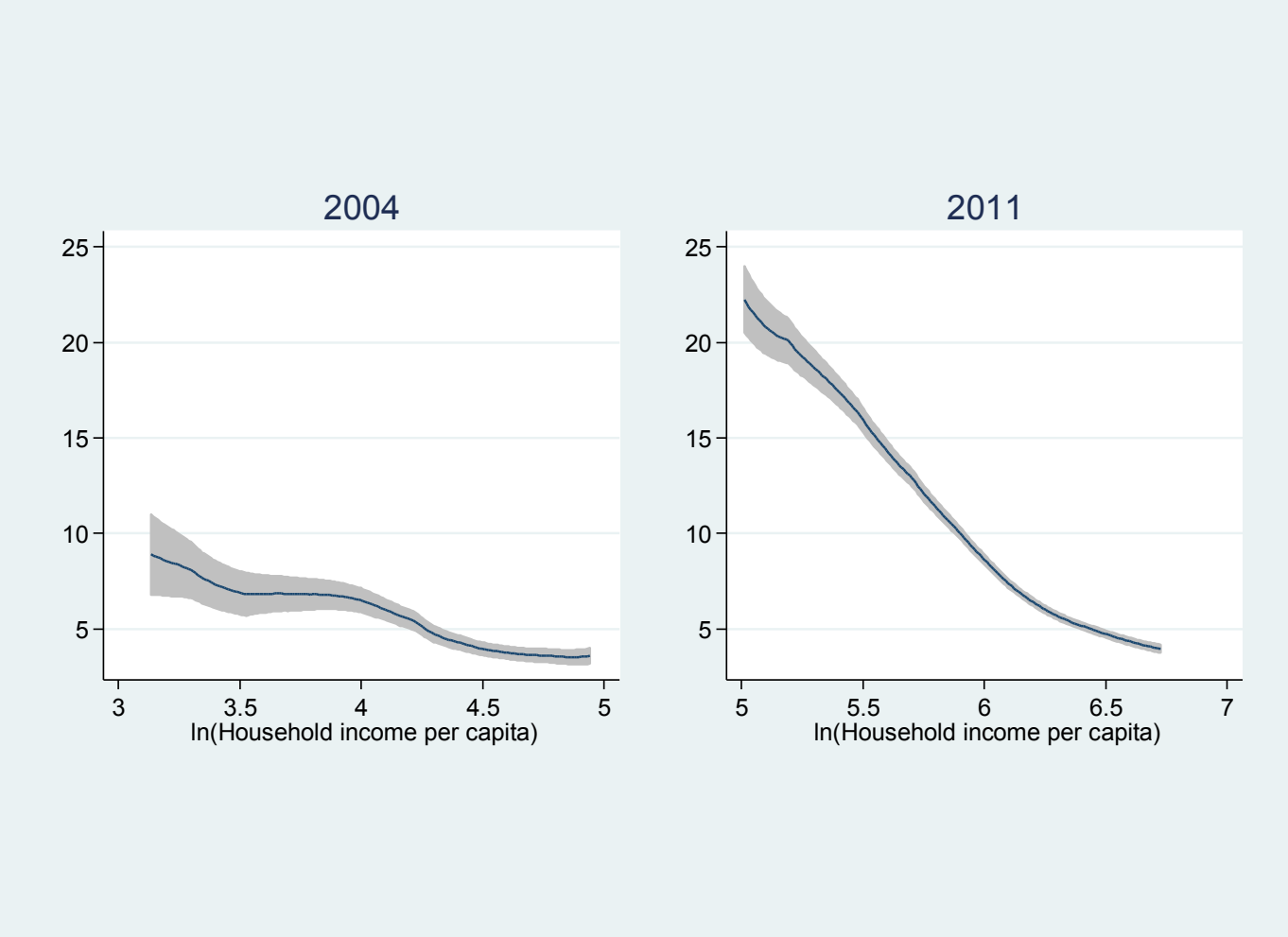
2004/2005



(*) The relationships between expenditure shares and expenditure per capita were obtained by non-parametric regressions.

Source: own based on ENGHo 1996/1997 and ENGHo 2004/2005.

