

## Domestic policy responses to the food price crisis: The case of Bolivia

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### Abstract

In face of the global food crisis of 2007–2008, severe concerns arose about how developing countries would be affected by the extreme short-term fluctuations in international commodity prices. We examine the effects of the crisis on Bolivia, one of the poorest countries of the Americas. We focus on the effectiveness of the domestic policy interventions in preventing spillovers of the development of international food prices to domestic markets. Using a cointegration model, we study price interdependencies of wheat flour, sunflower oil and poultry. The analysis suggests that the policy measures taken had little effect on food security during the food crisis. Throughout the entire period, perfect price transmission between the Bolivian poultry and sunflower oil markets and the respective international reference markets existed. Bolivian prices were determined by international prices and the policy interventions in the markets of these two commodities were not found to have had an effect. The government's large-scale wheat flour imports did not shield Bolivian consumers from the shocks of international prices.

**Keywords:** agricultural trade policies, Bolivia, cointegration, error-correction, food crisis, food security, market integration, price transmission

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### 1 Introduction

The period between 2007 and 2009 was characterised by strong fluctuations of international prices of agricultural commodities, particularly those of grains and oilseeds. From 2007 until the first half of 2008, world market prices of these products soared in a never experienced way. Often referred to as the 2007–2008 food crisis (von Braun, 2008a), this period has received substantial attention from the academic community and triggered a number of concerns about the consequences of extreme short-term increases and higher volatility in international agricultural/food commodity

prices (De Hoyos & Medvedev, 2011; Headey & Fan, 2008; Masters & Shively, 2008; Valero-Gil & Valero, 2008).

By presenting a case study of Bolivia, a land-locked developing country located in the central part of South America, the present article contributes to the debate about these concerns. Due to its comparatively low development status and its problematic food security situation, Bolivia deserves attention in the context of the food price crisis: according to the Multidimensional Poverty Index 2010, Bolivia in that year had the largest share of poor people in the South American region (OPHI, 2010). In 2007, when measured at the national poverty line, 60 percent of the population lived in poverty with 27 percent of the population suffering from undernourishment (World Bank, 2011). For the Bolivian economy, agriculture and livestock production are important activ-

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ities, contributing a share of 9.7 percent to the annual total gross domestic product (GDP) in 2008. When adding the contribution of the food/feed manufacturing industry in Bolivia, which also comprises the oilseed and sugar cane processing industry, this share rises to 14.6 percent (INE, 2009b). Bolivia's agricultural sector comprises three major geographical blocks, each of them characterized by its own production system: the western high plateau, the tropical eastern lowlands and the transition valleys in between. Due to large-scale commercial production and processing of oilseeds in the tropical lowlands, Bolivia is a net-exporter of agricultural commodities (INE, 2010). Agricultural exports accounted for almost 16 percent of the country's total exports in 2007 and soy/sunflower oil, soy meal and oil extraction cakes accounted for 62 percent of the overall value of Bolivian agricultural exports in the same year (INE, 2009a, 2010).

The turmoil in global agricultural markets during the 2007–2008 food crisis coincided with a number of profound changes in the domestic political landscape of Bolivia. A new socialist government (which had the most support in the highlands and valleys at that time) aimed at fundamentally reforming the agricultural sector and the land property laws. In consequence, political conflicts between this government and the opposition arose, adding to already existing strong conflicts on regional autonomy issues and the distribution of tax revenues from gas exports. These events were crucial to the agricultural sector since the opposition has its strongholds in the lowlands in the Eastern part of Bolivia, centre of the country's commercial and export-oriented agriculture.

Bolivia represents an interesting case to study the impacts of the strong short-term increase in the levels and the fluctuations in international food prices of world markets on the domestic market of a developing country. At the time the crisis hit, it simultaneously was subject to profound domestic policy changes and sought to implement policies aimed at curbing the spread of the crisis into the country. The objective of this analysis is to assess whether and to which degree prices of Bolivian agricultural products were influenced by international price shocks during the 2007–2008 food crisis, taking into account the implementation of policies directed towards the control of foreign trade. We therefore focus on the evaluation of the effectiveness of the policy measures which have been implemented to avoid the spread of the crisis to domestic markets. We approach this question by analysing price dynamics and interdependencies in time and space, that is, horizontal price transmission, by using cointegration techniques.

