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Poverty impacts of changes in the international prices agricultural commodities: recent evidence for Argentina (an ex-ante analysis)[¥]

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Abstract: *Argentina has benefited greatly from the increase in prices of agricultural commodities. With a large share of its population with low and medium-low incomes, however, a sizable part of households is likely to be adversely affected by the accompanying rise in the price of the consumption basket. An ex-ante analysis suggests that this is the case. Changes through a less obvious channel (i.e. in factor incomes) are likely to be more beneficial to middle-income households. In general, all households experience losses, with poorer households being the most affected. When accounting for transfers financed through the collection of export taxes, poorer households benefit. In the absence of compensatory measures, increases in the prices of agricultural commodities could potentially have an important impact in terms of indigence and poverty.*

JEL Codes: F10, F13, F14, F16, I30.
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1. Introduction and motivation

The current research agenda on international trade reflects increasing interest in examining the potential effects of deepening international relations on social welfare, employment, inequality and poverty, with the goal of developing policy recommendations for minimising undesirable effects. Most of the studies reflecting this new interest have adopted a micro perspective, facilitated by the increasing availability of statistics at the household level, especially for developing and less developed countries.

Argentina, a country with relative abundance of land, has benefited greatly from the increase in agricultural commodity prices throughout the past decade. Nevertheless, rises in the prices of commodities used as intermediate inputs in the production of staple goods are often accompanied by adverse effects on poverty, as such goods tend to account for a large share of the total expenditures of poorer households. The current importance of this issue is illustrated by the fact that the United Nations Conference on Trade and Development (UNCTAD, 2013) devoted an entire chapter to issues concerning the direct effects of the 2003-2011 commodity boom on poverty and food insecurity.

We simulate the possible ex-ante impact of increases in the prices of agricultural commodities on poverty at the household level. In Section 2, we present selected figures, in order to specify the issue of interest, and review existing literature on trade policy and poverty relating to the case of Argentina.[1] A stylised theoretical model presented in Section 3 serves as the foundation for our empirical approach (although we do not formally put it to test). In Section 4, we develop the empirical framework and present the results, estimating the set of parameters that constitute the core

element of the analysis (as presented in Section 5). In this analysis, we simulate the effects of increases in the international prices of agricultural commodities on welfare and poverty. Section 6 is of summary and conclusions.

2. The Trade-Poverty nexus for Argentina: Recent figures and previous evidence

During the period 2002–2012, average prices for the main agricultural products exported by Argentina (i.e. soybeans, soybean meal, soybean oil, sunflower oil, maize and wheat) increased by 42%–84%, relative to the preceding 10-year period. At almost the same time that international prices for agricultural commodities started to increase, Argentina experienced a major economic and social crisis. The crises meant, at the end of 2001, the collapse of the monetary regime and its convertibility with the US dollar, causing the country to default on its debt. After almost a decade of price stability, high rates of inflation re-emerged, having a greater effect on the prices of tradable goods, especially those directly related to agricultural commodities. Other side effects of the crisis included impressive increases in unemployment and poverty.

In response to the rapid and increasing deterioration in the economic conditions of an important part of the population, the government implemented compensatory policies aimed at attenuating the impact of the crisis. The main measure involved the implementation of a system of cash transfers, which persisted even after the crisis had abated. To finance these transfers the government implemented a system of very high export taxes (20%–25%) in 2002. These taxes, which applied primarily to agricultural commodities, would eventually be increased even further (up to 30%–32%), even after the most turbulent part of the crisis had passed.

At the peak of the crisis that started in 2002, when the local currency had already depreciated by almost 300%, the increase in the prices of agricultural commodities contributed to further increases in consumer prices, especially for tradable goods. For example, in the period 2002–2011,[2] the overall consumer price index increased by 420%. During the same period, the consumer price index for food and beverages increased by 638.7%. This was the highest increase amongst the nine consumption categories (followed by an increase of 612.6% in the index for clothing). As indicated in Figure 1, there appears to have been a positive relationship between consumer prices and international prices for agricultural commodities.

[Figure 1 about here]

2.1. Empirical evidence

The economic literature on links between open trade policies and the positive impact that they are assumed to have on economic growth and development reflects a consensus based on results measured at the aggregated level. This consensus could be called into question, however, when considering the broad set of interrelated factors affecting social welfare outcomes due to trade liberalisation, particularly with regard to the likelihood that it will have a beneficial impact for all households. In practice, trade policies have strong redistributive effects, in most cases benefitting some economic groups while adversely affecting others. In particular, if poor individuals are amongst those adversely affected, this is likely to compromise the long-run developmental opportunities for specific countries or regions.

Studies by McCulloch, Winters and Cirera (2001) and by Winters, McCulloch and McKay (2004) have deepened and clarified the scope of the debate by arguing that

empirical evidence (from both cross-country and country-specific case studies) has yet not provided with homogeneous results, with episodes of liberalisation, in which the living conditions of the poor deteriorated. In the literature, partial equilibrium techniques prevail over general equilibrium (GE) approaches for assessing the direct impact of trade liberalization on poverty. One crucial factor in decisions to adopt the partial equilibrium approach is that it allows the identification of household income and consumption effects. A similar analysis applying GE techniques to quantify distributive effects resulting from price shocks would be limited, due to the lack of sufficient disaggregation to trace the full impact of policies on poverty. One obvious disadvantage of the partial equilibrium approach is that it ignores a number of second-order effects, as well as some direct effects. Our analysis is subject to this problem as well.

The partial equilibrium approach proceeds from the canonical work of Deaton (1989). It has been advanced by the important methodological contribution of Porto (2006), whose methodology allows the identification of two crucial transmission channels: a) the change in relative prices due to a given trade reform and b) the effects of these price variations on households as consumption and income earners. This approach has been facilitated by the availability of household surveys, especially for developing and less developed countries.

The case of Argentina has been examined in studies by Porto (2006 and 2010), by Barraud and Calfat (2008) and by Barraud (2009), all of which use household survey data to estimate the impact of trade openness on families.

Existing evidence for Argentina (Barraud and Calfat, 2008; Porto, 2006 and 2010) has focused on measuring the effects on poverty resulting from trade liberalisation in the

1990s. Barraud and Calfat (2008) find out that trade liberalisation had a pro-poor effect through the reduction in the prices of tradable goods and through the effects on the labour market in the sector of non-tradable goods. In contrast, Barraud (2009) reports that trade liberalisation within the manufacturing sector between 1988 and 1998 had a negative impact on poverty at the household level. In a pioneering methodological work, Porto (2006) observes that the implementation of MERCOSUR[3] had a beneficial effect for Argentinean households across the entire income distribution. As noted by Porto, this result can be attributed to the fact that, prior to the reform, Argentinean trade policies had provided greater protection to the rich than they had to the poor. After the reform, some protections were provided to the poor. Finally, Porto (2010) examines the impact of improving access to international agro-manufacture export markets on poverty in Argentina through two channels: the effects of price changes on food expenditures and on wages. Porto's measurement of improved market access is equivalent to an increase in the international price of agro-manufacturing commodities. The most important finding is that improvements in market access are likely to lead to declines in poverty in Argentina. This result could be attributed largely to large wage elasticities (up to 0.85) relative to the prices of agro-manufacture goods.

Consistent with the latter contribution by Porto, the objective of the present study is to contribute to understanding concerning the potential effects of the recent increase in the price of agricultural commodities (which is expected to persist over the medium-run) on poverty in Argentina. To date, no studies have yielded any evidence directly relating to the implications of increasing agricultural commodity prices on the poor in Argentina.[4]

3. Theoretical framework

In this section, we develop a very simple, stylised model that highlights the influence of international commodity prices on internal prices (for both goods and factors of production). In the interest of simplicity, we ignore several issues, which we attempt to address in the empirical application.[5] Given the lack of appropriate data, we do not put the model to any structural testing in the sections to follow. Nevertheless, the model does justify the empirical approach that we apply.

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

$$W = p\left(P_S^D\right) \tag{1}$$

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

Under the small economy assumption, we have:

$$P_S^D = EP_S^*\left(1+T\right) \tag{2}$$

where *E* is the nominal exchange rate, P_S^* is the vector of international commodity prices and *T* is the vector that reflects the ad-valorem equivalent of the country trade policy, thus yielding:

$$W = p\left(P_S^*, E, T\right) \tag{3}$$

In addition, the economy includes *M* traded manufacturing sectors, $M_F \subset M$ of which produce food goods. Following what has become standard in the trade literature, the

M manufacturing sectors are monopolistically competitive, with production exhibiting increasing returns to scale (IRS). In each sector *m*, each producer (whether domestic or foreign) produces a differentiated variety, using all factors of production and primary commodities. In addition, *N* non-traded sectors are also monopolistically competitive, with each domestic producer producing a differentiated variety under IRS using only the production factors.[6]

Assuming 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 international commodity prices and other variables (e.g. nominal exchange rate, domestic taxes/subsidies, trade policy).