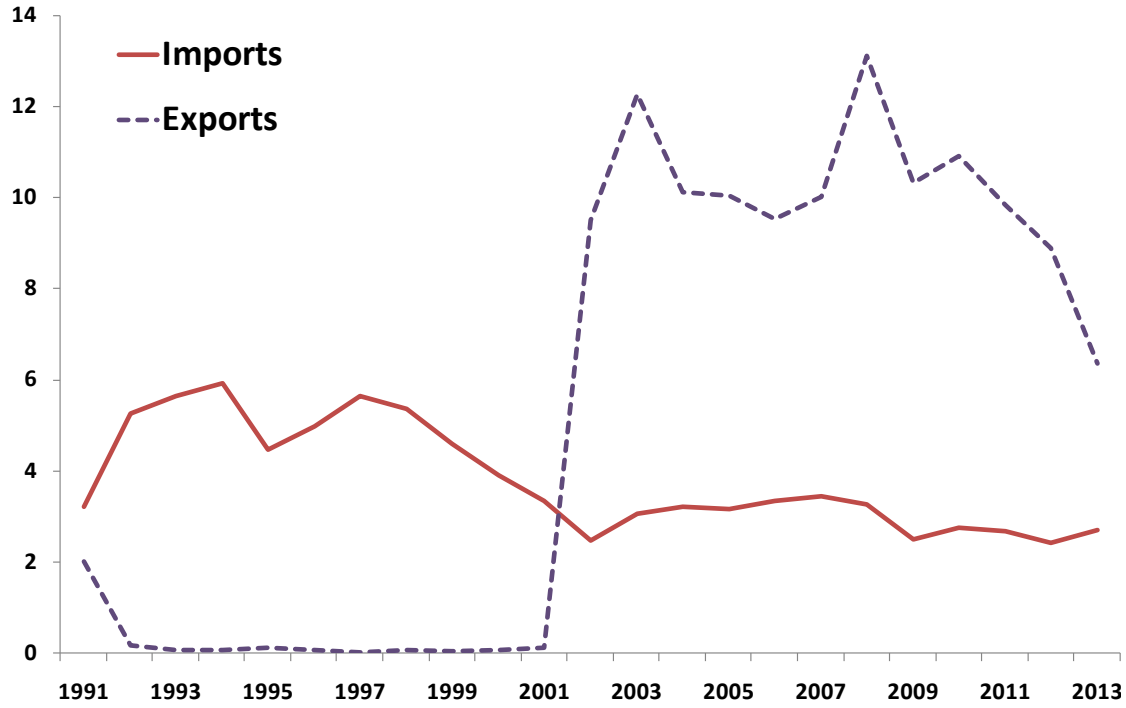
Figure 3 Cash transfers as percentage of household per-capita income. Deciles 1 and 2



Note: the relationships are estimated through non-parametric regressions. Source: own based on Permanent Household Survey.

Figure 4 Tax revenues on Foreign Trade

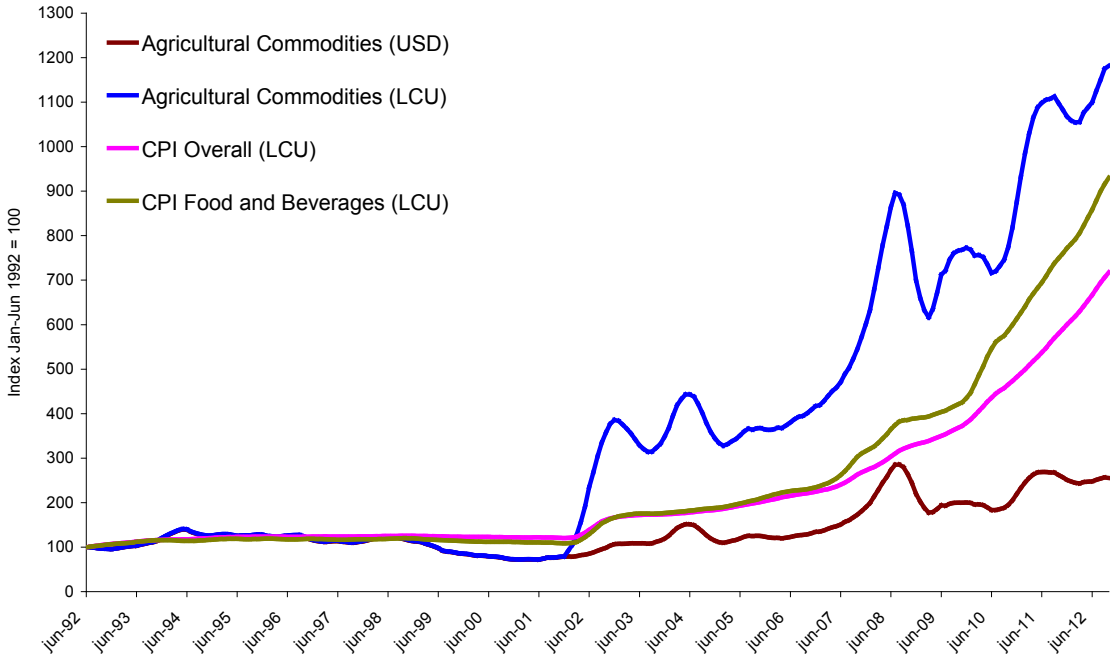
% of Total Revenues by National Government (*)