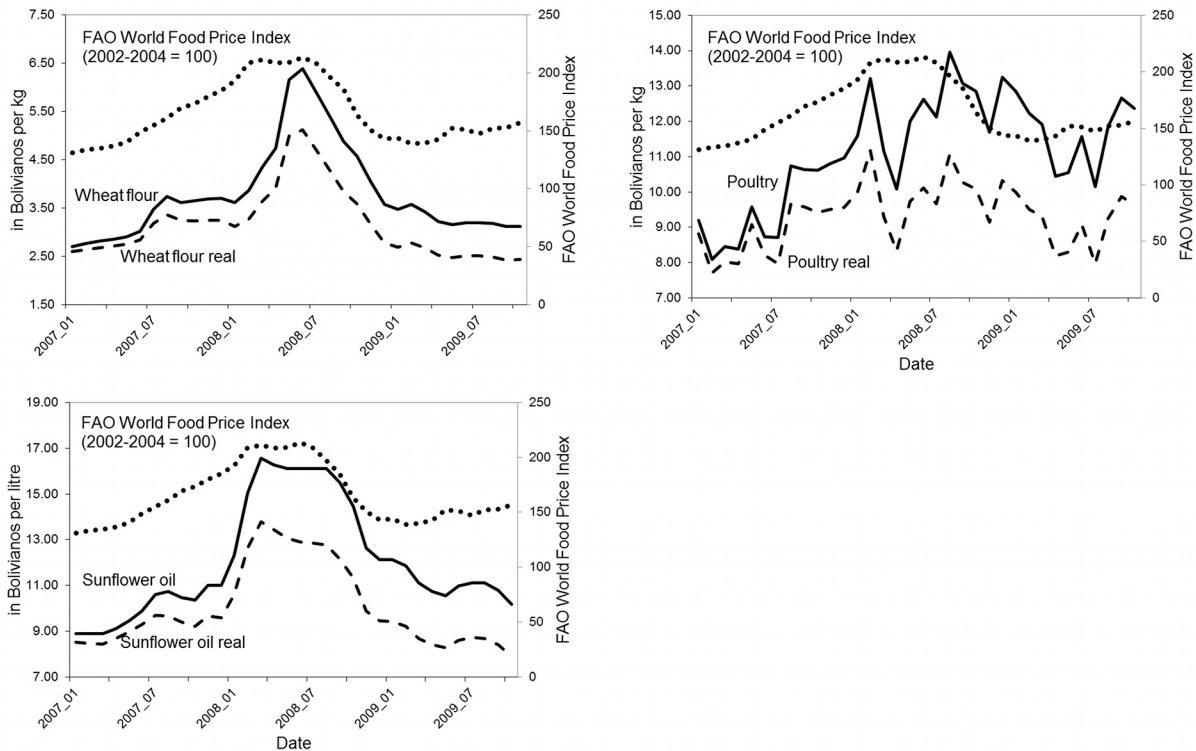
The literature on the 2007–2008 food crisis mainly focuses on its causes (e.g. Dewbre *et al.*, 2008; Piesse & Thirtle, 2009), its macro-economic consequences (e.g. Headey & Fan, 2008; FAO, 2009; Sarris *et al.*, 2010) and policy options (e.g. Sarris *et al.*, 2010; Timmer, 2010; von Braun, 2008b). Some studies assess whether and to which degree price shocks induced by the soaring international food prices were transmitted from international to national prices. Benson *et al.* (2008), for example, use correlation analysis to assess the integration of Ugandan markets for different staples with world markets.