More specifically, let us assume that there are two primary commodities, *A*1 and *A*2, whose internal prices are given by:

$$p_{A1}^{d} = E\, p_{A1}^{*} \left(1 + \tau_{A1}\right) \tag{4.a}$$

$$p_{A2}^{d} = E\, p_{A2}^{*} \left(1 + \tau_{A2}\right) \tag{4.b}$$

where *E* is the nominal exchange rate, τ_{A1} and τ_{A2} are the ad-valorem equivalents of the country trade policy on goods *A*1 and *A*2 (respectively), with the superscript * referring to international values. Given the small country assumption, we arrive at:

$$w_1 = f_1\left(P^{*}, T, E\right) \tag{5.a}$$

$$w_2 = f_2\left(P^{*}, T, E\right) \tag{5.b}$$

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

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

$$TC_{i,m} = C_{i,m}\left(\alpha_m + \beta_m x_{i,m}\right) \tag{6}$$

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:

$$C_{i,m} = w_1^{\mu_m} w_2^{\delta_m} \left(p_{A1}^d\right)^{\gamma_m} \left(p_{A2}^d\right)^{1-\mu_m-\delta_m-\gamma_m} \tag{7}$$

Each industry is monopolistically competitive, with each firm in sector *m* facing a constant elasticity of demand equal to σ_m[7], such that the producer price of a domestically produced variety *i* in sector *m* is given by:

$$p_{i,m} = C_{i,m}\beta_m \left(\frac{\sigma_m}{\sigma_m - 1}\right) \tag{8}$$

Under the simplifying assumption that there are no domestic taxes or subsidies, the consumer price for a domestically produced variety is:

$$p_{i,m}^c = p_{i,m} \tag{9}$$

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

$$p_{i,m*}^c = E\, p_{i,m*} \left(1 + \tau_m^{imp}\right) \tag{10}$$

Finally, assuming that all firms within a given sector are identical, and assuming a CES function that determines the consumption of each variety of sector *m*, the consumer price index for all varieties (produced domestically and imported) of a given sector *m* is:

$$P_m = \left[N_m \left(p_{i,m}^c\right)^{1-\sigma_m} + N_{m*} \left(p_{i,m*}^c\right)^{1-\sigma_m}\right]^{\frac{1}{1-\sigma_m}} \tag{11}$$

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

Proceeding from calculations similar to those used for the *M* sectors, we obtain the following relationships for each non-traded sector *n*:

$$TC_{i,n} = C_{i,n}\left(\alpha_n + \beta_n x_{i,n}\right) \tag{12}$$

$$C_{i,n} = w_1^{\eta_n} w_2^{1-\eta_n} \tag{13}$$

$$p_{i,n} = C_{i,n}\beta_n\left(\frac{\sigma_n}{\sigma_n - 1}\right) \tag{14}$$

$$p_{i,n}^c = p_{i,n} \tag{15}$$

$$P_n = \left[N_n\left(p_{i,n}^c\right)^{1-\sigma_n}\right]^{\frac{1}{1-\sigma_n}} \tag{16}$$

Using (5) and (7)–(10) into (11), and (5) and (13)–(15) into (16) clearly reveals that the consumer price indices for the *M* and *N* sectors are only functions of international commodity prices (in the case of imported varieties, the effects of international commodity prices enter indirectly through their effects on the producer prices of such varieties) and the parameters of the model. These relationships, as well as the effects of international commodity prices on factor prices, are the ones to be estimated in the next section.

4. Price and wage elasticities

Our methodology for estimating the effects of a change in international prices on household welfare follows the well-known and widely used method developed by Deaton (1989) and by Benjamin and Deaton (1993).[8] This method consists of estimating two links, one that connects international commodity prices to internal prices (goods and factors) and a second link connecting internal prices to household welfare. In this section we estimate elasticities of consumer prices and wages with respect to the international price of agricultural and other commodities. Having obtained these elasticities, we use them in Section 5 to simulate the effects of 100%

change in the international prices of agricultural commodities on household welfare, as well as on poverty rates.

4.1. Elasticities of Consumer Prices

Most of the existing literature on the subject relies on impulse-response analysis to compute the pass-through of international prices to internal prices. Many studies (e.g. Furlong and Ingenito, 1996); Krichene, 2008; Zoli, 2009; Ferrucci, Jiménez-Rodriguez and Onorante, 2010; Rigobon, 2010; Ianchovichina, Loening and Wood, 2014) fit a Vector Auto-regressive (VAR) model and then estimate the corresponding response of internal prices to a given shock in international commodity prices. This approach fails to provide a 'standard' measure of elasticity, however, as it captures the response of the internal price to a 'shock' in the international price, with this shock usually defined as one standard deviation.

In contrast, in our case, we estimate long-run elasticities by identifying a Vector Error Correction model (VECM)[9] that allows us to obtain the elasticities according to the usual definition. More important, the identification of the cointegrating relationships implies the addition of theoretical assumptions, thus providing an economic content to the analysis of the long-run dynamics of the price-time series.

Let us consider the VEC representation of a VAR of order *l*, given by:

$$\Delta p_t = \Pi p_{t-1} + \Gamma_1 \Delta p_{t-1} + \ldots + \Gamma_{l-1} \Delta p_{t-l+1} + u_t \qquad (17)$$

Given that p_t is a Kx1 vector containing at least one I(1) variable, Π is a singular KxK matrix with rank equal to *r*. As noted by Juselius (2006), this captures the long-run effects. Further, Π can be written as $\Pi=\alpha\beta'$, where the Kxr matrix β is the cointegrating matrix. We are interested in analysing the rx1 vector $ec_{t-1}=\beta' p_{t-1}$, which

contains the cointegration relations between prices. In particular, if the variables included in p_t are expressed as logarithms, the coefficients in β represent elasticities. When these relationships are interpreted according to economic theory, the concept of cointegration matches the notion of long-run equilibrium.

In particular, we estimate four separate VECM, one for each category of goods: food and beverages (pc^{fb}), clothing (pc^{clo}), equipment (pc^{equ}) and other goods (pc^{oth}). In each VECM, we define a 5x1 vector, in which the first element is the log of the consumer price index, and the remaining elements are the log of the nominal exchange rate (*e*) and the log of three international price indices: agricultural (*pwa*), metals (*pwm*) and agricultural raw materials (*pwarm*).[10] The specific order in which variables enter each vector is dictated by the assumption that international prices lead the long-run trend in the consumer price under consideration.

The estimation strategy is as follows. Unit root tests are applied for each variable separately, in order to determine the order of integration. For each model, the optimal lag length for the VAR representation is then computed according to different criteria, and cointegration tests are performed in order to determine the number of cointegration relationships. Finally, each VECM is estimated separately for each vector (after imposing identifying restrictions).

In all models, we use monthly data covering the period 2003–2011. The time span is defined by two factors. First, we select a period with a homogeneous domestic macroeconomic pattern, with exchange-rate flexibility (with a strong intervention by the Central Bank), loose monetary policy and medium/high inflation rates. Second, given the situation depicted in Figure 1, the series representing the international price index of agricultural commodities has displayed a deterministic upward trend since the

beginning of the 2000s. It is important to note that, despite the distinction between domestic and imported varieties in the theoretical framework specified in Section 3, the consumer price indices reported by Official Statistical Offices do not distinguish between the two. For this reason, we are unable to estimate separate elasticities for domestic and imported varieties. Taken together, this implies that the results reported below are the elasticities of consumer prices, which include both domestically produced and imported varieties.

The estimated coefficients for the four models are presented in Table 1. In all four of the cases, the null hypothesis that the cointegration rank is equal to 1 cannot be rejected, thus leaving only one cointegration equation in each case. This result implies that, in the long-run, consumer prices are determined by the exchange rate and the remaining international commodity prices. The finding of only one cointegration equation provides no statistical evidence to support the hypothesis that the exchange rate depends on international commodity prices or that international prices are related through a common trend. The outcome that the nominal exchange rate does not depend on international commodity prices could be explained by the fact that, during the period analysed, and despite a *de jure* flexible exchange rate regime, the government intervened heavily through the Central Bank and other federal agencies in order to avoid abrupt changes in the nominal exchange rate.[11]

Given that all of the variables in the cointegration equations are located in the RHS, the signs of the elasticities should be inverted prior to interpretation. In all cases, the elasticity with respect to the exchange rate (*e*) is positive and significantly different from zero. As expected, this captures much of the macroeconomic volatility of this period.

With respect to the international prices of agricultural commodities, we obtained positive elasticities in each of the four cases, with three of these elasticities being statistically significant: food and beverages (at 1%), clothing (at 1%) and equipment (at 10%). As could be expected, the highest value is for food and beverages. The elasticity for clothing appears to be somewhat high. With one exception, the estimated elasticities for the other commodities, metals and agricultural raw materials are statistically insignificant.

To summarise the results of this section, the analysis focuses on estimating four VECM in order to identify the long-run relationship between consumer prices, exchange rate and international commodity prices. As expected, the estimated elasticities for the case under investigation (i.e. agricultural commodities) are positive, and with one exception significantly different from zero. In addition, the evidence did not support the hypothesis that the exchange rate is connected to international commodity prices, nor that international commodity prices share at least one common trend in the long-run.