(*) Total Revenues include contributions to the National Social Security System and the share of tax revenues that are automatically transferred to the Provinces under different tax-sharing regimes.

Source: own based on Subsecretaría de Ingresos Públicos.

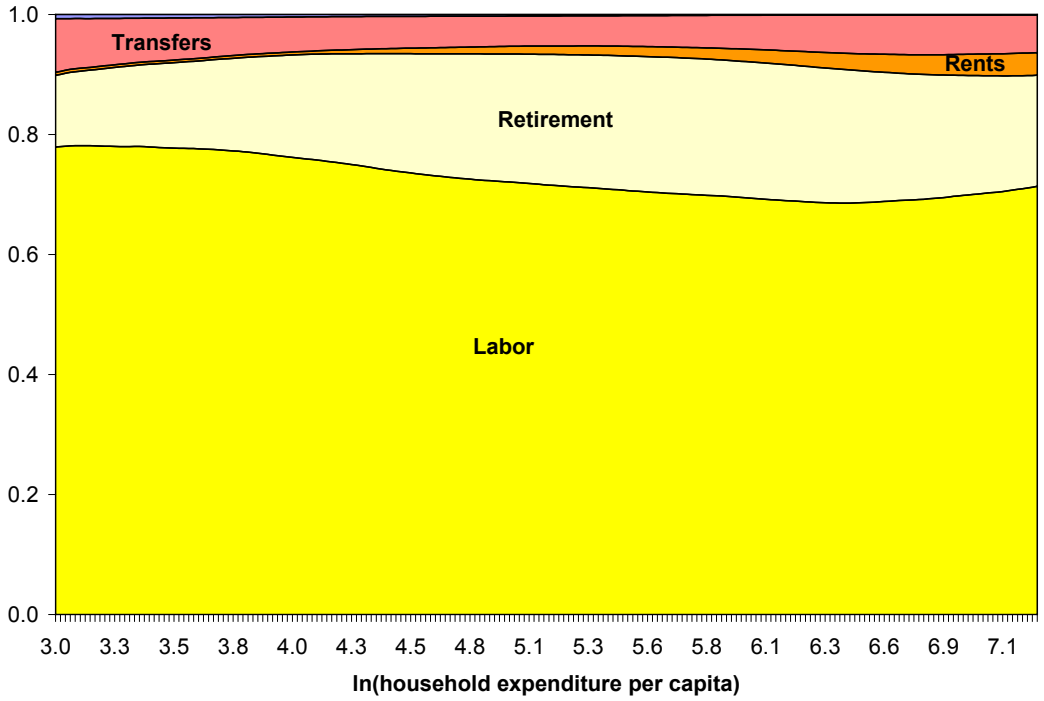
Figure 5 Agricultural commodity and consumer prices (six-month moving average)