Very little attention has been given to the analysis of the policy decisions taken by poor countries in response to the crisis and the effectiveness of these regarding the alleviation or prevention of the crisis' effects on prices in domestic food markets. While Meijerink *et al.* (2009) provide an extensive account of the actual policy measures taken in East Africa, Ivanic & Martin (2008) explicitly address the consequences of the crisis for the poor in developing countries. Cudjoe *et al.* (2010) examine the transmission of price signals to regional markets in Ghana before the background of the 2007–2008 food crisis by combining the assessment of price transmission with a micro-economic welfare analysis at the household level. Our research, in contrast, links the results from the analysis of the transmission of price shocks from the world market to the national market of Bolivia with the policy framework implemented by the Bolivian government in response to this food crisis. Along with this focus, this analysis is one of the first studies which deals in detail with the institutional framework of the transmission of price shocks during the 2007–2008 food crisis in developing countries.

The study proceeds with a description of the events related to the food price crisis in Bolivia. Focusing on three key products, namely wheat flour, poultry and sunflower oil, a narrative of the policy measures taken in response to the crisis is constructed. Due to the practical absence of peer-reviewed literature, this narrative is mainly based on a review of government sources, newspaper articles and grey literature.

### 1.1 Bolivia's policy responses to raising food prices in 2007-2008

The analysis focuses on three key commodities. The first commodity considered is wheat flour, which is Bolivia's most important agricultural import product regarding the absolute import value (INE, 2010). Wheat flour and bread are important staples for household con-



**Fig. 1:** Nominal and real prices of selected Bolivian food products (in Bolivianos)

Source: SIPREM (2009), FAO (2010), SIMA (2010a,b) and authors' calculations.

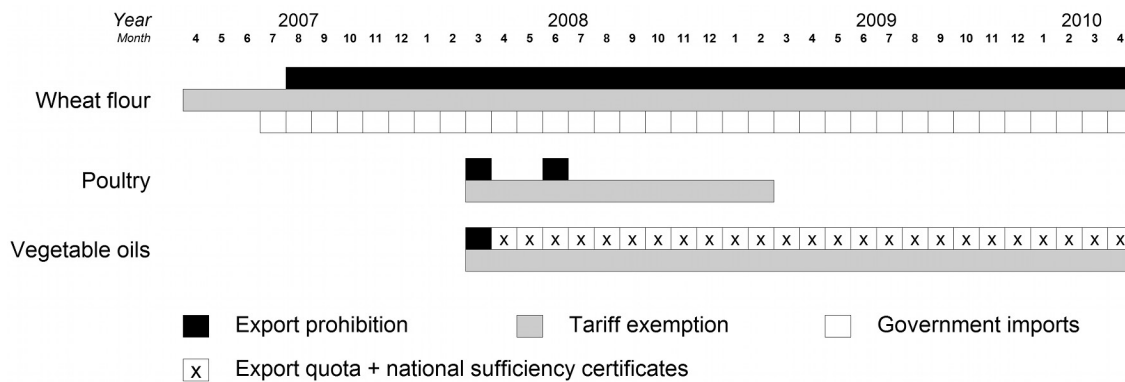
Note: Prices appear on the left ordinates. Prices of wheat flour and poultry are given in Bolivianos per kg and prices of sunflower oil in Bolivianos per litre. Real prices are deflated to the average 2006 level. Sunflower oil prices are domestic Ex Works prices. Wheat flour prices are quotes for the wholesale level for imports from Argentina.

sumption (Pérez-Cueto *et al.*, 2006) which is also reflected by the high weighting factor of 14.8 percent in the sub-category “*foods consumed at home*” of the Bolivian Consumer Price Index (CPI) consumption basket (INE, 2009b). Second, the study deals with poultry, which represents an important product for domestic consumption also for poorer households in urban and peri-urban zones. Within the sub-category “*foods consumed at home*” of the CPI in Bolivia, poultry has a share of 7.5 percent and thereby is considered to be of higher importance than other staples in Bolivia such as rice and potatoes (INE, 2009b). Third, sunflower oil as a major agricultural export product is taken into account in the study. Although sunflower oil is not the most relevant vegetable oil for domestic consumption, it is a key product of the Bolivian food processing industry for export (INE, 2010; Zeballos, 2008). In case of other commodities which are of importance in the Bolivian context either no data was available (e.g. rice) or the commodity was not subject to policy interventions (e.g. potatoes).