[Table 1 about here]

4.2. Wage elasticities

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

$$\ln w_{jt} = \alpha + \sum_{s} \sum_{edu=1,2,3} \beta_{edu} \left(d_{edu} \times \ln P_{st}^{*} \right) + \sum_{edu=1,2,3} \delta_{s,edu} \left(d_{edu} \times \ln e_{t} \right) + \mathbf{Z_j} \Pi + u_{j,t} \qquad (18)$$

where w_{jt} is the log of the average hourly wage for an individual *j*, P_s^* is an index of the international prices of commodities in group *s*; d_{edu} (*edu*=1,2,3) are three dummy variables distinguishing between three different levels of formal education: incomplete

secondary school or less (*edu*=1), complete secondary school or incomplete tertiary/university (*edu*=2) and complete tertiary/university (*edu*=3); 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 four alternative specifications (see Table 2 for the control variables included in **Z** in each case). The interaction of the variables included in the set **Z** with a time trend allows changes in wages to be explained by variables other than the international prices of the commodities considered here and the exchange rate, thus avoiding the introduction of bias into the calculation of the wage elasticities.

Equation (18) was estimated using a pool of cross-sectional household surveys for the period 2003–2011. The Permanent Household Survey (PHS), which is conducted quarterly by the National Institute of Statistics and Censuses (INDEC), covers only the urban population. We are therefore unable to include the rural population in the analysis. In the case of Argentina, the rural population accounts for about 7% of the total population. In the estimation, we include only individuals working as salaried employees in either the formal or the informal sector. For the period under investigation, this represents 75% of the working population. In all regressions, each observation is weighted by the inverse of the probability of its being included in the sample, such that the results are representative of the population.

The results for wage elasticities with respect to agricultural commodities are reported in Table 2. There is a positive and significant relationship between the international price index of agricultural commodities and the wage rate for the three groups of workers. The coefficient is not statistically significant in only one case (i.e. semi-skilled labour). As expected, the magnitude of the elasticity is the largest for the least skilled

workers. At the bottom of Table 2, we report the results of tests for the equality of the coefficients amongst the various groups. In the simulations conducted in the next section, we use the estimates from Model 1, which is the most parsimonious.

[Table 2 about here]

5. Effects of the increase in the international prices of agricultural commodities on welfare and poverty [12]

Our primary goal is to simulate the welfare and poverty effects that might follow an increase in the international prices of the main agricultural commodities exported by Argentina. Having obtained the elasticities of consumer prices and wages with respect to the international prices of agricultural commodities, we can simulate the welfare effects that would follow a given shock in the international agricultural commodity prices. This is the second of the two previously mentioned links.

In particular, the welfare effect for a household *h* is measured as the negative of the compensating variation (a negative value represents a welfare loss, while a positive value represents a welfare gain) relative to its initial expenditure:

$$\frac{dx_0^h}{e^h} = -\left(\sum_{g\in N,M} s_g^h \psi_{g,p_{s_A}}\right) d\ln p_{s_A} + \left(\sum_j \theta_j^h \varepsilon_{w,p_{s_A}}^j\right) d\ln p_{s_A} + TR^h \qquad (19)$$

where s_g^h is the budget share spent on varieties produced by sector *g*; $\psi_{g,p_{s_A}}$ is the elasticity with respect the international price index of agricultural commodities $\left(p_{s_A}\right)$ of the consumer price index for goods of sector *g*; θ_j^h is the salaried labour income of member *j* as a share of total income of household *h*; and $\varepsilon_{w,p_{s_A}}^j$ is the wage elasticity that captures the proportional change in the wage rate of household member *j*, as a response to the change in the international prices of agricultural commodities. The

first term in the RHS of (19) is the welfare effect that takes place through consumption, while the second term measures the effect through changes in labour income.

As Argentina was going through one of its most important economic crises ever (as mentioned in Section 2), the government implemented a system of very high taxes on exports in 2002. The revenue from these taxes has helped to finance an intricate set of transfers and subsidies, which include both cash transfers paid directly to households and transfers to the productive sector to subsidise public services (e.g. electricity, gas and other fuels, and transportation). Given the magnitude of these transfers, which have grown exponentially in recent years, and in order to obtain a more complete picture of the effects derived from an increase in the international price of agricultural commodities, we also add a term to the RHS of (19): TR^h, which is the amount of transfers received by household *h* as a proportion of its initial expenditure. Due to the lack of data, we cannot account for the effects of price subsidies. We therefore assume that all transfers go directly to consumers.

Two elements should be taken into consideration when calculating TR^h: 1) the amount of the additional revenues that the government would receive as a result of the increase of the international price of agricultural commodities, and 2) the distribution of these additional revenues between households. In the following paragraphs, we explain how we have addressed these two issues.

Assuming that there is only one commodity (for the sake of simplicity), the amount of revenues derived from export taxes[13] is given by:

$$R = P^w \times X\left(P^w, \tau, tpf\right) \times \tau\left(P^w\right) \tag{20}$$

where P^w is the international price, X is the quantity exported, τ is the tax rate, and *tpf* is a measure of the available technology. Assuming that our economy is small, P^w is

exogenous, while *X* is a function of the international price and the export tax. Finally, the export tax also depends on the international price, as the government might have incentives to change the tax rate when the international price changes.

Using (20), the change in revenues is given by:

$$\Delta R \cong X\tau\Delta P^{w} + P^{w}\tau\left[\left.\frac{\partial X}{\partial P^{w}}\right|_{\bar{\tau}} + \frac{\partial X}{\partial \tau}\frac{\partial \tau}{\partial P^{w}}\right]\Delta P^{w} + P^{w}X\frac{\partial \tau}{\partial P^{w}}\Delta P^{w} \qquad (21)$$

The first term on the RHS of (21) is the direct impact of a change in P^{w}. The second term is the effect due to the change in *X* because of the change in P^{w} (the direct effect keeping τ constant and the indirect effect because of the change in τ). Finally, the third term is the effect due to the change in τ, keeping P^{w} and *X* constant.

The accurate measurement of (21) far exceeds the objective of this paper, especially given the kind of information such a measurement would require is unfortunately not available. We therefore take a much simpler route, resorting to some rough 'back-of-the-envelope' calculations.

Assuming that *tpf* is exogenous and that it grows at an annual rate of ε,[14] the change (Δ) in *X* between *t* and *t-1* (assuming a constant internal demand) because of a change in P^{w} and τ is given by $\Delta_{t,t-1}X_{\Delta P^{w},\Delta\tau} = X_{t} - X_{t-1}(1+\varepsilon)$. Dividing this expression by the observed change in exports, $\Delta_{t,t-1}X$, we obtain the proportion of the change due to changes in price and the tax rate on exports. We applied this proportion to the observed change in the collection of export taxes to obtain the additional amount of taxes that would follow to ΔP^{W}. We have re-escalated our calculations to reflect the fact that the difference between *t* and *t-1* ΔP^{w} is not necessarily equal to the 100%. Finally, to avoid the influence of exogenous shocks on *X*, we exclude years in which weather conditions had a negative impact on production, as well as those in which

external conditions had a negative impact on exports. This procedure left us to work with all two-year combinations using the years 2001 (just before the implementation of export taxes), 2003, 2005 and 2007,[15] for which we take the simple average. Following this procedure, an increase of 100% in P^W produces an annual additional tax collection of 2.2 billion USD. One unintended result of our admittedly convoluted procedure is that the amount of 2.2 USD billion is almost identical to the amount we would have obtained had we made the much simpler assumption that the percentage change in the tax collection was equal to the increase in world prices, with the tax rate and quantity exported remaining constant.

The second element to be addressed concerns the manner in which the change in the tax collection is allocated amongst households. Unfortunately, no detailed information is available with regard to social transfers paid by the government. Nevertheless, the National Survey of Household Expenditures (ENGHo) provides the total amount of monetary transfers received by each household member, independently of origin, in addition to qualitative information concerning the type of transfers they receive. With this information, we proceed as follows: for individuals reporting having received transfers because of unemployment insurance and/or an employment support programme, we consider that all transfers received by a person were transfers from the government. In contrast, for individuals declaring transfers other than unemployment insurance and/or employment support programmes, we assume that the individual has not received transfers from the government. The transfers received by each household are equal to the sum of the transfers received by all of its members. Having obtained the transfers received by each household, we calculate their distribution within each percentile of total household income. Using this distribution,

we allocate the additional tax from the increase of the international price of agricultural commodities. Within each percentile, we assume that each household receives an equal amount.[16] As a sensitivity analysis, we also simulate a scenario in which transfers are equally distributed across all households, independently of the percentile to which they belong.

For reasons of data availability, we do not consider any effects on non-labour income. In addition, because of data restrictions, we assume that households do not produce for their own consumption.