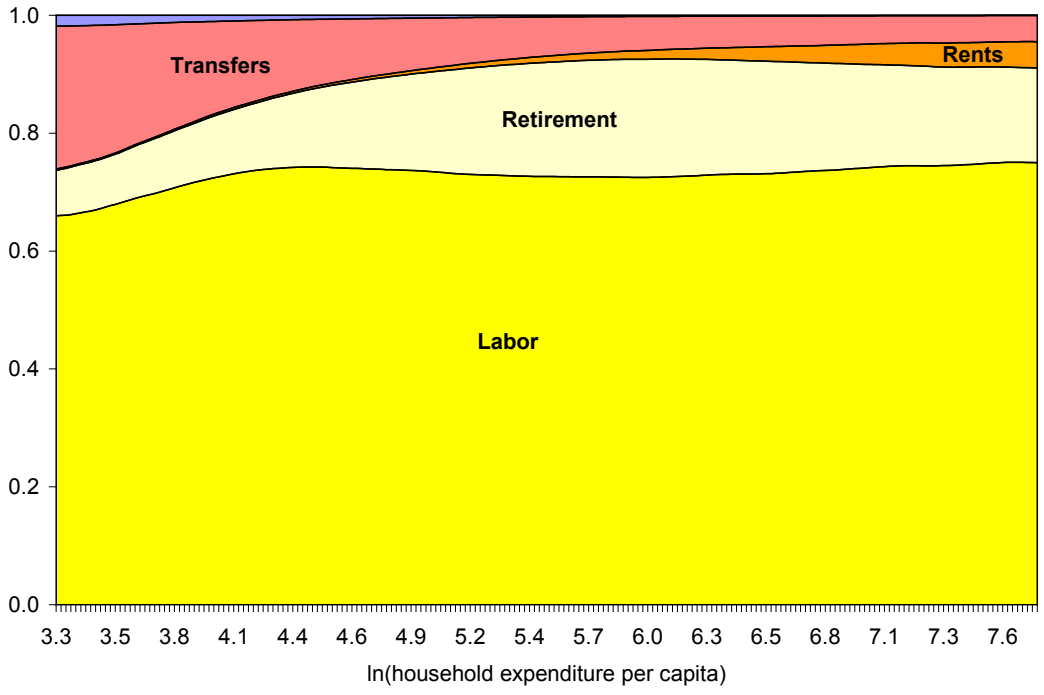
Source: own based on WITS, Instituto Nacional de Estadísticas y Censos, Government Province of San Luis, and www.indexmundi.com (retrieved on November 12, 2012)

Figure 6 Income sources and household expenditure (*)