From 2007 until 2009, the dynamics of Bolivian food prices resembled those of prices on international markets. Figure 1 depicts the development of nominal and

real food prices of the selected agricultural products in Bolivia during this period, along with the FAO World Food Price Index on the right ordinate (FAO, 2010). The price increases started in the middle of 2007. Both sunflower and wheat prices showed pronounced peaks during the second half of 2008 and closely resembled the development of the FAO World Food Price Index, whereas a similar development cannot be observed for poultry prices.

Reacting to the increasing food prices, from 2007 onwards the Bolivian government implemented a series of policy interventions for agricultural markets which were oriented towards trade institutions, consumers and producers (GIEWS, 2009). A number of objectives for these measures had been officially declared by the government. The main goal was to achieve food security according to the National Development Plan (Supreme Decree (SD) 29272, ch. 4.2.3). Furthermore, the impacts of La Niña in 2007–2008 were to be mitigated. Last, the government tried to buffer the food price increases of the international market in the domestic market in order to protect the most vulnerable households (SD 29460).



**Fig. 2:** Product-specific policy interventions during the 2007-2008 food crisis in Bolivia

Source: Authors' elaboration based on SD 29090, 29182, 29229, 29339, 29460, 29480, 29491, 29524, 29610, 0026, 00144, 00346, *La Razón* (2007), Salinas (2010).

Note: A Supreme Decree is a legal instrument of the Bolivian executive; only the constitution and laws are superior in the legal hierarchy (WTO, 2005, 14). Herein, we cite the Supreme Decrees as SD following by its number (they are not mentioned in the references list). All of them are published in various issues of the *Gazeta Nacional del Estado Plurinacional de Bolivia*.

Figure 2 provides an overview of the most relevant policy interventions implemented by the Bolivian government for the three above mentioned commodities, each of which will be elaborated on in detail below.

### 1.2 Wheat flour

Bolivia is a large net-importer of this commodity, importing more than 70 percent of its national wheat consumption (FAOSTAT, 2011). Wheat flour is the most important agricultural import product in terms of the annual import value (INE, 2010). Approximately 95 percent of the officially documented annual quantity of wheat and wheat flour imports originates from Argentina and the remainder from the US (Herbas, 2008).

Policy interventions in the Bolivian wheat flour market commenced in April 2007 along with the contemporaneously increasing international wheat prices. The first measure taken was an import tariff exemption for the basic bread ingredients wheat flour and wheat, yielding a temporary lowering of the tariff rate to zero percent. This measure certainly facilitated further wheat flour imports from Argentina, summing to the large amounts of wheat flour which are smuggled from Argentina to Bolivia anyway (Herbas, 2008).

Additionally, since July 2007, Argentinian wheat flour has been distributed at subsidised prices to the national bakery sector by the public company *Insumos Bolivia*, which has importing and marketing of raw materials and production inputs as among its mandates (Los Tiempos, 2007, SD 29727). The rationale behind this

input subsidy was to provide cheap bread for consumers in the larger Bolivian towns. Typically, the subsidised imports of Argentinian wheat flour were distributed at a price of about two thirds of the wholesale price (Herbas, 2008). Since late May 2009, wheat flour imported by *Insumos Bolivia* was officially no longer exclusively destined to the national bakery sector but also made available to consumers and other food industries (SD 0144). Although, apart from small quantities of wheat flour traded with Peru (INE, 2010), almost no wheat was exported from Bolivia during previous years, exports of wheat flour and wheat were prohibited from August 15, 2007 on by SD 29229 which was renewed several times. Hence, the ban rather has to be considered as a complementary measure to the governmentally subsidised wheat flour prices in order to prevent re-exports to Peru.

