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Effects on welfare and poverty of the increase in international prices of agricultural commodities. A simulation exercise for Argentina, México and Uruguay

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A simulation exercise for Argentina, México and Uruguay[¥]

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Abstract: *With a large share of households with low and medium-low income, the increase in agricultural commodity prices has the potential to hurt a sizable part of the population through a rise in the price of the consumption basket. Ex-ante this is the case. A less obvious channel, through changes in labor income would be more beneficial to middle-income households in Argentina and Uruguay, and to low-income ones in Mexico. Overall, in Argentina and Mexico all households experience losses, between 3% and 7.5% of their initial expenditure in the former case, and between 10% and 12% in the latter. In both cases, poorer households are the most affected. In Uruguay, instead, households at the upper end of the distribution would benefit with the increase in the international price of agricultural commodities, with low-income households losing as much as 7.5%. In terms of poverty, the increases would be between 19% and 34%, with Uruguay being the most affected and Argentina the least. Increases in indigence would be even greater, between 29% (Argentina) and 52% (Mexico). Also, the results show that households in a situation of indigence and/or poverty, would move in average further away from the threshold lines, meaning that within each category, poor and indigent households become more homogeneous among them.*

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

Keywords: trade, commodity prices, poverty, Argentina, Mexico, Uruguay.

1. Introduction and motivation

There has been 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.

In this paper we concentrate on the cases of Argentina, México and Uruguay, countries with a large share of their populations with low and middle-low income, so there is a need to consider potentially negative effects, such as 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 staple goods, which explain a large share of total expenditure in poorer households. As an example of the current importance of this issue, UNCTAD (2013) 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.

In the next sections we assess the ex-ante impacts on welfare and poverty at the household level, that can arise due to the increase in the international prices of agricultural commodities. In section 2 we review the existing literature on the nexus between trade policy and poverty for the three countries we are interested in.[1] In section 3 some descriptive statistics are presented. Section 4 develops the empirical framework, and present the results, to estimate the set of parameters that constitute the main ingredient to the analysis carried out in section 5, where we simulate the welfare and poverty effects of a rise in the international prices of agricultural commodities. Section 6 summarizes our main results.

2. The Trade-Poverty nexus: some previous evidence

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, because of the broad set of interrelated factors affecting social welfare outcomes as a result of trade liberalization, when dealing with the potentially beneficial impacts 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 liberalization 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 liberalization 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. Of course, the partial equilibrium approach has the drawback that it leaves aside some second order effects, and even some direct effects. Our exercise is not free of this problem.

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[1] 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.

The partial equilibrium approach in the existing literature dealing with the trade liberalization 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. Barraud and Calfat (2008), Baraud (2009), and Porto (2006) focused on measuring the effects on poverty that resulted from trade liberalization in the nineties. Barraud and Calfat (2008) show that trade liberalization had a pro-poor effect via the reduction in the price of tradable goods and through the effects on the labor 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 liberalization 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[2] 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 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, result that is mostly driven by relatively large wage elasticities to the prices of agro-manufacture goods (up to 0.85). Recently, Moncarz, *et al.* (2015) concludes that the increase in the international prices of agricultural commodities during 2002-2011 would have had a negative effect on welfare over the entire income distribution, increasing also the levels of poverty and indigence.[3]

For Mexico the evidence is more abundant, which as pointed out by Nicita (2009) has focused mostly on examining the effects of globalization on Mexico, while other branch concentrated on the effects of trade liberalization of some specific agricultural products such (e.g. corn). In addition to Nicita (2009), which studies the effects of the trade liberalization that took place in Mexico during the period of 1990–2000, taking into consideration the diverse effects of trade policies on local markets (domestic prices, wages and welfare), and allowing for different responses among Mexico's regions, another important recent contribution is that of Porto (2010) which assess the impacts of trade reforms in agriculture on household behavior in rural Mexico, focusing on consumption (first and second order effects) and income (endogenizing household income to correct for the potential biases in the estimation of own- and cross-price elasticities in consumption) responses. Nicita's results suggest that Mexican tariff liberalization in the nineties, reduced consumers' prices both for agricultural and manufacturing products and increased the wage gap between skilled and unskilled laborers, with a net positive impact on households, mostly because of the reduction in the cost of the consumption basket, but with not all population benefiting from tariff liberalization, especially those with their income largely dependent on agricultural activities. Porto (2008) finds out, for rural Mexico, that allowing for consumption and income responses is important in order to obtain an

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[2] 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.

[3] As with most of the existing literature, the only effect on income that is taken into account is that on wages. This is, a priori, an important drawback, since an increase in the prices of agricultural commodities should have a positive effect, surely not minor, on the land's rent.

accurate empirical assessment of trade policy. According to his results, the proposition that net consumers will be hurt by price increases whereas net producers will be benefited is only true in a static scenario, but when consumers are allowed to adjust quantities, farmers adjust production, and local labor markets react to the changed prices, net consumers can become net producers, thus benefiting from price increases.

Finally, in the case of Uruguay the evidence is much more scarce. A recent study by Borraz, *et al.* (2012) analyzes the impact of MERCOSUR on poverty and inequality through two main transmission channels: prices and income. They found that while trade liberalization favored a reduction in poverty indicators, it had an almost zero effect on income inequality, concluding that trade integration policies cannot be regarded as 'poverty-alleviating' per se.

Following Porto (2006) our objective is to contribute to the understanding of how the recent increase in the price of agricultural commodities could have affected welfare and poverty at the household level. We assume an urban model, where households consume products, sell labor but do not produce agricultural commodities. Leaving aside this last effect means that our analysis concentrates on about 91-93% of the population in Argentina and Uruguay, and about 78% in Mexico. With the exception of Moncarz, *et al.* (2015) for Argentina, none of the previous evidence for the countries analyzed here has dealt directly with the implications of increasing agricultural commodity prices on the poor.[4]

3. Agricultural commodity prices, consumer prices and poverty

During the first decade of the current century, international commodity prices increased substantially. The case of agricultural commodities were not the exception.

In the case of Argentina, for the main agricultural products exported by the country (soybeans, soybean meal, soybean oil, sunflower oil, maize and wheat), average prices during the 2002-2011 period increased between 34% and 78% compared to the average of the preceding ten year. A similar picture emerges in the case of Mexico, for which the main agricultural products imported[5] by the country (groundnuts, maize, rice, sorghum, soybeans, and wheat), increased between 32% and 47%. Finally Uruguay did not show a different pattern, with increases between 32% and 47% (beef, rice, wheat, and soybeans). In Figure 1 we show the evolution of the average prices for the basket of commodities considered for each country, which increased 42% for Argentina, 43% for Mexico, and 41% for Uruguay when comparing the averages for 1992-2001 with those for 2002-2011. As we can appreciate, there was a priori a quite similar behavior for the three countries, with an apparent larger volatility in the cases of Argentina and Mexico than in Uruguay.

The increase in the international prices of agricultural commodities, through a rise in the price of goods that constitute the food basket, which are intensive in the use of these commodities as inputs, has the potential to hurt a sizable proportion of the population in countries where most of households have low and medium-low income.

As Table 1 shows clearly, the three countries we are looking at, fall into this last category, with about two-third of households with a level of per capita income lower than the country's mean. Moreover, a significant proportion of households have an income below half the average income of the country, and in the case of Mexico, even less than one quarter.

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[4] de Hoyos and Medvedev (2011) analyze the poverty impact of higher food prices from a global perspective. Lederman and Porto (2015) is a recent review on the effects of changes in commodity and other prices on household welfare, with focus on less developed and developing countries.

[5] Differently from Argentina and Uruguay, which are next exporter of agricultural commodities, for Mexico we consider the main agricultural commodities imported by the country.

Due to this pattern of income distribution, it is no surprise that a large share of households spend an important part of their income in food and beverages (see Figure 2), whose prices, as shown in Figure 3, showed an apparently positive relationship with the international prices of agricultural commodities.

4. Computing long-run elasticities of consumer prices and wages with respect to world prices

Most of the existing literature on the subject relies on performing an impulse-response analysis to compute the pass-through of international prices to internal 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 internal 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 internal price to a one-percentage change in the international price (i.e. the elasticity of the internal price with respect to the international price), that "VAR approach" captures the response of the internal 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.[6] 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.

Let's consider the VEC representation of a VAR of order l, given by:

$$\Delta p_t = \Pi p_{t-1} + \Gamma_1 \Delta p_{t-1} + ... + \Gamma_{l-1} \Delta p_{t-l+1} \tag{1}$$

Given that p_t is a Kx1 vector that contains at least one I(1) variable, Π is a singular KxK matrix with rank equal to r. Further, Π can be written as $\Pi = \alpha\beta'$, where the Kxr matrix β is the cointegrating matrix. We are interested in analyzing the rx1 vector $ec_{t-1} = \beta' p_{t-1}$, that contains the cointegration relations between prices. In particular, if the variables included in p_t are expressed in logarithms, the coefficients in β represent the elasticities that measure the response of consumer prices to the international ones. Providing that the cointegrating rank is known, the reduced-rank maximum likelihood estimator (α_e, β_e) is available; however it only estimates consistently the cointegrating space. Therefore, it is necessary to identify K-r variables utilizing prior information. We 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. For identification purposes, our assumption is that consumer prices are driven by the international ones.