1996/1997



2004/2005

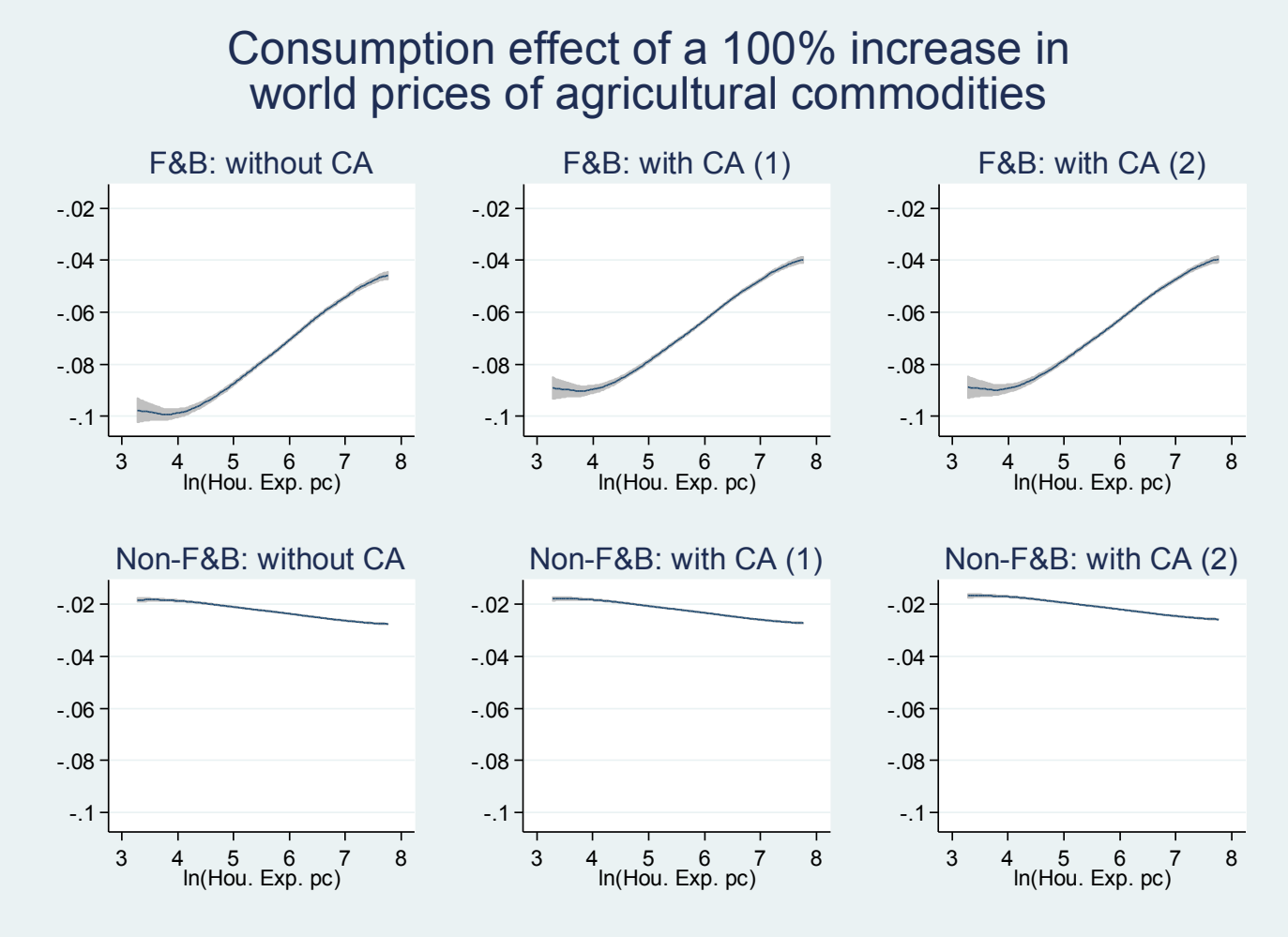


(*) The relationships between income shares and expenditure per capita were obtained by non-parametric regressions.

Note: Labour includes salaried workers, self-employed and employers; Rents include housing rents, dividends and interest.