A further measure was the intervention by the public "Enterprise for Support in Food Production" (EMAPA), which was founded in 2007, into the production and marketing of wheat. This intervention encompassed the provision of subsidised fertiliser, governmental purchases and milling of wheat, as well as the distribution of subsidised (domestically produced) wheat flour to final consumers (EMAPA, 2008, 2010). The subsidised national wheat flour has been distributed to consumers via central sales locations and local retail stores located in the suburbs of the largest Bolivian towns (EMAPA, 2010).

Hence, the stabilisation of consumer prices could have occurred via three ways. First and most directly,



consumers would pay considerably lower prices for bread prepared from the subsidised flour. The second and more indirect way was that parts of the state-imported wheat flour which had been resold on domestic wholesale markets (as it occurs with other subsidised food products in Bolivia such as milk powder destined to poor households) affected the national wholesale price level. Third, the availability of subsidised flour was expected to lead to lower demand for flour imported in the usual way, hence leading to lower wholesale prices across the country and causing a divergence of the Bolivian prices from international prices. According to Herbas (2008), however, there is evidence which shows that in 2007–2008 not the whole amount of state-imported wheat flour was used in bread production. Some of the subsidised wheat flour might have been re-sold on wholesale markets or even smuggled to Peru.

### 1.3 Poultry

In the case of poultry the government employed two export bans and a tariff exemption during the 2007–2008 food crisis. Regarding the temporary bans on poultry, implemented from February 27 to March 28, 2008 and from May 27 to June 25, 2008, criticism was raised that, due to the low amounts of exports relative to national production (less than 0.5 percent), a ban would not be effective in addressing the issue of fluctuating poultry prices on the national market (CAINCO, 2008).

Similarly, a tariff exemption for poultry from February 2008 to February 2009 (Figure 4) did not lead to increased imports during 2008. Imports of poultry to Bolivia always had been close to zero during previous years. In 2009 only, there was first an inflow of about 300 t of poultry to Bolivia which, however, was insignificant compared to the national production volume (INE, 2010).

Therefore, the tariff exemption seems to have been rather a political sign instead of a policy measure of profound economic impact. First, its implementation served to pressure the domestic poultry industry by signalling that the government would indeed consider augmenting domestic supply by facilitating the inflow of tariff-free foreign meat. Second, the media attention resulting from its implementation seems to have been used by the government to demonstrate to voters that it was committed taking political decisions in favour of consumers against rising poultry prices.

In summary, Bolivia's low national price level of poultry, as compared to the neighbouring countries, is mainly determined by a self-sufficient supply. In ad-

dition, the absence of refrigerated storage and a weak transport infrastructure capacity prevent poultry imports.

### 1.4 Sunflower oil

Sunflower oil represents the oilseed complex which comprises raw oilseeds, oil meals, oil extraction cakes and vegetable oils. About one third of Bolivia's annual vegetable oil production is consumed domestically which is mainly soy oil (La Razón, 2008). Sunflower oil is almost exclusively destined for export. In 2008, approximately 78,000 t of sunflower oil were exported from Bolivia, having an export value of US \$ 114 Mio., which corresponds to 11.4 percent of the total value of agricultural exports in that year (INE, 2010).

For sunflower oil, like for all other vegetable oils, a temporary export ban was implemented between March 19 and April 18, 2008 (SD 29480, see Figure 5). Since its removal, all exports of vegetable oils are subject to quotas. The government periodically sets a global quota depending on the domestic demand and supply situation. Exporting companies have to apply every four to six months for an individual share (Riva, 2010). Furthermore, oilseed processing companies have to acquire so-called sufficiency certificates, each of them corresponding to an export permission granted to an individual exporter within the global quota. The permissions are granted by the authorities only if the national market is "*sufficiently supplied at fair prices*" (SD 29524, Article I).