As pointed out by Juselius (2006), all the long-run effects are captured in the Π matrix, and the VECM provides a way to distinguish between long- versus short-run coefficients. Given that $\beta' p_{t-1}$ represents a stationary linear combination of the variables, the coefficients of β describe the relations of these variables in the steady-state. When these relationships are interpreted according to the economic theory, the concept of cointegration matches the notion of long run equilibrium.

In this section we compute long-run elasticities of consumer prices and salaries. To do this, we perform a cointegration analysis between variables. Particularly, we consider two different alternatives to identify these coefficients. In what follows we make a brief description of them.

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[6] 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.

4.1. Identifying long-run elasticities by estimating a Vector Error Correction Model (VECM) for each response variable

In this case the strategy is to estimate a different VEC model for each response variable. When the objective is to estimate the consumer price elasticities, each model will provide the elasticity of a given consumer price index with respect to the international price index of agricultural commodities and to the nominal exchange rate. To do this, we define the following four vectors:

$$p^{fb}{}_t = (pcfb_t, e_t, pwa_t)'$$

$$p^{clo}{}_t = (pcclo_t, e_t, pwa_t)'$$

$$p^{equ}{}_t = (pcequ_t, e_t, pwa)' \qquad (2)$$

$$p^{oth}{}_t = (pcoth_t, e_t, pwa_t)'$$

In each model, $p^j{}_t$ is a 3x1 vector that contains (the log of) the consumer price index for a given category of goods (j = fb, clo, equ, oth), (the log of) the exchange rate index (e), and (the log of) the international price index of agricultural commodities (pwa). In the four vectors, the first element corresponds to a consumer price index (i.e. food and beverages, clothing, equipment, and other goods), the second one represents the nominal exchange rate, while the remaining element is given by international price index of agricultural commodities, which is supposed to led the long run trend in the referred consumer price.

For the vector $ec^j{}_{t-1} = \beta^{j'} p^j{}_{t-1}$, if $rank(\beta^j) = 1$, then $\beta^{j'} = (1, \beta^j{}_{11}, \beta^j{}_{21})$ and the cointegration equation is represented as:

$$pcj_{t-1} = \beta^j{}_{11} e_{t-1} + \beta^j{}_{21} pwa_{t-1} \qquad (3)$$

The proposed estimation framework is also capable to test additional hypothesis in an open economy. For instance, given the order the variables enter the vector $p^j{}_t$, if two cointegration relations were found, then two hypotheses could be considered: first, consumer prices are driven by international commodity prices, and second, the exchange rate depends also on international commodity prices. It is supposed that the cointegration rank ranges between 1 and 2 because at least one of the three variables in the vector is I(1).

The estimation strategy is as follows. Unit root tests are applied on each variable separately to determine the order of integration. The following stage entails working separately with the vectors $p^{fb}{}_t$, $p^{clo}{}_t$, $p^{equ}{}_t$, $p^{oth}{}_t$. The optimal lag length for the VAR representation of each vector is computed according different criteria. Cointegration tests are run to determine the cointegrating rank associated to Π^{fb}, Π^{clo}, Π^{equ} and Π^{oth}.[7] Finally, each VECM is estimated separately for each vector (after imposing identifying restrictions) to obtain β^{fb}, β^{clo}, β^{equ} and β^{oth}, which are thought to contain the long run elasticities of consumer prices ($pcfb$, $pcclo$, $pcequ$, $pcoth$) with respect to the exchange rate (e) and the international price of agricultural commodities (pwa).

When the objective is to estimate the wage elasticities, each model will provide the elasticity of a given wage index with respect to the exchange rate and the international price index of agricultural commodities. Thus, we define the following three vectors:

$$w^1{}_t = (w1_t, e_t, pwa_t)'$$

$$w^2{}_t = (w2_t, e_t, pwa_t)' \qquad (4)$$

$$w^3{}_t = (w3_t, e_t, pwa_t)'$$

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[7] The results of these preliminary analyses are available upon request.

In each model, w^j_t is a 3x1 vector that contains (the log of) the average hourly wage for different levels of formal education ($j = 1, 2, 3$)[8], (the log of) the exchange rate index (e) and (the log of) the international price index of agricultural commodities (pwa). For the vector $ec^j_{t-1}=\beta^{j\prime}w^j_{t-1}$, if rank($\beta^j$)=1, then $\beta^{j\prime}=(1, \beta^j_{11}, \beta^j_{21})$ and the cointegration equation is represented as:

$$wj_{t-1} = \beta^j_{11}\,e_{t-1}+\beta^j_{21}\,pwa_{t-1} \tag{5}$$

and we follow the estimation strategy as it was depicted above.

4.2. Identifying long-run elasticities by performing a unique cointegration analysis for the entire set of the response variables

In this case the strategy is to estimate a single VECM including all variables. For the case of consumer prices, and defining the following vector:

$$p_t=(pcfb_t, pcclo_t, pcequ_t, pcoth_t, e_t, pwa_t)' \tag{6}$$

for the cointegration equations $ec_{t-1}=\beta'p_{t-1}$, if rank(β)=4, then:

$$\beta' = \begin{pmatrix} 1 & 0 & 0 & 0 & \beta_{51} & \beta_{61} \\ 0 & 1 & 0 & 0 & \beta_{52} & \beta_{62} \\ 0 & 0 & 1 & 0 & \beta_{53} & \beta_{63} \\ 0 & 0 & 0 & 1 & \beta_{54} & \beta_{64} \end{pmatrix}$$

where, for example, the first cointegration equation is given by:

$$pcfb_{t-1} = \beta_{51}\,e_{t-1}+\beta_{61}\,pwa_{t-1} \tag{7}$$

In equation (7), β_{51} and β_{61} represent the elasticities of $pcfb$ with respect to e and pwa, respectively. The estimation strategy is as follows. The optimal lag length for the VAR representation of the vector p_t is computed according different criteria. Cointegration tests are run to determine the cointegrating rank associated to Π. Finally, the VECM is estimated (after imposing identifying restrictions) to obtain β, which are thought to contain the long run elasticities of consumer prices ($pcfb$, $pcclo$, $pcequ$, $pcoth$) with respect to the exchange rate (e) and the international price of agricultural commodities (pwa). To estimate the pass-through of international commodities prices to wages, we define:

$$w_t=(w1_t, w2_t, w3_t, e_t, pwa_t)' \tag{8}$$

For the cointegration equations $ec_{t-1}=\beta'w_{t-1}$, if rank(β)=3, then:

$$\beta' = \begin{pmatrix} 1 & 0 & 0 & \beta_{41} & \beta_{51} \\ 0 & 1 & 0 & \beta_{42} & \beta_{52} \\ 0 & 0 & 1 & \beta_{43} & \beta_{53} \end{pmatrix}$$

where, for example, the first cointegration equation is given by:

$$w1_{t-1} = \beta_{41}\,e_{t-1}+\beta_{51}\,pwa_{t-1} \tag{9}$$

such that β_{41} and β_{51} represent the elasticities of $w1$ with respect to e and pwa, respectively. Then, the estimation strategy follows the one previously described.

Next we present the results obtained for Argentina, Mexico and Uruguay.

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[8] Unskilled (j=1), Semi-skilled (j=2) and Skilled (j=3). Individuals are divided into the three groups depending on their formal education. Argentina and Uruguay: incomplete high school or less (j=1), complete high school or incomplete tertiary/university (j=2), complete tertiary/university (j=3). Mexico: incomplete secondary or less (j=1), complete secondary or incomplete high school (j=2); complete high school or incomplete/complete tertiary/university (j=3).

4.3 Results

4.3.1. Argentina

Table 2 reports the elasticities of consumer prices with respect to the international price index of agricultural commodities and the exchange rate. We use monthly data covering the period 2003-2011.[9] In choosing the time span we have taken into account two facts: firstly, we choose a period with a homogeneous domestic macroeconomic pattern, with exchange rate flexibility (but with a strong intervention by the Central Bank), loose monetary policy and medium/high inflation rates. Secondly, there is another factor that justifies the selection of this time period. 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.

In this case we estimated only one VECM containing consumer prices, the exchange rate and the international price index of agricultural commodities in order to compute the corresponding coefficients. Given that in the cointegration equations all the variables are located in the RHS, the sign of the elasticities need to be inverted in order to be interpreted. The corresponding cointegration test could not reject the null hypothesis that the cointegration rank is equal to 4. This means that four long-run trends can be identified, each indicating a distinctive long association between each consumer price and the international price of the agricultural commodities.

In all cases the elasticity with respect to the international price index of agricultural commodities is positive, and they are significant at a 1% confidence level for *pcfb*, *pcclo* and *pcoth*, while the estimate for *pcequ* is significantly different from zero at a 5% confidence level.

With regards to the elasticities of wage rates with respect to the price index of agricultural commodities, we used quarterly data for the period 2003-Q3 to 2011-Q4. Here, we also followed the strategy of identifying only one VECM , by considering a vector containing all the response variables (the three types of wages) jointly with the exchange rate and the price index of agricultural commodities. The cointegration analysis indicated that the null hypothesis of three cointegrating vectors cannot be rejected. As shown in Table 3, all coefficients mean, as expected, a positive elasticity, and significantly different from zero. It can be seen that there exist three different patterns of transmission: the lower the level of education the greater the pass-through of commodities prices to domestic wages.