5.1. Welfare effects

Using the estimated elasticities, budget shares from the ENGHo of 2004/2005, and assuming an increase of 100% in the international prices of agricultural commodities, we apply equation (19) to obtain the effects on welfare. We then perform non-parametric regressions of the welfare effects as a function of household per capita expenditures.[17]

Before looking at the results of the simulations, we report descriptive statistics on consumption patterns and sources of income (see Table 3), as these factors combine with the elasticities discussed before to determine the magnitude of the simulated effects. The category of food and beverages is clearly of much greater importance for poorer households, with equipment and other goods acquiring more weight for more affluent households. These differences help to explain why the results of our simulations indicate that poorer households are affected more negatively through the consumption effect. The differences between households are less important when considering sources of income, which partly reflect the lower participation of salaried

labour for the poorest households. This difference is one of the reasons why such households benefit less through the effect on labour income, even when members of these households are predominantly unskilled workers, for whom we obtained a higher wage elasticity. The overall relatively low participation in salaried labour provides at least a partial explanation for the low figures obtained for the labour income effect. This result also highlights one drawback of the analysis, given its inability to account for effects operating through other sources of income. Such effects are likely to diminish the magnitude of the aggregate negative effect revealed by our results.

[Table 3 about here]

The welfare effects that operate through consumption are displayed in Figure 2.[18] The simulation of these effects requires addressing two sources of randomness: the sampling variability of budget shares and the estimation of the responses of consumer prices to international agricultural commodity prices. To account for both of these sources of variability, we adopted the following procedure. The randomness due to sampling variability of households (and therefore of budget shares) is controlled by weighting each observation by the inverse probability of its inclusion in the sample.[19] To address the variance in the estimated elasticities, we follow Porto (2006), re-sampling from their empirical asymptotic distribution. From the VECM, we obtain, for each category *j* of consumption goods, an estimate $\hat{\beta}_j$ of the elasticity of consumer prices with respect to the international price index of agricultural commodities, in addition to an estimated standard error $\hat{\sigma}_j$, under the standard assumptions $\hat{\beta}_j \sim N\left(\beta_j, \sigma_j\right)$, where β_j and σ_j are the true parameters values. In each loop, a

new elasticity is then assigned to the formula in order to calculate the welfare effect. The non-parametric regression is performed for each of the 200 replications in order to generate new estimates of the average welfare effect. After the 200 replications, we compute the standard error of the estimated regression functions to build the 90% confidence bands.

For the four categories of consumption goods, we obtain positive elasticities of consumer prices with respect to the international price index for agricultural commodities. It is therefore not surprising that all households lose in response to an increase in the prices of agricultural commodities. As Figure 2 shows, households at the lowest end of the expenditure distribution are the most affected through the increase in the price of food and beverages. The opposite effect emerges for non-food and beverage goods, for which the simulated effects are smaller and more homogeneous over the entire distribution. In the aggregate, poorer households are the ones most affected by increases in agricultural commodity prices, with losses of up to almost 15.25% of their initial household expenditures.

[Figure 2 about here]

To obtain the income labour effects, we use the wage elasticities reported in Table 2. Using the income share of each member of the household, and again assuming an increase of 100% in the price of agricultural commodities, we calculate the effect occurring through changes in wages. As with the simulation of the consumption effects, it is necessary to consider the sources of variability in the income effect. In this case, we apply the same methodology as before, but with the difference that, because the three wage elasticities are estimated simultaneously by a single equation (and not separately, as with the elasticities of consumer prices), it is necessary to consider both

their own variance and their covariance. We now have an estimated vector of elasticities $\hat{\mathrm{B}}$, along with a variance-covariance matrix $\hat{\Omega}$, such that, under standard assumptions $\hat{\mathrm{B}} \sim N(\mathrm{B}, \Omega)$, where B is the true vector of parameters and Ω is its asymptotic variance-covariance matrix.

As shown in Figure 3, there is a positive effect through an increase in labour income, with middle income households (4.1% of initial expenditure) and households at the upper end of the distribution (3%) being the most favoured. The poorest households win the least (2.5%). At first glance, this result might seem counterintuitive as, consistent with the pattern of comparative advantages of the country, the largest elasticity of wages is for unskilled labour. It could nevertheless be explained in terms of the higher share of salaried labour as a source of income for households with middle and middle-high income. In any case, for all households, the increase in labour income is not enough to compensate for the welfare loss on the consumption side.[20]

[Figure 3 about here]

Accounting for the consumption and income effects, the poorest households are the most affected (see Figure 4). Nevertheless, all households lose with the increase of agricultural commodity prices, with losses range from 8.5% to around 12.3% of the initial expenditures. The distribution of losses along the distribution of per capita household expenditures is, a priori, in line with what could be expected. Increases in the prices of agricultural commodities hurt the poorest households due mostly to the larger weight of food and beverages (goods intensive in the use of agricultural commodities) in household consumption.

[Figure 4 about here]

The imposition of export taxes on the main agricultural commodities allowed the government to finance a wide system of direct (cash) and indirect (price subsidies) transfers. The welfare effects derived from the assumption that the additional tax revenues are transferred back to households are reported in Figure 5. Low and middle-low income households benefit, with the magnitude of their welfare gains well above the losses reported in Figure 5. A comparison of the outcomes with and without transfers is provided in Figure 6.

[Figure 5 about here]

[Figure 6 about here]

5.2. Effects on indigence and poverty

To grasp an approximate idea of the relative importance of the impact of an increase in the international prices of agricultural commodities on poverty, we report the indigence and poverty rates that would follow an increase of 100% in Table 4, as along with two additional measures: the gap and severity of indigence and poverty. In Argentina, indigence and poverty are measured in absolute terms, comparing the income of a household with the minimum expenditures required in order not to fall into either of the two categories. The indigence line is defined as the minimum expenditure that a man between the ages of 30 and 59 year would need in order to acquire the basic food basket (CBA), and the poverty line is obtained by multiplying the CBA by the Engel coefficient, which yields the total basic basket (CBT). The indigence and poverty baskets are calculated for each household by multiplying the CBA and the CBT by household size, expressed in adult equivalents.

To obtain the new CBA value for each household, we update the original indigence line for the time at which the household was surveyed, considering the effect that works through the increase in the consumer price of food and beverages.[21] The new poverty line is subsequently obtained by using the Engel coefficient for the time at which each household was surveyed.[22] New household incomes are calculated taking into account only the effect on the labour income of salaried household members.

From the results reported in Table 4, before accounting for transfers, indigence increases by 2.35 pp and poverty increases by 5.86 pp; the relative increase in poverty is about 25%, and the increase in indigence is 37%. These changes imply that about 246,000 new households would fall into indigence with 613,000 falling into poverty. Another interesting result is that, if we were to consider the depth of indigence and poverty instead of using a headcount measure, the gap and severity of both indices would increase more than their corresponding rates. In other words, in addition to an increase in indigence and poverty in response to the raise in the international price of agricultural commodities, households that were already indigent and/or poor tend to move further away from the threshold lines, as do new households falling into those categories. This result means that, within each category, poor and indigent households tend to become a more homogeneous group, while becoming more heterogeneous with those that do not fall into indigence/poverty.

The inclusion of transfers has several important effects. At this point, indigence decreases when the distribution of transfers has a pro-poor bias, and it remains almost unchanged (a 0.56 pp. increase) when all households receive an equal amount. Moreover, the gap and severity of indigence are reduced. In the case of poverty, an increase in response to higher commodity prices remains, although these changes are

considerably lower than they are under the scenario without transfers.[23] In addition, in contrast to the previous situation, the gap and severity of poverty increase by a lower proportion than the corresponding rate.

[Table 4 about here]

In 2005, the year for which we perform the simulations, direct cash transfers from the federal government amounted to approximately 50% of the collection of export taxes on the agricultural commodities considered in our analysis. As a final exercise, we assume that only half of the increase in export taxes is given back to consumers. Under this alternative scenario, both indigence and poverty increase, regardless of the criteria used for the distribution of transfers financed with export taxes. Not surprisingly, compared to the case with the full distribution of export taxes, the relatively larger increase takes place in the case of extreme poverty. This outcome is not surprising, since according to available empirical evidence (see Azevedo, Inchauste, Olivieri, Saavedra and Winkler, 2013), extreme poverty is more likely to be affected by cash transfer programmes.

6. Summary and conclusions

The increase in the prices of agricultural commodities was of great benefit to Argentina, especially during a period in which the country was almost completely excluded (forcibly and/or voluntarily) from international financial markets. Given the large share of the population with low and medium-low incomes, however, the increase in agricultural commodity prices could potentially harm a sizeable part of the population by increasing the prices of goods that account for an important share of household expenditures, especially food. A less obvious channel works through

changes in factor incomes. In the case of salaried labour income, this effect would be more beneficial to middle income households, although its magnitude is not large enough to compensate for the negative effects occurring through changes in the price of consumption goods. Once we include the effects derived from transfers financed with the collection of taxes on exports, the results reveal a much less negative picture, with the possibility of poorer households experiencing some improvement. Overall, the net effect is likely to be a small increase in poverty.