The implementation of the export ban on vegetable oils, such as soy, sunflower, peanut, palm or cotton seed oil, between March 19 to April 18, 2008 coincided with the main oilseed harvest in Bolivia. Although it only lasted for one month, the first production batches of soy and sunflower oil were only sold abroad again after more than 60 days (Salinas, 2008). In the meantime, the entire production chain of the oilseed industry was about to collapse. Oilseed processing companies stopped buying the raw materials which caused liquidity problems to producers and slowed down their production in the face of the insecure resumption of the export activities (Salinas, 2008; La Razón, 2008).

The tariff exemption for imports of vegetable oils had been proclaimed in the Supreme Decree No. 29460 on February 27, 2008. Official imports of vegetable oils to Bolivia are very low. For example, they amounted to only 1,100 t in 2007 which corresponded to only 0.4 percent of Bolivia's exports of vegetable oil. Import quantities even further declined in 2008 and 2009 despite the exemption (INE, 2010).

## 2 Materials and Methods

### 2.1 Data

The price data of three commodities were obtained from various sources (Figures 3 to 5). Figure 3 shows weekly wholesale prices of imported Argentinian wheat flour of the Bolivian markets of Santa Cruz, La Paz, Cochabamba and Sucre between January 2007 and February 2010 (T=164). The US and the Argentinian free on board (FOB) export prices for wheat grain represent the international reference prices from the Bolivian perspective.

Figure 4 depicts the weekly wholesale prices for poultry in Cochabamba and Arequipa between 2004 and 2009 (T=312). All of the Bolivian poultry exports originate from the former city. The wholesale price for poultry in Arequipa in Southern Peru is regarded as an international reference price since it is the main destination for Bolivian exports. The grey bars in Figure 4 indicate the two temporary export prohibitions issued for poultry by the Bolivian government between February 27 to March 28, 2008 and May 27 to June 25, 2008, respectively.

Figure 5 shows the monthly Bolivian Ex Works (EXW) price for bottled refined sunflower oil from Santa Cruz for 2003 to 2009 (T=84). The world market price is represented by the FOB price of crude European sunflower oil shipped to Argentinian seaports. Wholesale prices for bottled vegetable oil from Arequipa and Trujillo (Peru) are further regarded as international reference prices. The grey bar indicates the Bolivian export ban for vegetable oil between March 19 and April 18, 2008.

In order to create continuous series for the analysis, data gaps are closed by calculating a random value based on the adjacent lower and upper observation to the missing value in the time series. In all cases the number of missing values was low enough not to affect the estimation results. The price series are converted into US \$ by using official nominal banking exchange rates from the central banks of Bolivia/Peru. To facilitate the interpretation of the results, all price series are transformed taking natural logarithms.

### 2.2 Unit root and cointegration testing

The augmented Dickey-Fuller (ADF) test is used to test for unit roots in the price series. Based on the visual inspection of the price series, an ADF test with or without time trend is applied. The appropriate lag-length is selected according to the Hannan-Quinn model selection criterion (Lütkepohl & Krätzig, 2004). If a price

series is found to possess a unit root, the ADF test is applied to its first differences in order to check for the order of integration of the series. The Johansen trace cointegration test (Johansen, 1991) is applied to pairs of unit root price series in order to obtain evidence on the existence of cointegration relationships which are interpreted in the given context as stable long-run equilibria.