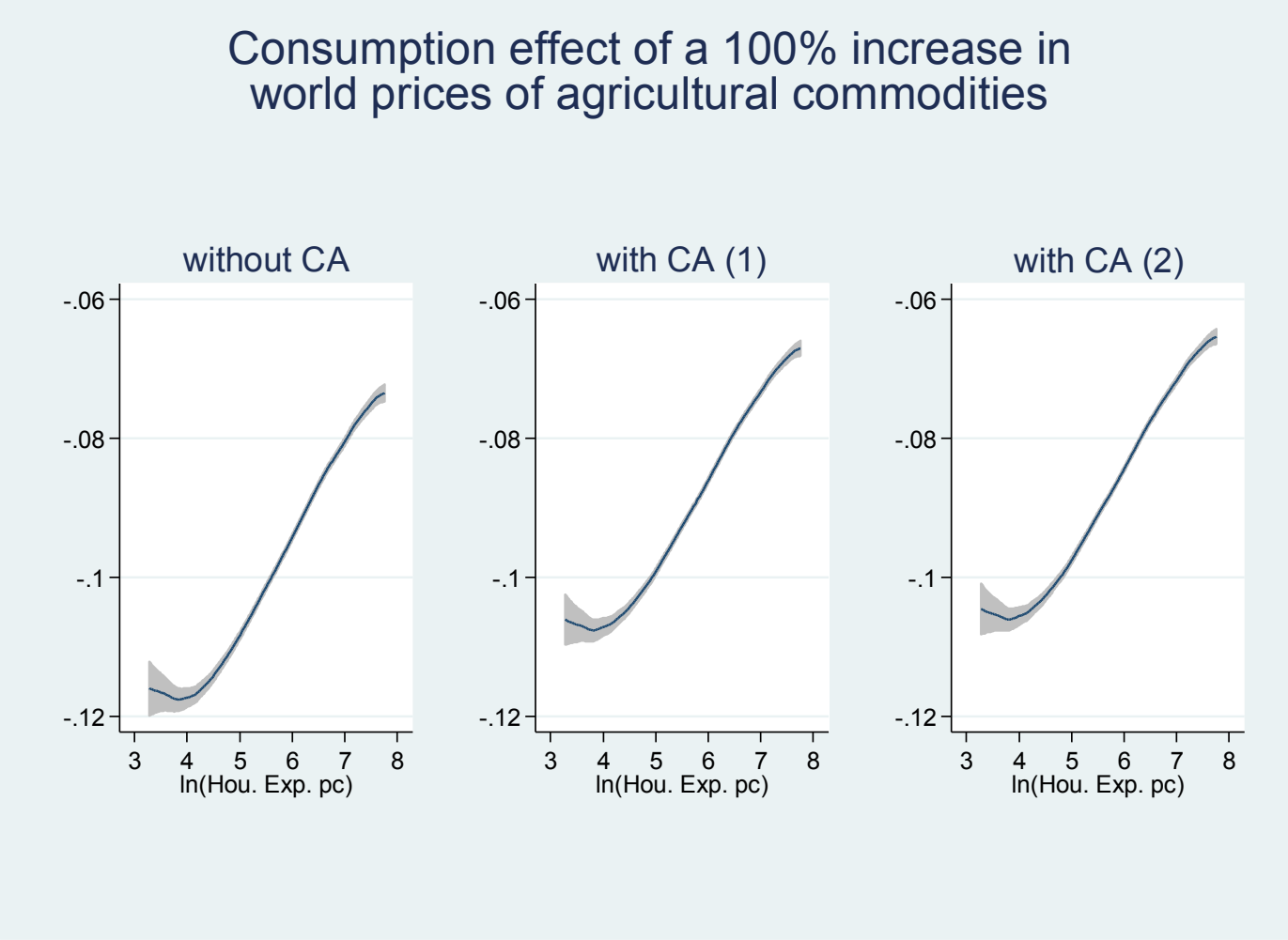
Source: own based on ENGHo 1996/1997 and ENGHo 2004/2005.

Figure 7



(1) considering only own-price elasticities. (2) considering own- and cross-price elasticities.

Figure 8



(1) considering only own-price elasticities. (2) considering own- and cross-price elasticities.