Finally, several limitations should be acknowledged, especially the inability (due to lack of data) to allow for effects occurring through changes in factor rewards other than salaried labour, which accounts for around 50% of household income. The scenarios with transfers assume that all of these transfers were direct cash payments, given the impossibility of accounting for transfers through price subsidies for public services (e.g. energy, gas and transport). The distribution of such transfers is likely to favour the richer households, as a large percentage of these beneficiaries live in high-income cities, most notably Buenos Aires.

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

[2] Since 2007, distrust has been increasing with regard to the price statistics generated by the National Institute of Statistics and Census (INDEC). For this reason, the price indices for the period 2007–2011 were obtained using inflation data calculated by the Government of the Province of San Luis.

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

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

[5] One of these issues is the relationship between international commodity prices and the exchange rate.

[6] The assumption that non-traded goods are produced using only production factors is a simplification, with no impact on the relationships of international prices of commodities with either consumer prices or factor rewards.

[7] 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.

[8] Examples include Porto (2006, 2010), Barraud and Calfat (2008), Ivanic and Martin (2008), Nicita (2009), Leyaro, Morrisey and Owens (2010), Borraz, Rossi and Ferres (2012) and Ferreira, Fruttero, Leite and Lucchetti (2013).
[9] Anderson and Tyers (1992) use an error-correction model to compute elasticities for changes in border prices relative to domestic producer prices.
[10] We exclude fuels because the set of policies (taxes, maximum prices, and quantitative restrictions) implemented during the period under consideration implied a complete disconnection between international prices and internal prices. In response to the concerns raised by one referee, we tried to control for the evolution of the prices of imported intermediate goods. We were nevertheless unable to reject the null hypothesis that the prices of intermediate goods share a common trend with the international prices of primary commodities.
[11] After Argentina had moved beyond the most turbulent moments of the 2002, and during the period here considered, the annual rate of depreciation of the local currency never exceeded 10%, with the exception of the months following the beginning of the world economic crisis in 2008 and during most of 2009. Moreover, during the times when international commodity prices were at their highest, the government intervened to avoid the appreciation of the local currency.
[12] Data sets and software routines are available from the authors upon request.
[13] In this exercise, we do to consider the potential indirect effects of changes in agricultural commodity prices on the collection of other taxes.
[14] As reported by Lema and Saini (2014) for the period 2000–2010, and for the production of grains and oilseeds (wheat, corn, sunflower and soya), we use a *tpf* growth rate of 4.74%.
[15] We exclude the year 2002, as it represents the peak of Argentina's economic collapse. We also exclude 2009, because exports fell in response to the world crisis; the years 2004, 2006, 2008 and 2010 are excluded as well, because bad weather conditions impacted on the production of the sector (in varying magnitudes) and thus on the volume of exports.
[16] We are grateful to an anonymous referee for suggesting this procedure.
[17] The sample size used in the regressions consists of 26,431 observations.
[18] In all figures, solid lines represent average effects, with dashed lines representing the 90% confidence bands.
[19] We also followed Porto (2006) by attempting to take random samples of households from the ENGHo survey. Although the results were almost identical, our approach demanded much less computation time. Weights are taken from the ENGHo.
[20] The fact that we do not consider non-labour income may bias our results against the richer households, as the increase in the international prices of agricultural commodities brought about an important improvement in the rent of land used in agricultural production. In addition, the use of this rent by landowners meant important contributions to others sectors of the economy, especially the building industry.
[21] Even though it would ideally be more appropriate to work with changes in the prices of goods that constitute the CBA (data to which we have no access), the correlation of the consumer price index for food and beverages with the indigence and poverty lines is around 0.99 in both cases.
[22] Engel coefficients are taken from the INDEC.
[23] This result is consistent with the findings of Azevedo *et al*. (2013), which indicate that transfer programmes of the kind discussed here are more successful in addressing indigence (extreme poverty), although they are subject to limitations with regard to reducing poverty levels.

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Table 1
Coefficients of cointegration relations

Cointegration equation	pc^{j}_{t-1} (#)	e_{t-1}	pwa_{t-1}	pwm_{t-1}	$pwarm_{t-1}$	$TREND_{t-1}$
ec^{fb}_{t-1} (a)	$p^{fb}_t=(pcfb_{t-1}, e_{t-1}, pwa_{t-1}, pwm_{t-1}, pwarm_{t-1})'$					
	1.000	-2.630***	-0.326***	-0.097*	-0.111	
	(0.000)	(0.145)	(0.068)	(0.056)	(0.136)	
ec^{clo}_{t-1} (b)	$p^{clo}_t=(pcclo_{t-1}, e_{t-1}, pwa_{t-1}, pwm_{t-1}, pwarm_{t-1})'$					
	1.000	-2.482***	-0.268***	-0.199***	0.102	
	(0.000)	(0.115)	(0.054)	(0.044)	(0.108)	
ec^{equ}_{t-1} (c)	$p^{equ}_t=(pcequ_{t-1}, e_{t-1}, pwa_{t-1}, pwm_{t-1}, pwarm_{t-1})'$					
	1.000	-0.895***	-0.156*	0.046	0.106	-0.005***
	(0.000)	(0.120)	(0.095)	(0.095)	(0.194)	(0.000)
ec^{oth}_{t-1} (d)	$p^{oth}_t=(pcoth_{t-1}, e_{t-1}, pwa_{t-1}, pwm_{t-1}, pwarm_{t-1})'$					
	1.000	-1.936***	-0.083	-0.02	-0.137	
	(0.000)	(0.115)	(0.054)	(0.044)	(0.108)	

(#) *j*: *fb, clo, equ, oth*.
Standard errors between brackets. *** p<0.01, ** p<0.05, * p<0.1.
For the first two VECM, the Hannan-Quinn and Schwarz Criteria indicate that the optimal VAR lag length is equal to 1. For the third VECM, the Akaike, Final Prediction Error, Hannan-Quinn and Schwarz Criteria indicate that the optimal VAR lag length is equal to 1. For the fourth VECM, the Final Prediction Error, Hannan-Quinn and Schwarz Criteria indicate that the optimal VAR lag length is equal to 1.
In all cases, the null hypothesis H_0: rank(β^j)=1 cannot be rejected. For this reason, the VEC was specified assuming a cointegration rank equal to 1. The cointegration test was performed using the Lütkepohl and Saikkonen (L&S) procedure.
The specification details for the remaining VECs are as follows:
(a) Deterministic variables: CONST, endogenous lags (in differences): 0, sample range: [2003 M2, 2011 M12], T=107, estimation procedure: One stage. Johansen approach.
(b) Endogenous lags (in differences): 0, sample range: [2003 M2, 2011 M12], T=107, estimation procedure: One stage. Johansen approach.
(c) Deterministic variables: TREND, endogenous lags (in differences): 0, sample range: [2003 M2, 2011 M12], T=107, estimation procedure: One stage. Johansen approach.
(d) Deterministic variables: CONST, endogenous lags (in differences): 0, sample range: [2003 M2, 2011 M12], T=107, estimation procedure: One stage. Johansen approach.
Source: Original calculations.

Table 2
Wage elasticities (with respect to international prices of agricultural commodities)

	(1)	(2)	(3)	(4)
Incomplete Secondary School or less (a)	0.1317***	0.1443***	0.1447***	0.0985***
	(0.023)	(0.017)	(0.020)	(0.019)
Complete H. School/Incomplete Tertiary/University (b)	0.0891***	0.0607***	0.0549***	0.0227
	(0.021)	(0.014)	(0.017)	(0.015)
Complete Tertiary/University (c)	0.0915***	0.1111***	0.0919***	0.0689***
	(0.028)	(0.025)	(0.031)	(0.024)
Observations	453,820	453,820	453,820	453,820
R-squared	0.647	0.649	0.648	0.649
Test of equality of coefficients (*p* values)				
H_O: (a) = (b)	0.000	0.000	0.000	0.000
H_O: (a) = (c)	0.095	0.165	0.034	0.244
H_O: (b) = (c)	0.915	0.022	0.148	0.047

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 (6–50, and more than 50 employees; the reference group is 1–5 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 (8 dummies; the reference year is 2003), 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 quadratic trend.
Model 4: same as Model 1, plus the interactions of the dummy variables (except for the year and quarter dummies) with the linear and quadratic trends.
All models include a constant term, as well as the interactions of the three educational dummies with the log of the international price indices of metals and agricultural raw materials, and the log of the nominal exchange rate.
Robust standard errors between brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 3
Expenditure shares and sources of income (%)
by quintile of household expenditure per capita

Quintile	Expenditure shares				Sources of household income		
	Food and beverages	Clothing	Equipment	Other goods	Labour	Salaried labour (*)	Transfers (**)
1	49.2	7.1	4.1	39.5	73.7	43.9	5.8
	(18.9)	(10.1)	(5.7)	(18.8)	(36.5)	(41.5)	(17.7)
2	44.2	8.0	5.0	42.7	73.6	51.5	2.5
	(16.4)	(9.8)	(6.2)	(16.9)	(37.2)	(42.4)	(10.5)
3	39.7	7.9	5.7	46.7	72.6	51.3	0.9
	(15.5)	(9.1)	(6.8)	(16.3)	(38.9)	(43.0)	(5.8)
4	34.9	7.7	6.6	50.8	72.8	50.8	0.5
	(14.4)	(8.2)	(7.5)	(15.6)	(39.0)	(42.8)	(5.2)
5	28.3	7.9	8.1	55.7	74.1	48.1	0.2
	(12.6)	(7.9)	(8.2)	(15.0)	(38.5)	(43.5)	(3.0)

(*) These figures include employees and domestic service. (**) They exclude child support transfers for divorced parents and permanent family transfers. Standard errors are noted between brackets.
Source: Original calculations based on ENGHo 2004/2005.