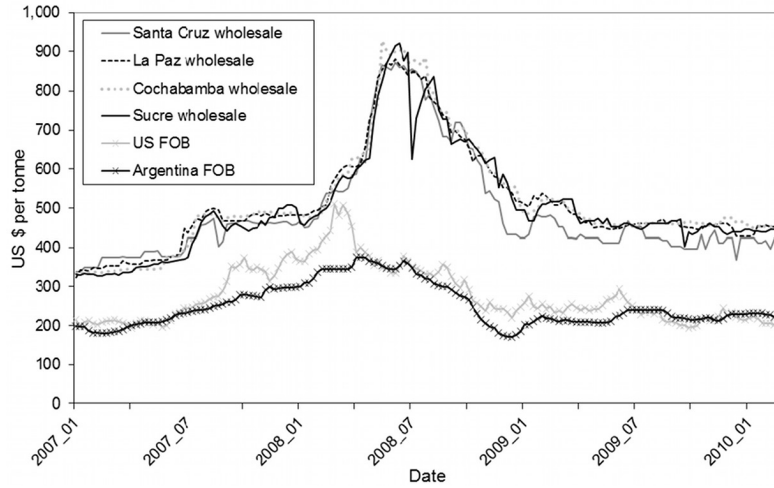
### 2.3 Model specification

If two price series are found to share a long-run equilibrium, that is, if evidence for cointegration is found, a vector error-correction model (VECM) is estimated for the price pair in order to obtain measures on the long- and short-run dynamics of the price dynamics. A VECM for a pair of prices takes the form:

$$\begin{bmatrix} \Delta p_t^A \\ \Delta p_t^B \end{bmatrix} = \begin{bmatrix} \alpha^A \\ \alpha^B \end{bmatrix} eq_{t-1} + \sum_{i=1}^k \begin{bmatrix} \gamma_{i1}^A & \gamma_{i2}^A \\ \gamma_{i1}^B & \gamma_{i2}^B \end{bmatrix} \begin{bmatrix} \Delta p_{t-i}^A \\ \Delta p_{t-i}^B \end{bmatrix} + \begin{bmatrix} \epsilon_t^A \\ \epsilon_t^B \end{bmatrix}$$

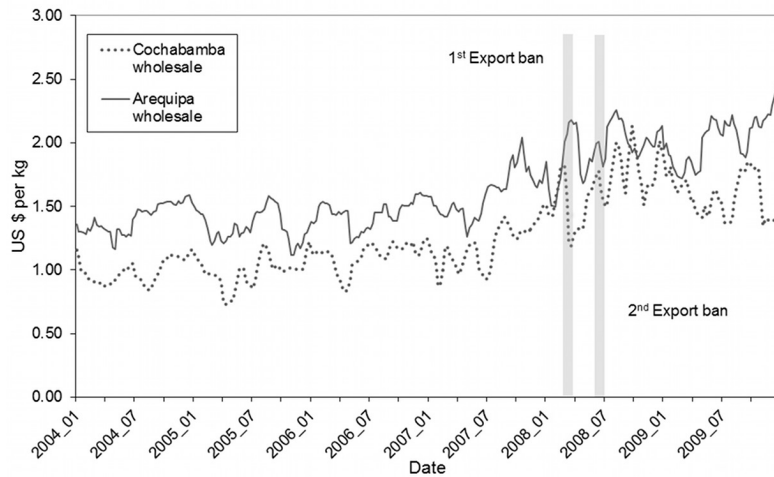
$p_t^l$ ,  $l \in \{A, B\}$  denotes the prices in markets A and B in period  $t$ , respectively, and  $\Delta$  is the first difference operator so that  $\Delta p_t^l = p_t^l - p_{t-1}^l$ . The term  $eq_1 = p_t^A - \beta^B p_t^B - \beta_0$  is the equilibrium error, i.e., the amount of disequilibrium, of the previous period. It quantifies the magnitude and direction of deviation from the long-run price equilibrium. It is a linear combination of the two prices which is stationary. Hence, it does not depart too far from its mean value but reverts to this value instead. The parameter  $\beta^B$  denotes the long-run price elasticity for the transmission of price shocks from market B to market A. The coefficients  $\alpha^A$  and  $\alpha^B$  represent the adjustment coefficients. They quantify the partial influence of the lagged equilibrium deviation on the prices in the contemporaneous period. The parameters  $\gamma_{i1}^l, \gamma_{i2}^l$  quantify the short-run dynamics, that is, the partial influences of past price changes on current price changes. The lag length  $k$  is selected according to the Hannan-Quinn criterion as suggested by Lütkepohl & Krätzig (2004). All VECMs are estimated with a constant restricted to the cointegration relationships.