Figure 9

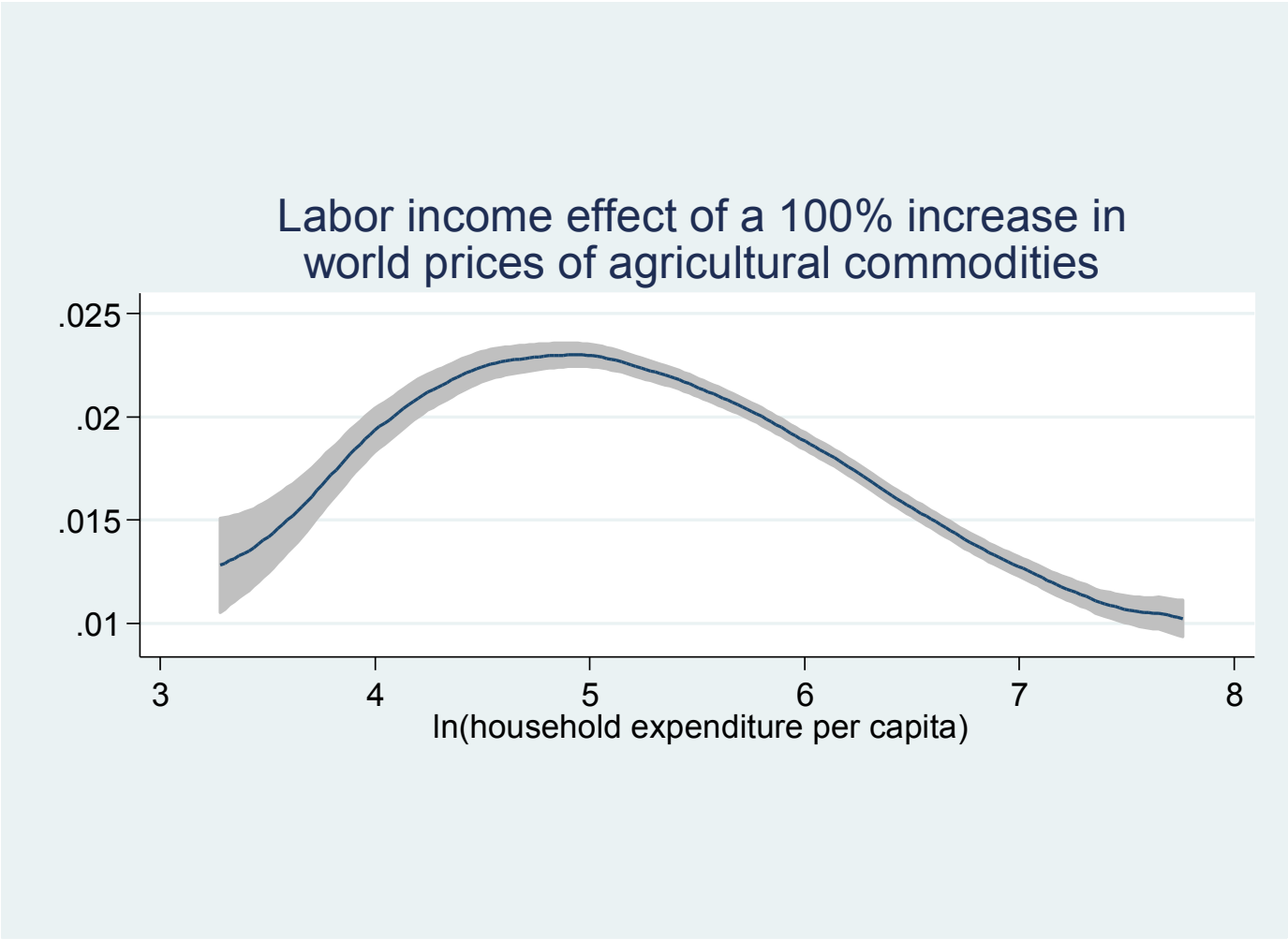
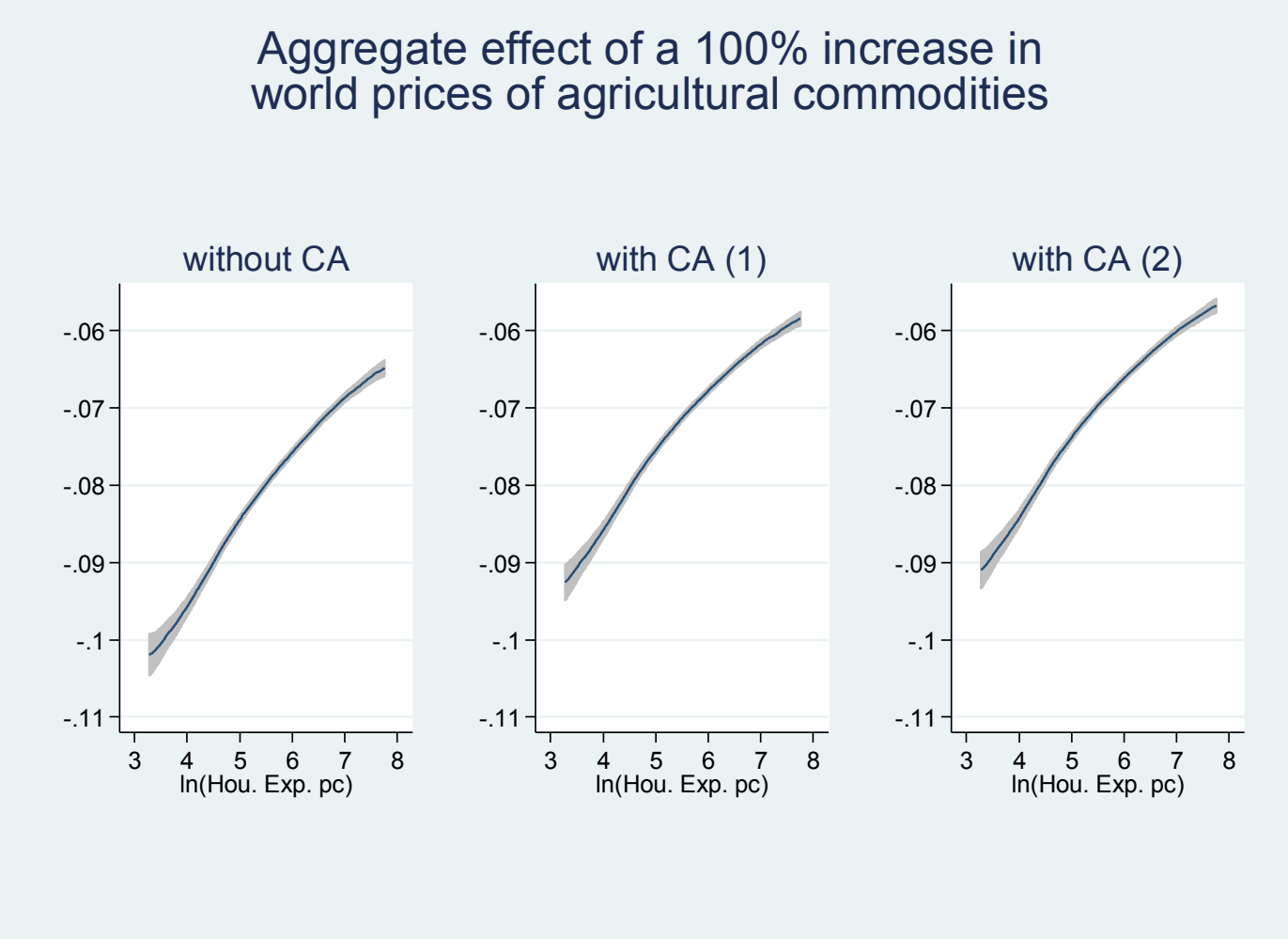