Table 4
Indigence and Poverty rates in urban areas
Before and after increase of 100% in international prices of agricultural commodities

(A) Before distribution of transfers

Variable			100% distribution of taxes	
			Value	Std. Error (*)
Indigence	Rate	Pre	6.33	0.36
		Post (a)	8.68	0.80
	Gap	Pre	2.16	0.15
		Post (a)	3.02	0.30
	Severity	Pre	1.12	0.10
		Post (a)	1.56	0.17
Poverty	Rate	Pre	23.18	0.57
		Post (a)	29.04	0.79
	Gap	Pre	8.68	0.28
		Post (a)	11.34	0.62
	Severity	Pre	4.61	0.19
		Post (a)	6.17	0.41

(B) After distribution of transfers

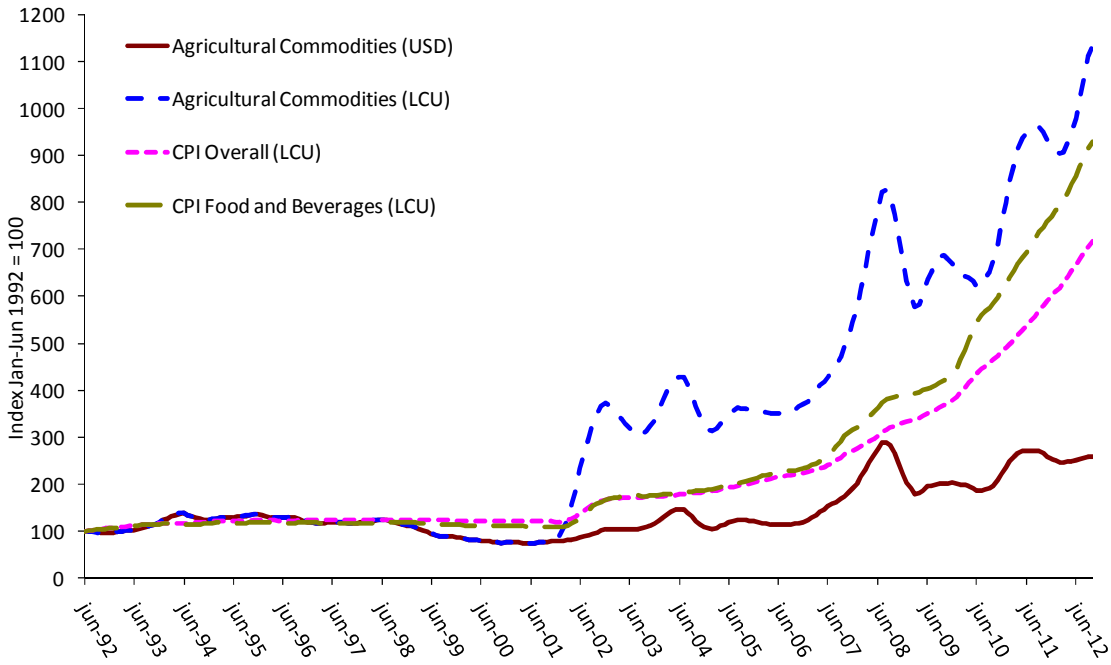
Variable			100% distribution of taxes		50% distribution of taxes	
			Value	Std. Error (*)	Value	Std. Error (*)
Indigence	Rate	Post (b)	5.94	0.72	7.22	0.78
		Post (c)	6.89	0.72	7.81	0.75
	Gap	Post (b)	1.88	0.24	2.34	0.27
		Post (c)	2.12	0.25	2.53	0.27
	Severity	Post (b)	0.95	0.11	1.19	0.13
		Post (c)	1.01	0.14	1.25	0.15
Poverty	Rate	Post (b)	25.31	0.86	27.11	0.83
		Post (c)	26.52	0.80	27.76	0.78
	Gap	Post (b)	8.98	0.60	10.07	0.63
		Post (c)	9.68	0.60	10.48	0.62
	Severity	Post (b)	4.55	0.37	5.26	0.39
		Post (c)	4.99	0.39	5.54	0.41

The rate, gap and severity of indigence and poverty are measured following Foster, Greer and Thorbecke (1984): $R = \frac{1}{N}\sum_{h=1}^{N}\left(\frac{z_h - y_h}{z_h}\right)^{\alpha} I^*\left(y_h < z_h\right)$, 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 $y_h < z_h$. If $\alpha = 0$, we obtain the rates of indigence/poverty; if $\alpha = 1$ we have the indigence/poverty gap, and if $\alpha = 2$, we have the indigence/poverty severity.

(a) After increase in prices; (b) after increase in prices and unequal transfers; (c) after increase in prices and equal transfers.

(*) Bootstrapped standard errors. Source: Original calculations.

Figure 1
Agricultural commodity and consumer prices
(six-month moving average)



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

Figure 2
Consumption effect of an increase of 100% in the international prices of agricultural commodities

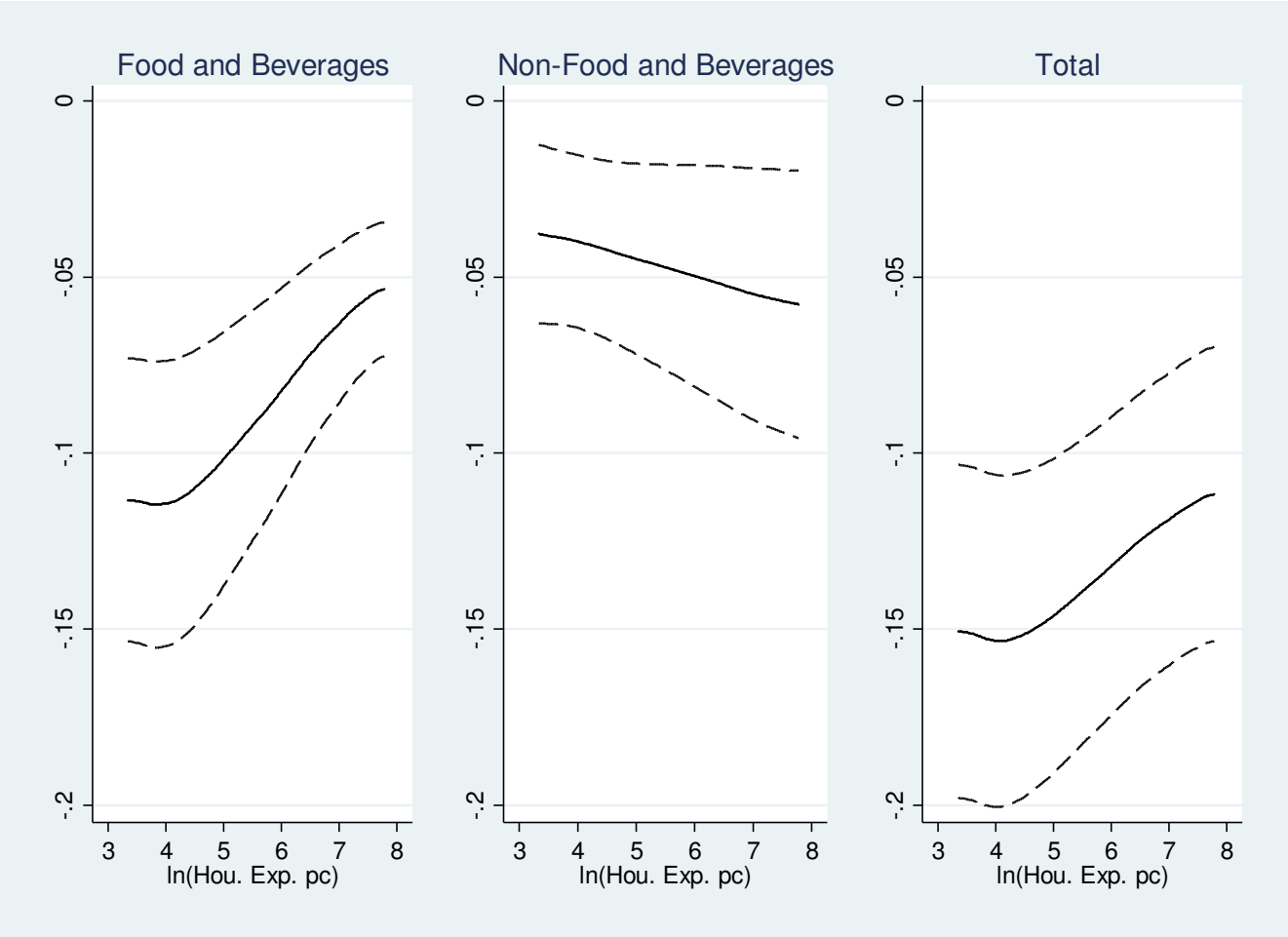


Figure 3
Labour income effect of an increase of 100% in the international prices of agricultural commodities