4.3.2. Mexico

For Mexico, the elasticities of consumer prices were computed by estimating only one VECM, using monthly data for the period 2002-2011. As in the case of Argentina, the cointegration test did not reject the null hypothesis of 4 cointegrating vectors. As reported in Table 4, the computed elasticities for *pcfb*, *pcclo*, *pcequ* and *pcoth* are positive, as expected, and significantly different from zero at the usual levels (1% for *pcfb*, *pcclo* and *pcequ*, and 5% for *pcoth*).

For the wage elasticities, we used quarterly data for 2002-2011, by adjusting a single VECM containing all the response variables. In this case, we did not reject the hypothesis that the cointegrating space has rank equal to 5. This finding suggests that the international prices of agricultural commodities not only impact in the long run on wages, but also on the exchange rate. This empirical result (world prices and exchange rate tend to be correlated) should not be surprising; actually, it is supported by theoretical research in the field of trade theory. As reported in Table 5, the estimated elasticity is positive and significantly different from zero for unskilled and semi-skilled workers at a 1% level, while the coefficient of skilled *labor* is not significantly different from zero. It also emerges that the pass-through to wages is greater for the case of workers with less education.

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[9] See the Appendix for a description on data and sources.

4.3.3. Uruguay

In Table 6 we present the elasticities of consumer prices for the Uruguayan economy for the period 2002-2011, using monthly data. In a similar way to Argentina and Mexico, the coefficients were estimated jointly by adding all the consumer prices in the same vector in order to perform the VEC analysis. The cointegration test did not reject the hypothesis of 4 cointegration relationships. Thus, the gathered evidence suggests that the long-run behavior of each consumer price is linked to the international prices through a specific stochastic trend, which is distinct to that of the remaining consumer prices. The elasticities of *pcfb*, *pcclo* and *pcequ* are significantly different from zero at a 1% level, while the coefficient for *pcoth* is not significantly different from zero (probably because the VEC system finds difficult to capture the dynamics of a variable that consists of an aggregate of the prices of different category of goods).

Finally, to capture the wage dynamics in Uruguay, we estimated separately 3 VECMs; in each case the dependent variable is the corresponding wage index associated to a different level of education (see Table 7) using monthly data for the period 2002-2011. The first thing to remark is that in every case the hypothesis of one cointegration relation was not rejected; this would imply that there is no evidence favoring the hypothesis that the exchange rate was driven by the international prices of agricultural commodities (this relationship would emerge in a second cointegration relation for each VECM). Second, the estimated coefficients are all significantly different from zero (1% level for the three cases). Third, and differently from Argentina and Mexico, the response of wages to the international prices of agricultural commodities seems to be independent of the education level. All in all, the coefficients are quite high, and show the vulnerability of workers to the international business cycles.

Overall, the estimated elasticities for consumer prices are in line with what can be expected a priori. For the three countries the elasticity of food and beverage is considerably higher than for the other three category of goods. However, counter intuitively, the lowest elasticities are for Argentina, the one among the three countries has experienced a much higher inflation process during the period here analyzed. Two explanations can be proposed for this finding. Firstly, Argentina implemented a system of very high export taxes which may have biased downward the magnitude of the pass-through. Secondly, the increasing inflation rates the country has been experiencing in the last 7/8 years are better explained by an increasing deficit of the public sector, that unable to finance it with genuine resources, for example through the bond market, resorted to increasing rates of monetary emission.

For the elasticities of wages, the magnitudes of the estimated coefficients are more similar between Argentina and Mexico, with larger estimates for the case of Uruguay. Also, in the first two cases, the elasticities are larger for the less skilled workers; while for Uruguay they are statistically similar in magnitude.

Finally, the larger elasticities obtained for Uruguay would be a reflection that the country is a more open (and small) economy than the other two.

5. Effects on welfare and poverty of an increase in the international prices of agricultural commodities

Our primary goal is to simulate the effects on welfare and poverty that may follow an increase in the international prices of agricultural commodities. Once we have 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 to a given shock in the latter.

In particular, the welfare effect on household *h* will be measured by the negative of the compensating variation relative to its initial expenditure:

$$\frac{dx_0^h}{e^h} = -\left(\sum_{g \in N,M} s_g^h \psi_{g,p_{s_A}}\right) d\ln p_{s_A} + \left(\sum_j \theta_j^h \varepsilon_{w,p_{s_A}}^j\right) d\ln p_{s_A} \tag{10}$$

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 labor 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 (10) is the welfare effect that takes place through consumption, while the second term measures the effect through changes in labor income. Considering the way in which equation (10) is computed, a negative value means a welfare loss, while a positive value means a welfare gain. In equation (10) we do not consider second-order effects that take place through changes in consumption patterns in response to changes in consumer prices, neither changes in the supply of labor. Also, and because of the lack of appropriate data, we do not take into account the effects on non-labor income, neither those due to the consumption of own-produced goods. Finally, as already mentioned above, all the following analysis ignores any impact on the rural population.

5.1. Welfare effects

Using the elasticities obtained in Section 4, and budget shares from the national surveys of household expenditures, and assuming a 100% increase in the international prices of agricultural commodities, applying equation (10) we obtain the effect on welfare for each. Then, we run non-parametric regressions of the welfare effects as a function of household per capita expenditure.

Before looking at the results of the simulations, in Table 8 we report some descriptive statistics about the consumption patterns and the sources of income, since these together with the elasticities of the previous sections determine the magnitude of the simulated effects. As it emerges clearly, in the case of the expenditure shares, the category of food and beverages has a much greater importance for poorer households, especially in Argentina and Mexico. These differences help to explain why in our simulations the poorer households are more negatively affected through the consumption effect. On the other hand, the differences between households are less important when we look at the sources of income, however it still is possible appreciate the lower participation of salaried labor for the poorest households. It is important to highlight a drawback of our the analysis, due to the fact that we cannot account for the effects working through other sources of income, which most likely would help to diminish the magnitudes of the aggregate negative effects we obtain.

In the simulation of the welfare effects we need to deal with two sources of randomness. The first comes from the sampling variability of expenditure shares and of the participation of salaried labor in the household income; while the second source emerges because of the error associated to the estimation of the responses of consumer prices and wages to international agricultural commodity prices. To jointly account for these sources of variability, we work as follows. The randomness due to sampling variability of households (and therefore of budget shares and that of the participation of salaried labor in household incomes) is controlled by weighting each observation by the inverse probability of its inclusion into the sample.[10] To deal with the variance of the estimated elasticities, we follow Porto (2006) and resample from their empirical asymptotic distribution. From de VEC models in section 4, we obtain, for each category of consumption goods and for each wage index, an

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[10] We also followed Porto (2006) and took random samples of households from the expenditure and income surveys. The results were almost identical, but our approach demanded much less computation time. Sample weights come from the countries' official statistic offices.

estimate $\hat{\beta}_j$ of the elasticity with respect to the international price index of agricultural commodities, and also an estimated standard error $\hat{\sigma}_j$. Under standard assumptions $\hat{\beta}_j \sim N\left(\beta_j, \sigma_j\right)$, where β_j and σ_j are the true parameters values. Then, in each loop a new elasticity is assigned to the formula to calculate the welfare effect. The non-parametric regression is run for each of the 200 replications to deliver 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.[11]

The welfare effect through the consumption of food and beverages is, as expected, negative for all households. When comparing among the three countries, two elements explain the differences. On the one hand the importance of food and beverages in consumption, which as seen before is greater in Argentina and Mexico than in Uruguay. On the other hand the size of the estimated elasticities, with Uruguay having the largest one, and Argentina the lowest. The differences within each country depend on the difference between the shares of the consumption of food and beverages across households. As shown in Figure 4, the welfare losses range between 5 and 15% of the initial household expenditure. Losses are larger in Uruguay, followed by Mexico, with the former showing also a larger variability across households.

In the case of the consumption of non-food and beverages (Figure 5), losses are of much lower magnitude. The main reason behind this result is the lower elasticities than the ones obtained for food and beverages.

Once we add the effects taking place through the consumption of all kind of goods, and because of the larger impact that works through the consumption of food and beverages, the qualitative results resemble those reported in Figure 4, but now with losses ranging between 8% and 18% (see Figure 6).

To obtain the labor income effects, we use the wage elasticities reported in Tables 3, 5 and 7. Then, using the share of salaried income of each member in the household total income, 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 7, there is a positive effect through the increase in labor income. In Argentina and Uruguay, middle income households are the one that benefit the most. The results for Argentina can be explained because of the larger share of salaried income in total household income for those in the middle of the distribution. In the case of Uruguay, in addition to the greater importance of salaried income for those in the middle of the distribution, another possible explanation is the higher elasticity of wages for semi-skilled workers. In Mexico, instead, the effect decreases continuously as we move upward along the distribution of the household expenditure per capita. In this case, the higher elasticity of wages for those with low and middle levels of education is enough to compensate for the fact that poorest households show a lower share of salaried income. In the comparison between the three countries, Uruguay shows the largest effect, while Mexico is at the opposite extreme. The reason behind these results is that the lower share of salaried labor in total household income in Uruguay, especially relative to Mexico, is more than compensated by the much larger elasticities of wages with respect to the international prices of agricultural commodities. However, for Uruguay the estimated effects are also less precise than for the other two countries.

Finally, once we add the effects that work through consumption and labor income, we obtain for the three countries that poorest households are the most affected (see Figure 8). In Argentina and Mexico all households experience losses, between 3% and 7.5% of their initial expenditure in the former case, and between 10% and 12% in the latter. In both cases, poorer households are the ones

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[11] In all Figures, the solid line is the average effect, while dashed lines are the 90% confidence bands.

that are most negatively affected. In Uruguay, instead, households at the upper end of the distribution would benefit with the increase in the international price of agricultural commodities, with low-income households losing up to 7.5%. Uruguay shows a much greater variability between households, while in Mexico the results are more homogeneous.