Labor income effect of a 100% increase in world prices of agricultural commodities
.025
.02
.015
.01
3
4
5
6
7
8
ln(household expenditure per capita)

Figure 10



(1) considering only own-price elasticities. (2) considering own- and cross-price elasticities.

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Appendix

Data sources

Nominal Exchange Rate	Banco Central de la República Argentina
Exports	WITS (World Integrated Trade Solution) of World Bank
Agricultural Commodity Index: weighted average of the prices of Maize, Soybeans, Wheat, Soybean Oil, and Sunflower Oil. Argentina's exports are used as weights	Own based on www.index-mundi.com and WITS
Soybeans: U.S. soybeans, Chicago Soybean futures contract (first contract forward) No. 2 yellow and par, US Dollars per Metric Ton	www.indexmundi.com (retrieved on November 12, 2012)
Soybean Meal: Chicago Soybean Meal Futures (first contract forward) Minimum 48 percent protein, US Dollars per Metric Ton	
Soybean Oil: Chicago Soybean Oil Futures (first contract forward) exchange approved grades, US Dollars per Metric Ton	
Maize (corn): U.S. No.2 Yellow, FOB Gulf of Mexico, U.S. price, US Dollars per Metric Ton	
Sunflower Oil: US export price from Gulf of Mexico, US Dollars per Metric Ton	
Wheat, No.1 Hard Red Winter, ordinary protein, FOB Gulf of Mexico, US Dollars per Metric Ton	
Commodity Fuel index: includes Crude oil (petroleum), Natural Gas, and Coal Price Indices	
Metals Price Index: includes Copper, Aluminium, Iron Ore, Tin, Nickel, Zinc, Lead, and Uranium Price Indices	
Agricultural Raw Materials Index: includes Timber, Cotton, Wool, Rubber, and Hides Price Indices	
Consumer Price Indices	Instituto Nacional de Estadísticas y Censos and Government Province of San Luis
Household Expenditure Survey (Encuesta Nacional de Gastos de los Hogares) 1996/1997 and 2004/2005	Instituto Nacional de Estadísticas y Censos
Household Survey (Encuesta Permanente de Hogares) 1995 to 2011	

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