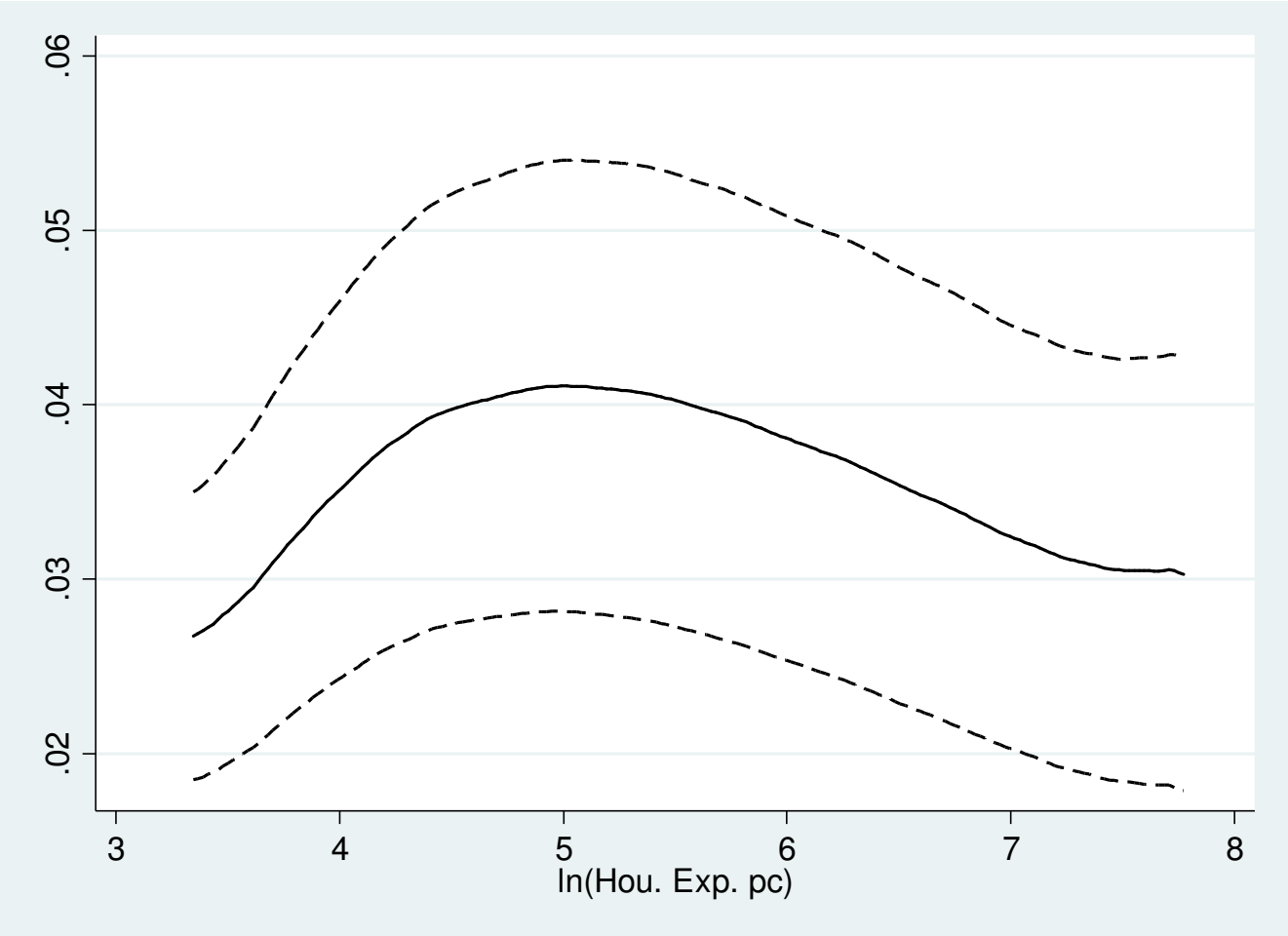


Figure 4
Aggregate effect of an increase of 100% in the international prices of agricultural commodities