All in all, the distribution of losses along the per capita expenditure of households is, a priori, in line with what could 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.

5.2. Effects on indigence and poverty

To grasp an approximate idea of how important is the impact on poverty of an increase in the international prices of agricultural commodities, in Table 9 we report the indigence and poverty rates that would follow after a 100% increase, as well as two additional measures: the gap and severity of indigence and poverty.[12] In the three countries, indigence and poverty are measured in absolute terms, comparing the income of the household with the minimum expenditures required not to fall into either of the two categories. The indigence line is defined for a individual of reference[13], measuring the minimum expenditure necessary to acquire the basic food basket (CBA), which is calculated to guarantee the intake of a certain number of calories. On the other hand, the poverty line is obtained by multiplying the CBA by the Engel's coefficient, which gives us the total basic basket (CBT). What constitute the CBT is more heterogeneous among the three countries studied here. For instance, while for Argentina the Engel's coefficient is about 2.0-2.2 (depending on the region), in Mexico is 2.0, and in Uruguay 4.6 for the city of Montevideo and 3.25 for the remaining urban areas. These differences make less reliable the comparison of the poverty rates between the three countries than those of indigence. Finally, multiplying the CBA and the CBT by the household size[14], the indigence and poverty baskets are calculated for each household.

To obtain the new value of the CBA for each household, we update the original indigence line for the time each household was surveyed, considering only the effect that works through the increase in the consumer price of food and beverages.[15] Then, the new poverty line is obtained using the Engel's coefficient for the time each household was surveyed. The new household incomes are calculated taking into account only the effect on labor income of salaried household members.[16]

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[12] The rate, gap and severity of indigence and poverty are measured following Foster *et al.* (1984), using the following formula: $R = \dfrac{1}{N}\sum_{h=1}^{N}\left(\dfrac{z_h - y_h}{z_h}\right)^{\alpha} I^{*}\left(y_h < z_h\right)$, 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.

[13] In Argentina the person of reference is a man between 30 and 59 of age, in Mexico and Uruguay, the indigence line, in per capita terms, is built on the basis of the food requirements of a group of representative households according to their socioeconomic and demographic characteristics.

[14] The three countries assume that there exist economies of scale within the household, so the household size is lower than the number of individuals. The assumptions about the economies of scale are not the same among the three countries.

[15] It would have been more appropriate to work with the changes in the prices of goods that constitute the CBAs, data we do not have access to, however, the correlation of the consumer price index for food and beverages with the indigence and poverty lines is around 0.99 in both cases.

[16] In this point is necessary to highlight an important difference between the methodology followed by Argentina and Mexico with that of Uruguay. Both, Argentina and Mexico do not include as part of the

As reported in Table 9, we obtain that a 100% increase in the international price of agricultural commodities would led to an increase in indigence of 1.8 pp. in Argentina, 3.2 pp. in Uruguay, and 6.5 pp. in Mexico. For poverty, the increases would be, 4.4 pp. (Argentina), 9.8 pp. (Uruguay) and 11.4 pp, (Mexico). However, while in absolute terms poverty rates increases more than those of indigence, the opposite is true when the changes are measured relative to the initial values; with indigence increasing between 40% (Uruguay) and 90% (Mexico) more than that of poverty. For instance, poverty rates would increase between 19% and 34% of their initial values, with Uruguay being the most affected and Argentina the least, while in the case of indigence the changes would be between 29% (Argentina) and 52% (Mexico).

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 both indices increase more than their corresponding rates. These results mean that there is not only an increase in indigence and poverty in response to the raise in the international prices of agricultural commodities, but also that those households who were already indigent and/or poor, as well as those who become indigent and/or poor, move in average further away from the threshold lines. These results mean also that within each category, poor and indigent households become more homogeneous among them.

6. Conclusions

With a large share of households with low and medium-low income, the increase in agricultural commodities prices has the potential to hurt a sizable part of the population through a rise in the price of goods that explain an important share of households expenditures, those that constitute the food-basket. The ex-ante simulations show that we can expect this to be the case.

A less obvious channel works through changes in factor incomes. In the case of salaried labor income, the magnitude of the positive effect is not large enough to compensate for the losses because of the changes in the prices of consumption goods, with the exception of the richest households in Uruguay.

In terms of poverty, there would be an increase between 19% and 34%, while for indigence the changes would be even greater, between 29% and 54%. Also, the results show that households in a situation of indigence and/or poverty, would move in average further away from the threshold lines, with households within each category, poor and indigent, becoming more homogeneous among them.

Finally, our results highlight the need for well designed compensatory measures to help those that could be most negatively affected. Finally, the analysis should be interpreted into the context of its limitations, mostly because of the impossibility to account for the effects working through changes in factor rewards other than salaried labor, especially the land rent, which in countries like Argentina and Uruguay benefited greatly from the increase in the prices of agricultural commodity.

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household income the amount corresponding to the imputed rental value for those households that own the house they live in, while Uruguay does. In all our analysis, and with the objective of make the results more comparable, we exclude the imputed rental value. Working this way means that for Uruguay, rates of indigence and poverty are higher than those reported officially.

Table 1
Proportion of households with per capita income lower than value of reference

		Less or equal than:		
		1/4 of medium income	1/2 of medium income	Medium income
Argentina	2003	18.0	39.4	68.0
	2011	10.4	31.0	66.2
Mexico	2005	26.8	41.8	68.1
	2011	31.5	43.3	66.8
Uruguay	2003	9.3	32.7	67.5
	2011	4.8	25.0	64.1

Source: own calculations based on Encuesta Permanente de Hogares (Argentina), Encuesta Nacional de Ocupación y Empleo (Mexico), and Encuesta Continua de Hogares (Uruguay). In all cases, household income excludes the implicit rent for those households who own the house they live in.

Table 2
Argentina: Consumer price elasticities
Coefficients of cointegration relations β'p_{t-1}
$p_t=(pcfb_t, pcclo_t, pcequ_t, pcoth_t, e_t, pwa_t)'$

Cointegration Equation	$pcfb_{t-1}$	$pcclo_{t-1}$	$pcequ_{t-1}$	$pcoth_{t-1}$	e_{t-1}	pwa_{t-1}	CONST	TREND
$ec_{1,t-1}$	1.000	0.000	0.000	0.000	-1.754	-0.279	-1.850	-0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.072)	(0.022)	(0.124)	(0.001)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***	{0.000}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-24.258]	[-12.799]	[-14.875]	[-7.583]
$ec_{2,t-1}$	0.000	1.000	0.000	0.000	-1.208	-0.102	-2.944	-0.008
	(0.000)	(0.000)	(0.000)	(0.000)	(0.046)	(0.014)	(0.079)	(0.000)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***	{0.000}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-26.269]	[-7.352]	[-37.220]	[-21.387]
$ec_{3,t-1}$	0.000	0.000	1.000	0.000	-1.539	-0.038	-3.270	-0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.053)	(0.016)	(0.091)	(0.000)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.018}**	{0.000}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-29.027]	[-2.372]	[-35.850]	[-7.001]
$ec_{4,t-1}$	0.000	0.000	0.000	1.000	-1.271	-0.048	-3.548	-0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.047)	(0.014)	(0.081)	(0.000)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.001}***	{0.000}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-26.855]	{0.001}	[-43.574]	[-11.777]

(Std. Dev.) {p - Value} [t - Value] *** p<0.01, ** p<0.05, * p<0.1.
The Akaike Info Criterion and Final Prediction Error indicated that the optimal VAR lag length is equal to 10. The cointegration test was run using Lütkepohl and Saikkonen (L&S) procedure. The null hypothesis H_0: rank(β)=4 cannot be rejected, so that the VECM was specified assuming that the cointegration rank is equal to 4. Remaining VECM's specification details are as follows: deterministic variables: CONST, TREND; endogenous lags (in differences): 9; sample range: [2003 M2, 2011 M12]; T=98; estimation procedure: One stage. Johansen approach. Further estimation details are available upon request.
Source: Own calculations.

Table 3
Argentina: Wage elasticities
Coefficients of cointegration relations $\beta'w_{t-1}$
$w_t=(w1_t, w2_t, w3_t, e_t, pwa_t)'$

Cointegration equation	$w1_{t-1}$	$w2_{t-1}$	$w3_{t-1}$	e_{t-1}	pwa_{t-1}	CONST	TREND
$ec_{1,t-1}$	1.000	0.000	0.000	-0.642	-0.244	-0.054	-0.039
	(0.000)	(0.000)	(0.000)	(0.066)	(0.015)	(0.229)	(0.001)
	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***	{0.812}	{0.000}***
	[0.000]	[0.000]	[0.000]	[-9.690]	]-15.960]	[-0-238]	[-47.753]
$ec_{2,t-1}$	0.000	1.000	0.000	-0.592	-0.175	-0.877	-0.040
	(0.000)	(0.000)	(0.000)	(0.103)	(0.024)	(0.261)	(0.001)
	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***	{0.001}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[-5.750]	[-7.380]	[-3.359]	[-42.434]
$ec_{3,t-1}$	0.000	0.000	1.000	-0.529	-0.096	-0.780	-0.036
	(0.000)	(0.000)	(0.000)	(0.095)	(0.022)	(0.403)	(0.001)
	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***	{0.053}*	{0.000}***
	[0.000]	[0.000]	[0.000]	[-5.560]	[-4.410]	[-1.934]	[-24.944]

(Std. Dev.) {p - Value} [t - Value] *** p<0.01, ** p<0.05, * p<0.1.
The Akaike, Hannan-Quinn and Schwarz Criteria indicated that the optimal VAR lag length is equal to 4. The cointegration test was run using Lütkepohl and Saikkonen (L&S) procedure. The null hypothesis H_0: rank(β)=3 cannot be rejected, so that the VECM was specified assuming that the cointegration rank is equal to 3. Remaining VECM's specification details are as follows: deterministic variables: CONST, TREND, SEASONAL and DUMMIES; endogenous lags (in differences): 3; sample range: [2004 Q3, 2011 Q4]; T=30; estimation procedure: One stage. Johansen approach. The estimation was carried out using quarterly data. Further estimation details are available upon request.
Source: Own calculations.

Table 4
Mexico: Consumer price elasticities
Coefficients of cointegration relations β'p_{t-1}
$p_t=(pcfb_t, pcclo_t, pcequ_t, pcoth_t, e_t, pwa_t)'$

Cointegration Equation	$pcfb_{t-1}$	$pcclo_{t-1}$	$pcequ_{t-1}$	$pcoth_{t-1}$	e_{t-1}	pwa_{t-1}
$ec_{1,t-1}$	1.000	0.000	0.000	0.000	0.920	-0.369
	(0.000)	(0.000)	(0.000)	(0.000)	(0.227)	(0.081)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[4.057]	[-4.587]
$ec_{2,t-1}$	0.000	1.000	0.000	0.000	-0.016	-0.142
	(0.000)	(0.000)	(0.000)	(0.000)	(0.070)	(0.025)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.816}	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-0.233]	[-5.754]
$ec_{3,t-1}$	0.000	0.000	1.000	0.000	0.470	-0.411
	(0.000)	(0.000)	(0.000)	(0.000)	(0.211)	(0.075)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.026}**	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[2.233]	[-5.490]
$ec_{4,t-1}$	0.000	0.000	0.000	1.000	0.152	-0.034
	(0.000)	(0.000)	(0.000)	(0.000)	(0.045)	(0.016)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.001}***	{0.035}**
	[0.000]	[0.000]	[0.000]	[0.000]	[3.362]	[-2.109]

(Std. Dev.) {p - Value} [t - Value] *** p<0.01, ** p<0.05, * p<0.1.

The Akaike Info Criterion indicated that the optimal VAR lag length is equal to 9. The cointegration test was run using Lütkepohl and Saikkonen (L&S) procedure. The null hypothesis H_0: rank(β)=4 cannot be rejected, so that the VEC was specified assuming that the cointegration rank is equal to 4. Remaining VECM's specification details are as follows: deterministic variables: SEASONAL DUMMIES; endogenous lags (in differences): 8; sample range: [2002 M10, 2011 M12]; T=111; estimation procedure: One stage. Johansen approach. Further estimation details are available upon request.

Source: Own calculations.

Table 5
Mexico: Wage elasticities.
Coefficients of cointegration relations β'w_{t-1}
w_t=($w1_t$, $w2_t$, $w3_t$, e_t, pwa_t)'

Cointegration Equation	$w1_{t-1}$	$w2_{t-1}$	$w3_{t-1}$	e_{t-1}	pwa_{t-1}
$ec_{1,t-1}$	1.000	0.000	0.000	0.000	-0.269
	(0.000)	(0.000)	(0.000)	(0.000)	(0.031)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-8.695]
$ec_{2,t-1}$	0.000	1.000	0.000	0.000	-0.187
	(0.000)	(0.000)	(0.000)	(0.000)	(0.037)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-5.109]
$ec_{3,t-1}$	0.000	0.000	1.000	0.000	0.017
	(0.000)	(0.000)	(0.000)	(0.000)	(0.047)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.718}
	[0.000]	[0.000]	[0.000]	[0.000]	[0.361]
$ec_{4,t-1}$	0.000	0.000	0.000	1.000	-0.088
	(0.000)	(0.000)	(0.000)	(0.000)	(0.020)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-4.460]

(Std. Dev.) {p - Value} [t - Value] *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
The Akaike Info Criterion, Hannan-Quinn and Schwarz Criteria indicated that the optimal VAR lag length is equal to 5. The cointegration test was run using Lütkepohl and Saikkonen (L&S) procedure. The null hypothesis H0: rank(β)=4 cannot be rejected, so that the VEC was specified assuming that the cointegration rank is equal to 4. Remaining VECM's specification details are as follows: deterministic variables: CONST; endogenous lags (in differences): 4; sample range: [2003 Q2, 2011 Q4]; T=35; estimation procedure: One stage. Johansen approach. The estimation was carried out using quarterly data. Further estimation details are available upon request.
Source: Own calculations.

Table 6
Uruguay: Consumer price elasticities
Coefficients of cointegration relations $\beta'p_{t-1}$
$p_t=(pcfb_t, pcclo_t, pcequ_t, pcoth_t, e_t, pwa_t)'$

Cointegration equation	$pcfb_{t-1}$	$pcclo_{t-1}$	$pcequ_{t-1}$	$pcoth_{t-1}$	e_{t-1}	pwa_{t-1}	TREND
$ec_{1,t-1}$	1.000	0.000	0.000	0.000	-0.446	-0.513	-0.005
	(0.000)	(0.000)	(0.000)	(0.000)	(0.029)	(0.0369	(0.000)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-15.358]	[-14.391]	[-10.990]
$ec_{2,t-1}$	0.000	1.000	0.000	0.000	-0.754	-0.169	-0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.052)	(0.064)	(0.001)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.009}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-14.415]	[-2.630]	[-5.412]
$ec_{3,t-1}$	0.000	0.000	1.000	0.000	-0.615	-0.331	-0.005
	(0.000)	(0.000)	(0.000)	(0.000)	(0.062)	(0.076)	(0.001)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.000}***	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-9.896]	[-4.328]	[5.517]
$ec_{4,t-1}$	0.000	0.000	0.000	1.000	-0.852	-0.027	-0.008
	(0.000)	(0.000)	(0.000)	(0.000)	(0.049)	(0.060)	(0.001)
	{0.000}	{0.000}	{0.000}	{0.000}	{0.000}***	{0.659}	{0.000}***
	[0.000]	[0.000]	[0.000]	[0.000]	[-17.349]	[-0.442]	[-11.158]

(Std. Dev.) {p - Value} [t - Value] *** p<0.01, ** p<0.05, * p<0.1.

The Akaike Criteria indicated that the optimal VAR lag length is equal to 9. The cointegration test was run using Lütkepohl and Saikkonen (L&S) procedure. The null hypothesis H_0: rank(β)=4 cannot be rejected, so that the VECM was specified assuming that the cointegration rank is equal to 4. Remaining VECM's specification details are as follows: deterministic variables: TREND; endogenous lags (in differences): 8; sample range: [2002 M10, 2011 M12]; T=111; estimation procedure: One stage. Johansen approach. Further estimation details are available upon request.
Source: Own calculations.

Table 7
Uruguay: Wage elasticities
Coefficients of cointegration relations β^{j} wj_{t-1}

Cointegration equation	wj_{t-1} (#)	e_{t-1}	pwa_{t-1}	TREND
	$w^1_t = (w1_{t-1}, e_{t-1}, pwa_{t-1})$			
$ec^1_{,t-1}$	1.000	-0.513	-0.367	-0.009
	(0.000)	(0.122)	(0.142)	(0.002)
	{0.000}	{0.000}***	{0.010}**	{0.000}***
	[0.000]	[-4.208]	[-2.579]	[-5.392]
	$w^2_t = (w2_{t-1}, e_{t-1}, pwa_{t-1})$			
$ec^2_{,t-1}$	1.000	-0.506	-0.401	-0.007
	(0.000)	(0.125)	(0.146)	(0.002)
	{0.000}	{0.000}***	{0.006}***	{0.000}***
	[0.000]	[-4.058]	[-2.752]	[-4.061]
	$w^3_t = (w3_{t-1}, e_{t-1}, pwa_{t-1})$			
$ec^3_{,t-1}$	1.000	-0.500	-0.406	-0.007
	(0.000)	(0.118)	(0.137)	(0.002)
	{0.000}	{0.000}***	{0.003}***	{0.000}***
	[0.000]	[-4.251]	[-2.953]	[-4.102]

(#) j: 1; 2; 3.
(Std. Dev.) {p - Value} [t - Value] *** p<0.01, ** p<0.05, * p<0.1.
For the first two VECM the Akaike, Hannan-Quinn and Schwarz Criteria indicated that the optimal VAR lag length is equal to 2. For the third VECM the Hannan-Quinn and Schwarz Criteria indicated that the optimal VAR lag length is equal to 2, and the Akaike indicated that the VAR lag length is equal to 3.
The cointegration tests were run using Lütkepohl and Saikkonen (L&S) procedure. In all cases the null hypothesis H_0: rank(β^j)=1 cannot be rejected, so that the VEC were specified assuming that the cointegration rank is equal to 1. Remaining VECM's specification details are as follows: deterministic variables: TREND; endogenous lags (in differences): 1; sample range: [2002 M2, 2011 M12]; T=118; estimation procedure: Two-stage Johansen approach. Further estimation details are available upon request.
Source: Own calculations.