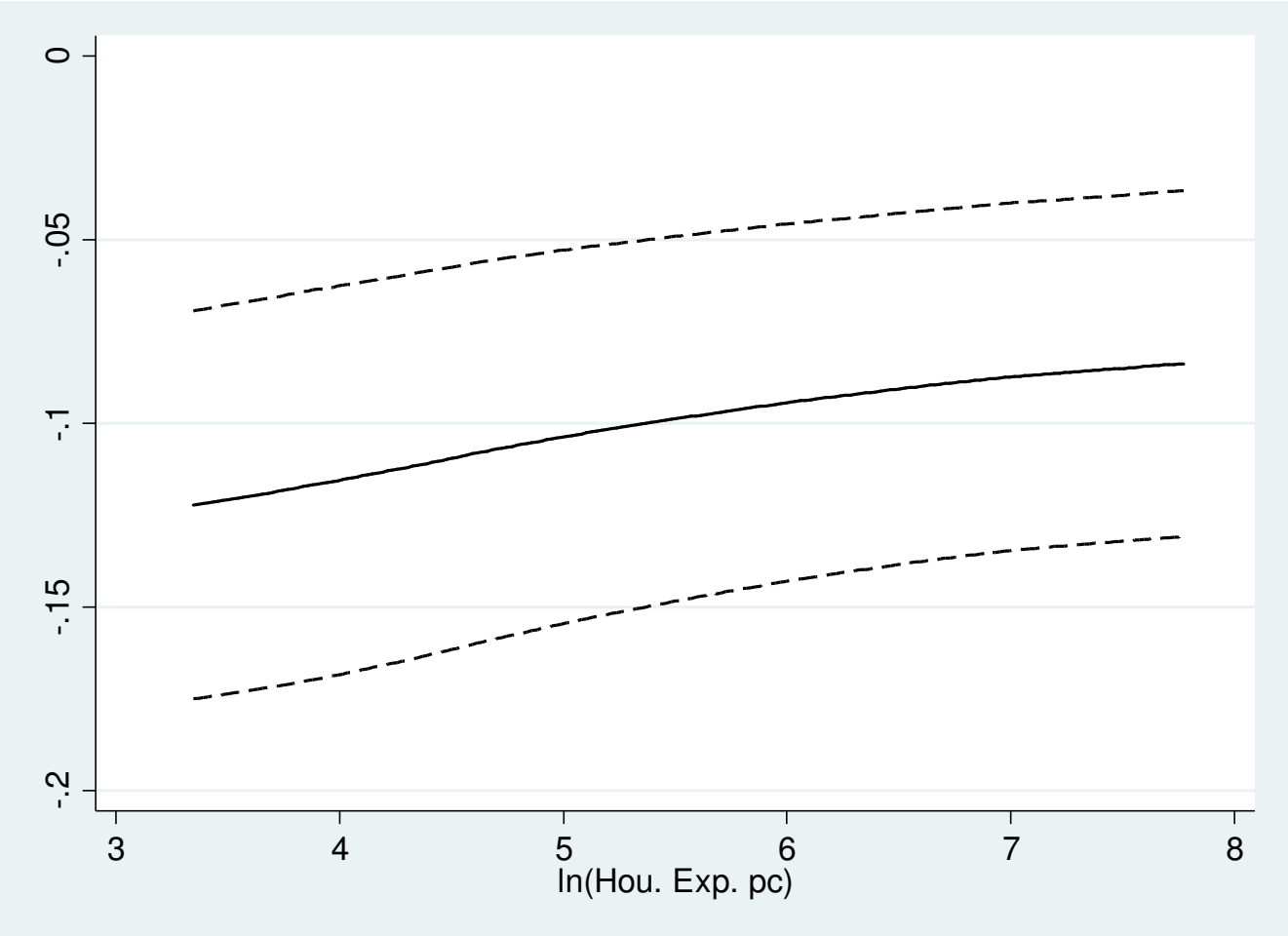
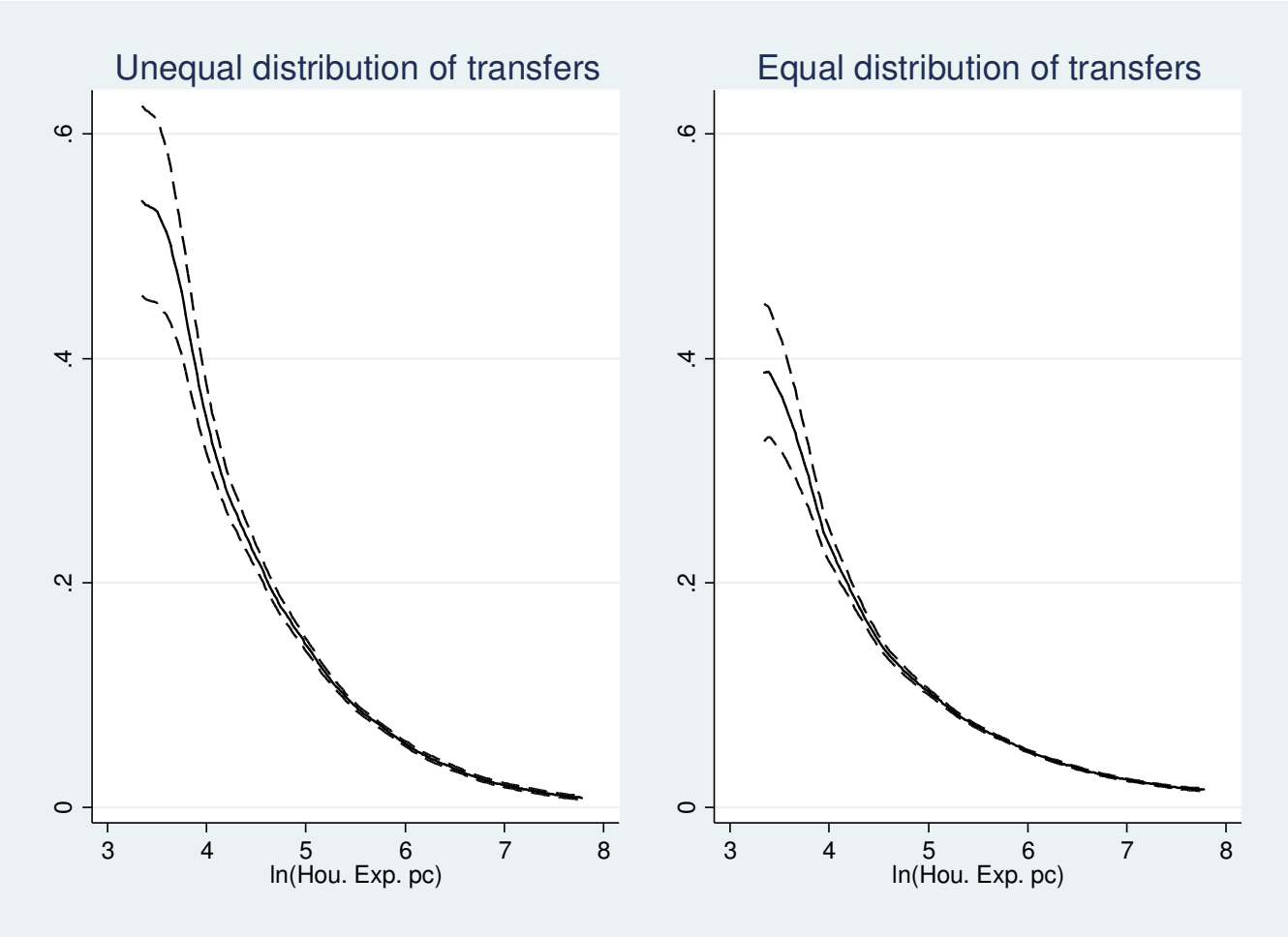
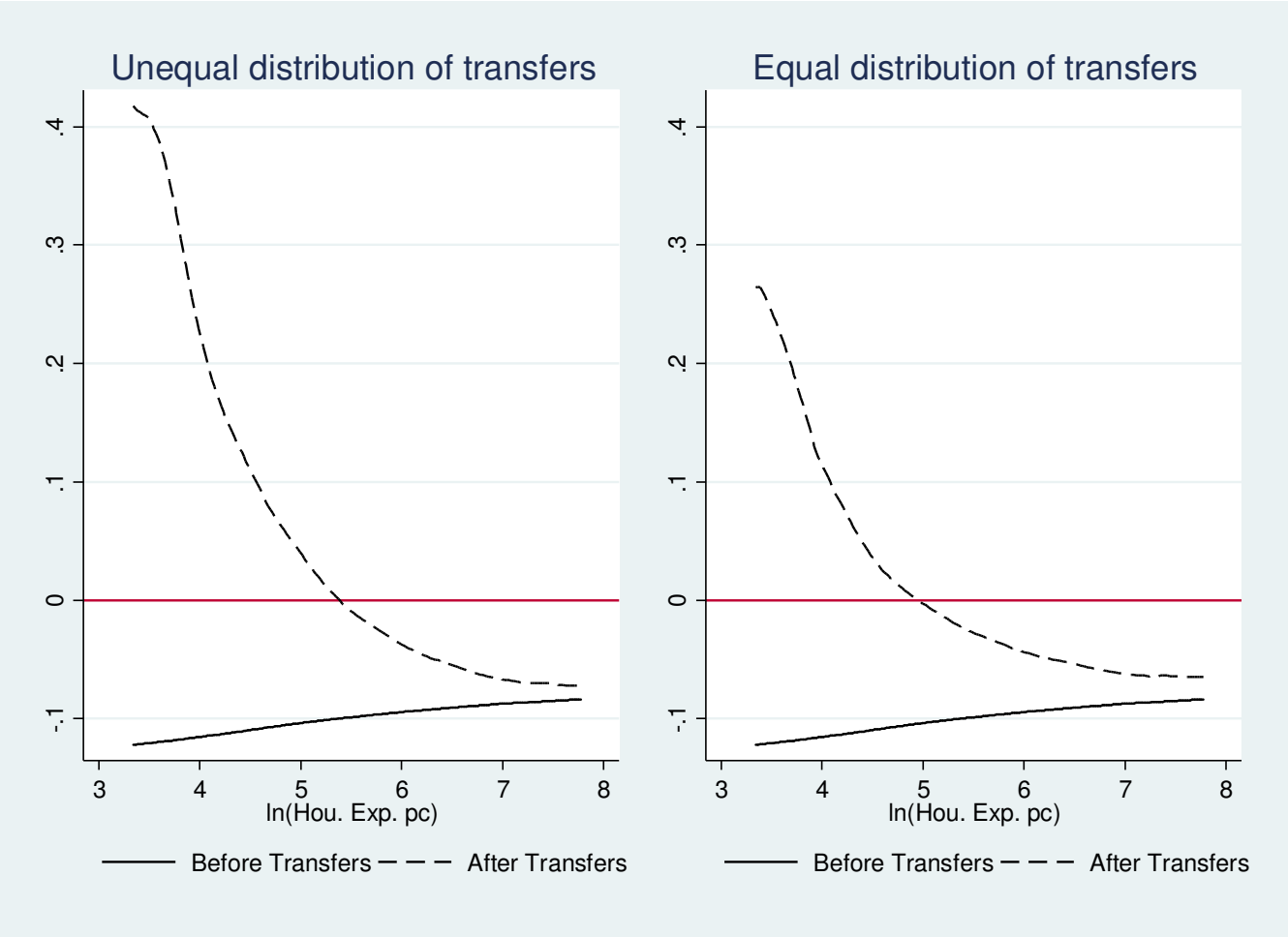


Figure 5
Welfare effects of the transfers financed by the increase in export taxes (*)



(*) After an increase of 100% in the international prices of agricultural commodities.

Figure 6
Welfare effects before and after transfers (*)



(*) Assuming an increase of 100% in the international prices of agricultural commodities.

Appendix: Data description and sources

Prices

Agricultural Commodity Index: weighted average of the prices of Soybeans, Soybean Meal, Soybean Oil, Maize, Sunflower Oil and Wheat. Argentina's exports are used as weights	Index	US dollar	Original calculations based on www.indexmundi.com and WITS
Soybeans: US soybeans, Chicago Soybean Futures contract (first contract forward) No. 2 yellow and par	Metric Ton	US dollar	www.indexmundi.com (retrieved on November 12, 2012)
Soybean Meal: Chicago Soybean Meal Futures (first contract forward) Minimum 48 percent protein	Metric Ton	US dollar	
Soybean Oil: Chicago Soybean Oil Futures (first contract forward) exchange approved grades	Metric Ton	US dollar	
Maize (corn): U.S. No.2 Yellow, FOB Gulf of Mexico, US price	Metric Ton	US dollar	
Sunflower Oil: US export price from Gulf of Mexico	Metric Ton	US dollar	
Wheat, No.1 Hard Red Winter, ordinary protein, FOB Gulf of Mexico	Metric Ton	US dollar	
Metals Price Index: includes price indices for Copper, Aluminium, Iron Ore, Tin, Nickel, Zinc, Lead and Uranium	Index	US dollar	
Agricultural Raw Materials Index: includes price indices for Timber, Cotton, Wool, Rubber and Hides	Index	US dollar	
Consumer Price Indices (food and beverages, clothing, equipment and other goods)	Index	A$ (Argentinean $)	Instituto Nacional de Estadísticas y Censos

Nominal exchange rate ($A/USD)	Banco Central de la República Argentina
Household Survey (Encuesta Permanente de Hogares) 2003-2011	Instituto Nacional de Estadísticas y Censos
Household Expenditure Survey (Encuesta Nacional de Gastos de los Hogares) 2004/2005.	
Exports (in USD)	WITS (World Integrated Trade Solution) of World Bank