Table 8
Shares in Consumption and Sources of Income
Values in % (#)

Quintile	FB	CLO	EQU	OTH	Salaried Labor	Labor
Argentina						
1	49.2	7.1	4.1	39.5	43.9	73.7
2	44.2	8.0	5.0	42.7	51.5	73.6
3	39.7	7.9	5.7	46.7	51.3	72.6
4	34.9	7.7	6.6	50.8	50.8	72.8
5	28.3	7.9	8.1	55.7	48.1	74.1
Mexico						
1	49.2	5.1	6.0	39.6	57.4	74.3
2	45.2	5.6	5.5	43.7	62.0	78.4
3	42.5	6.0	5.5	46.0	60.6	77.3
4	38.0	6.5	6.1	49.4	62.4	77.2
5	31.1	6.6	5.9	56.3	61.9	73.7
Uruguay						
1	38.5	5.1	4.3	52.1	40.5	58.1
2	31.6	3.9	3.6	60.9	47.0	62.2
3	26.1	4.0	3.7	66.3	46.4	61.6
4	22.9	3.8	4.0	69.4	46.8	61.3
5	15.8	3.8	5.5	74.9	39.2	57.4

source: own calculations based on Encuesta Nacional de Gastos de los Hogares 2004-2005 (Argentina), Encuesta Nacional de Ingresos y Gastos en los Hogares 2010 (Mexico), and Encuesta Nacional de Gastos e Ingresos de los Hogares 2005-2006 (Uruguay). FB: food and beverages; CLO: clothing; EQU: equipment; OTH: other goods and services. Labor: includes self employment. (#) Shares in consumption as a percentage of total household expenditure; sources of income as a percentage of total household income (excluding the imputed rental value for households which own the houses they live in).

Table 9
Indigence and Poverty rates in urban areas
Pre and post a 100% increase in international prices of agricultural commodities

Variable			Argentina		Mexico		Uruguay	
			Value	Std. Error (*)	Value	Std. Error (*)	Value	Std. Error (*)
Indigence	Rate	Pre	6.3	0.36	12.7	0.46	6.5	0.12
		Post	8.2	0.43	19.2	0.64	9.7	0.16
	Gap	Pre	2.2	0.15	4.1	0.18	2.1	0.05
		Post	2.8	0.17	6.2	0.26	3.5	0.07
	Severity	Pre	1.1	0.10	2.0	0.12	1.1	0.04
		Post	1.5	0.11	3.1	0.16	1.8	0.05
Poverty	Rate	Pre	23.2	0.57	42.3	0.63	28.9	0.23
		Post	27.6	0.62	53.7	0.78	38.7	0.66
	Gap	Pre	8.7	0.28	15.9	0.32	11.8	0.12
		Post	10.7	0.32	22.0	0.40	16.6	0.18
	Severity	Pre	4.6	0.19	8.2	0.22	6.6	0.08
		Post	5.8	0.22	11.9	0.31	9.6	0.12

The rate, gap and severity of indigence and poverty are measured following Foster *et al.* (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 $y_h < z_h$. 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.
(*) Bootstrapped standard errors.
Note: total household income excludes the imputed rental value for households which own the houses they live in.
Source: own calculations.

Figure 1
Average international prices of agricultural commodities
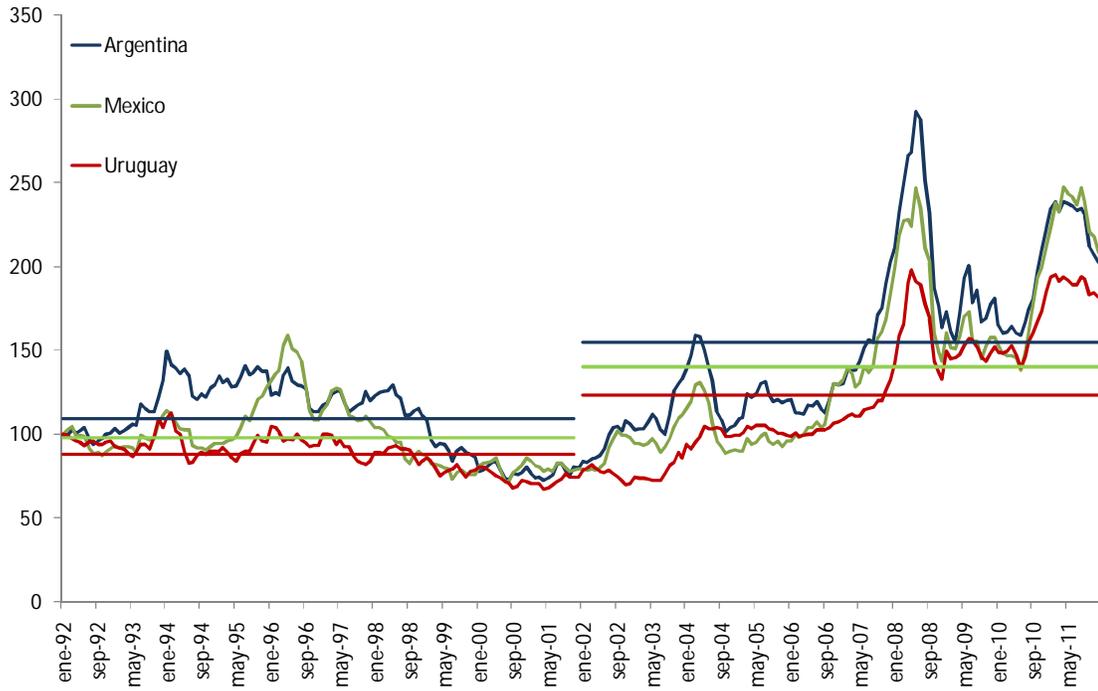
Argentina: export weighted average of prices for soybeans, soybean meal, soybean oil, sunflower oil, maize and wheat. **Mexico:** import weighted average of prices for groundnuts, maize, rice, sorghum, soybeans, and wheat. **Uruguay:** import weighted average of prices for beef, rice, wheat, and soybeans. Source: own based on WITS and www.indexmundi.com (retrieved on November 12, 2012).

Figure 2
Share of expenditure in Food and Beverages
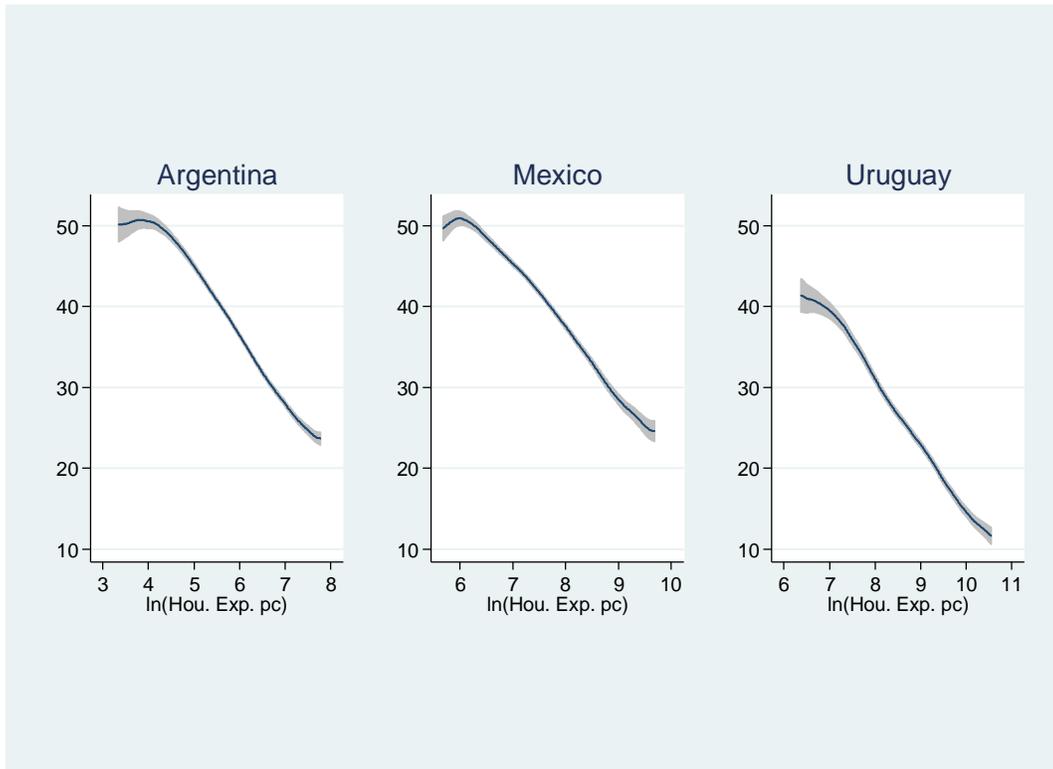
Source: own calculations based on Encuesta Nacional de Gastos de los Hogares 2004-2005 (Argentina), Encuesta Nacional de Ingresos y Gastos en los Hogares 2010 (Mexico), and Encuesta Nacional de Gastos e Ingresos de los Hogares 2005-2006 (Uruguay). In all cases, excluding consumption of own production. Household expenditure per capita (Hou. Exp. pc) in local currency.

Figure 3
**Consumer and agricultural commodity prices**
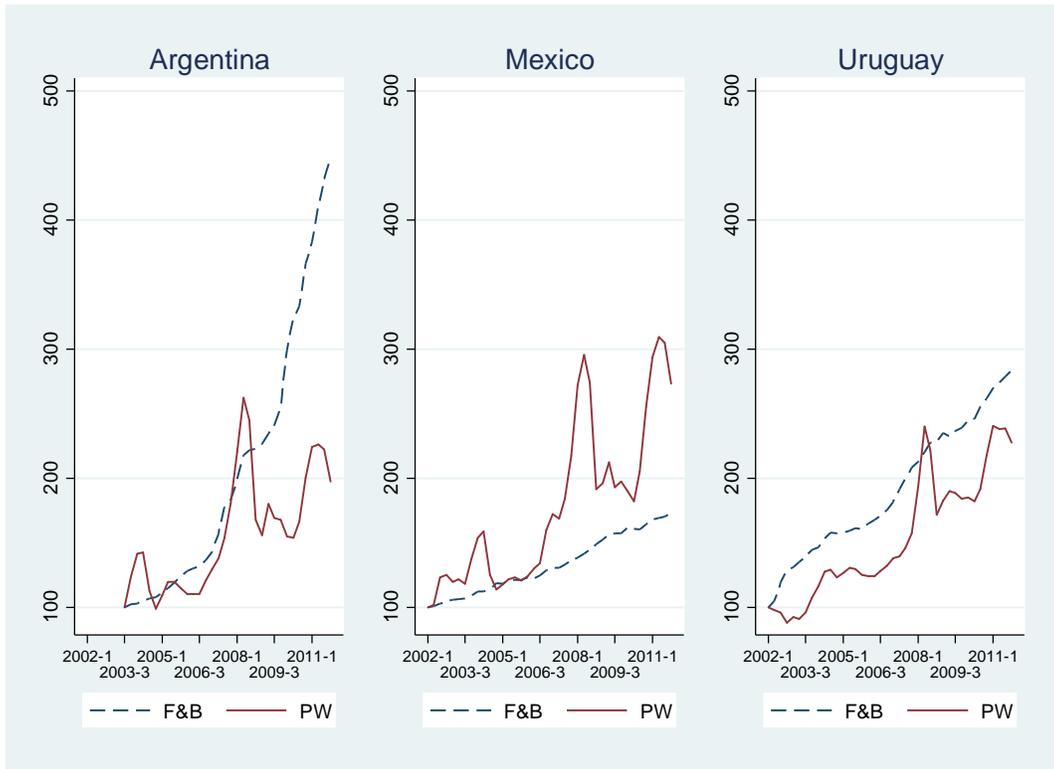
Figure 4
Consumption effect of a 100% increase in the international prices of agricultural commodities Food and Beverages
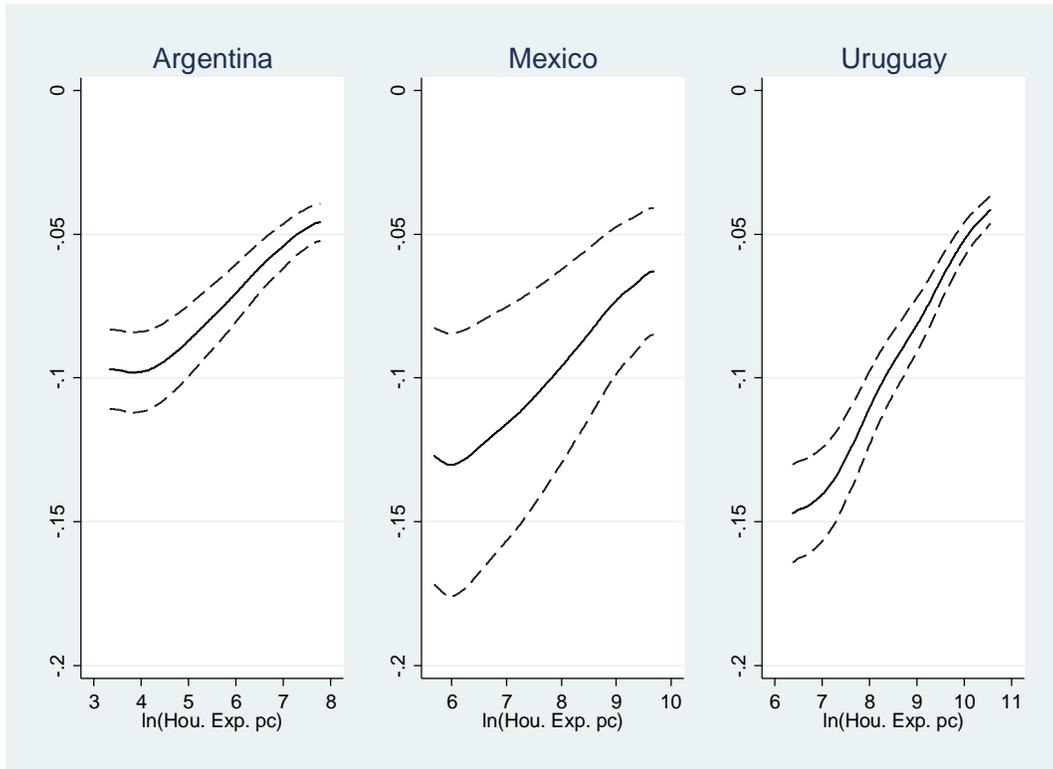
Figure 5
Consumption effect of a 100% increase in the international prices of agricultural
commodities Non-Food and Beverages
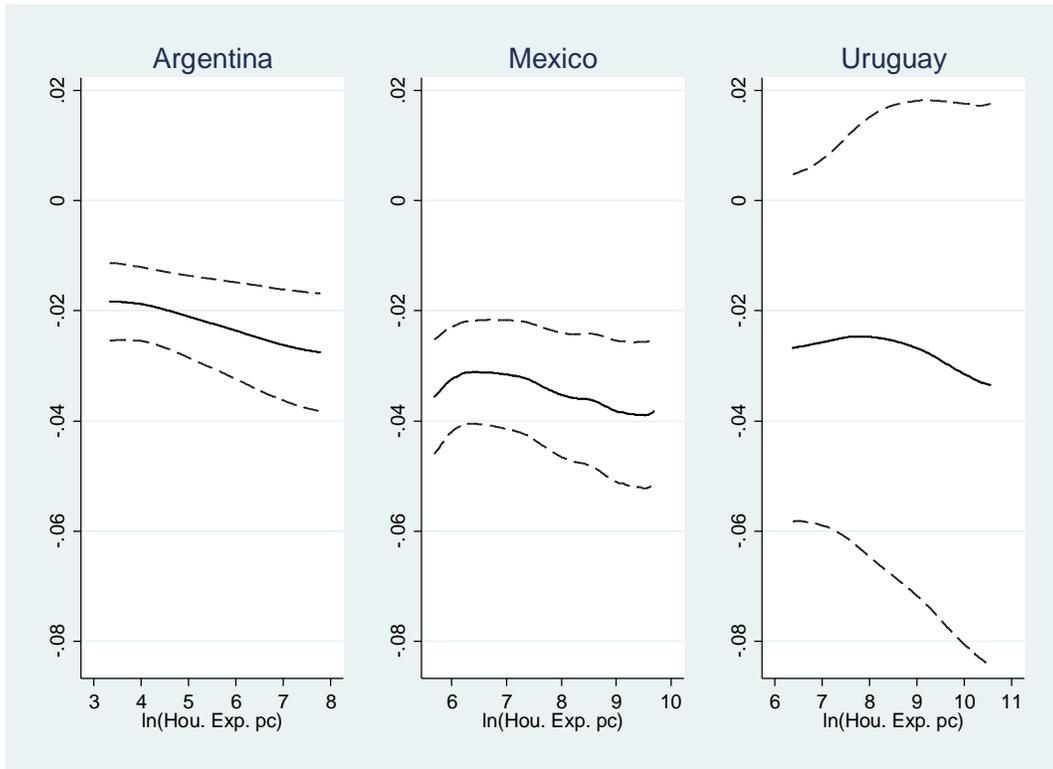
Figure 6
Aggregate consumption effect of a 100% increase in the international prices of agricultural commodities
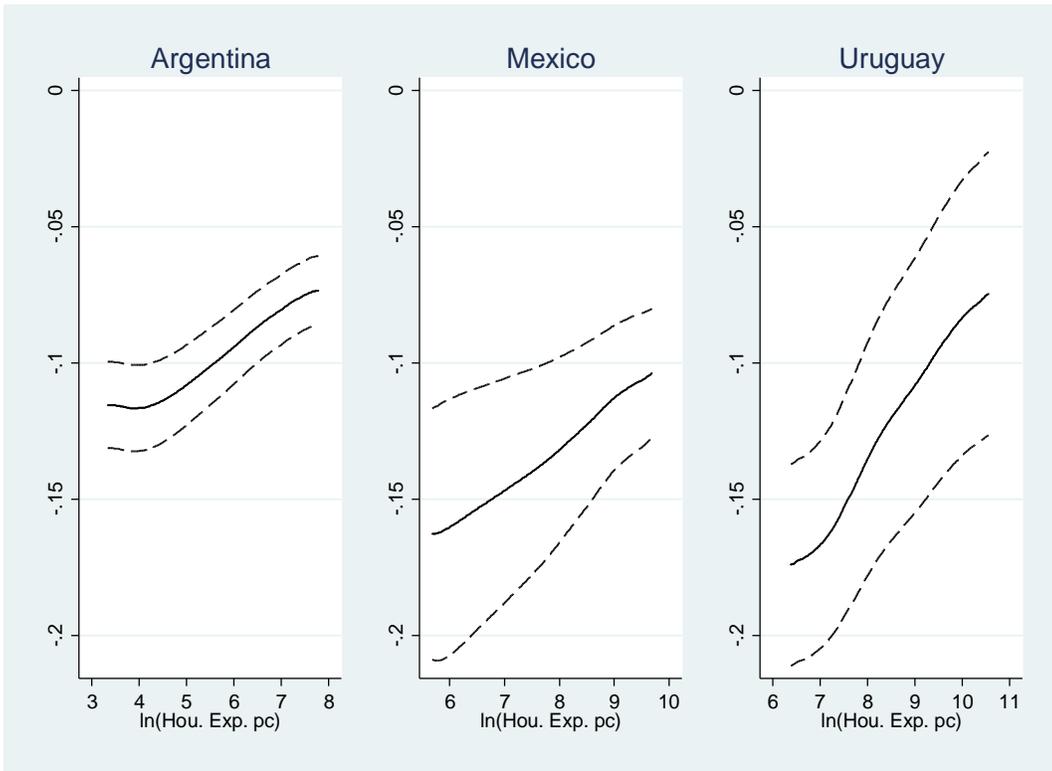
Figure 7
**Labor income effect of a 100% increase in the international prices of agricultural commodities**
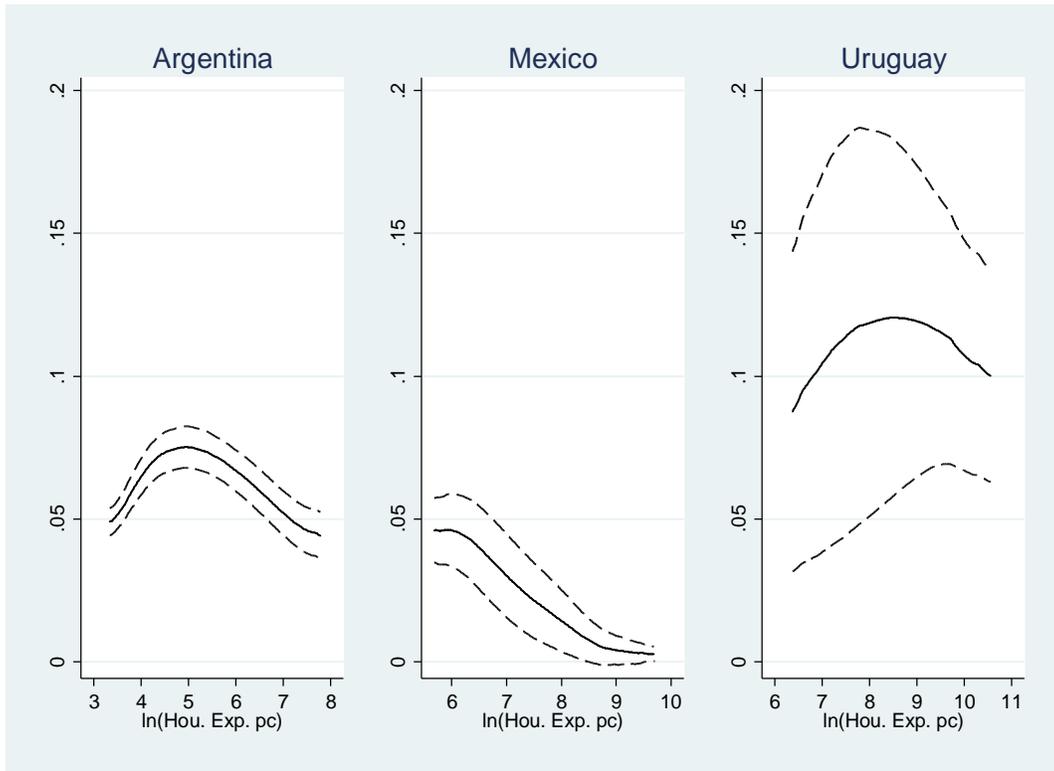
Figure 8
Aggregate effect of a 100% increase in the international prices of agricultural commodities
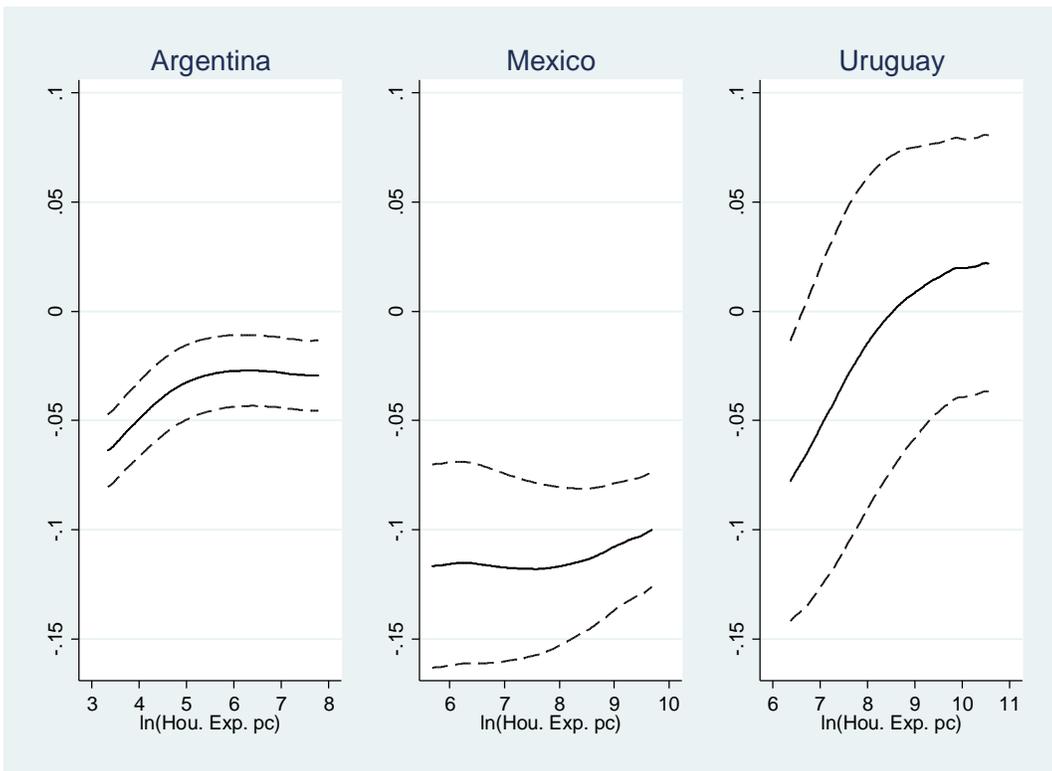
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Appendix

Data description and sources

Argentina:

Agricultural commodity prices: weighted average of the country main agricultural exports (Maize, Soybeans, Soybeans Meal, Soybean Oil, Sunflower Oil, and Wheat). Exports values are used as weights. Price indices are from www.indexmundi.com (retrieved on November 12, 2012) while exports are from WITS of World Bank.

Consumer Prices: are from Instituto Nacional de Estadísticas y Censos (2003-2006) and from the Government of Province of San Luis (2007-2011).[17]

Wages: average wages are from the Instituto Nacional de Estadísticas y Censos using the Encuesta Permanente de Hogares.

Nominal Exchange Rate: is from Banco Central de la República Argentina.

Household expenditures and incomes: are from Instituto Nacional de Estadísticas y Censos, Encuesta Nacional de Gastos de los Hogares 2004-2005.

Mexico:

Agricultural commodity prices: weighted average of the country main agricultural imports (Groundnuts, Maize, Rice, Sorghum, Soybeans and Wheat). Imports values are used as weights. Price indices are from www.indexmundi.com (retrieved on November 12, 2012) while exports are from WITS of World Bank.

Consumer Prices: are from Instituto Nacional de Estadística y Geografía.

Wages: average wages are from Instituto Nacional de Estadística y Geografía using the Encuesta Nacional de Empleo (2002-2004) and Encuesta Nacional de Empleo y Ocupación (2005-2011).

Nominal Exchange Rate: is from Banco de Mexico.

Household expenditures and incomes: are from Instituto Nacional de Estadística y Geografía, Encuesta Nacional de Ingresos y Gastos en los Hogares 2010.

Uruguay:

Agricultural commodity prices: weighted average of the country main agricultural exports (Beef, Wheat, Rice and Soybeans). Exports values are used as weights. Price indices are from www.indexmundi.com (retrieved on November 12, 2012) while exports are from WITS of World Bank.

Consumer Prices: are from Instituto Nacional de Estadística.

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[17] 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. Later, the distrust extended to other statistics, such as measures of poverty, employment, and growth, and most recently also to trade figures.

<u>Wages</u>: average wages are from Instituto Nacional de Estadística using the Encuesta Continua de Hogares.

<u>Nominal Exchange Rate</u>: is from Banco Central del Uruguay.

<u>Household expenditures and incomes</u>: are from Instituto Nacional de Estadística, Encuesta Nacional de Gastos e Ingresos de los Hogares 2005-2006.

Regional coverage

	Argentina	**Mexico**	**Uruguay**
Consumer prices	CABA[*]/San Luis	National	National
Wages	Urban areas	Main Metropolitan areas	Urban and Rural areas
Welfare / Poverty	Urban areas	Urban areas	Urban areas

(*) Ciudad Autónoma de Buenos Aires.