Furthermore, a Wald test is implemented to test the hypothesis of perfect market integration, that is, complete price transmission in the case that  $\beta^B$  can be restricted to unity. Granger-causality tests are applied to further determine the direction of the price transmission (Rapsomanikis *et al.*, 2003). Last, Chow tests are implemented in order to examine the stability of the model parameters.



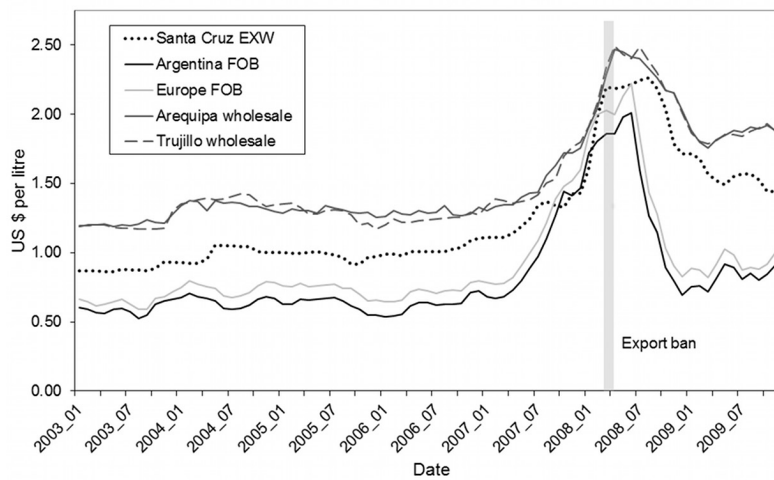
**Fig. 3:** Wheat and wheat flour prices (nominal prices, US \$ per tonne)

Source: SIMA (2010a), IGC (2010), DIMEAGRO (2010) and authors' calculations.



**Fig. 4:** Poultry prices (nominal prices, US \$ per kg)

Source: SIMA (2010b), SISAP (2010b) and authors' calculations.



**Fig. 5:** Sunflower oil prices (nominal prices, US \$ per litre)

Source: SIPREM (2009), ISTA Mielke GmbH (2010), SISAP (2010a)

### 3 Results

#### 3.1 Wheat flour

All national price series for wheat flour and the international reference prices of wheat grain (Figure 3) are found to possess a unit root at the 5 percent level. Cointegration with the US FOB price was only found for the La Paz wholesale price. On the other hand, throughout the period analysed from January 2007 until February 2010, all Bolivian wholesale price series appeared to be significantly cointegrated with the Argentinian FOB price at the 5 percent level (Table 1).

**Table 1:** Johansen Trace test results for wheat flour

Price pairs	<i>p</i> -value
Santa Cruz † – US FOB ‡	0.110
La Paz † – US FOB ‡	0.025
Cochabamba † – US FOB ‡	0.060
Sucre † – US FOB ‡	0.425
Santa Cruz † – Argentina FOB ‡	0.015
La Paz † – Argentina FOB ‡	0.001
Cochabamba † – Argentina FOB ‡	< 0.001
Sucre † – Argentina FOB ‡	0.005

The test was performed with constant and without trend. The *p*-values are given for the null hypothesis of no cointegration vs. the alternative of at least one cointegration relationship. Lag-lengths are selected according to the Hannan-Quinn criterion.

Note: † Wholesale price of wheat flour. ‡ Export price of wheat grain.

The unrestricted price transmission elasticities  $\beta^B$  are all close to unity (Table 2). The results of the Wald test point to perfect price transmission between the market pairs of Argentina and the Bolivian cities of Santa Cruz, La Paz, Cochabamba and Sucre, since the null-hypothesis of perfect market integration cannot be rejected for these cases.

The unrestricted model (results not shown here) suggests that the wholesale markets for wheat flour with larger road distance to the Argentinian border were affected more strongly by price shocks at the Argentinian wheat market than those being closer to the border (larger price transmission elasticity parameters  $\beta^B$ ). The restricted model corrects this impression by pointing to the fact that they responded in the long run by the same magnitude since all coefficients  $\beta^B$  can be restricted to unity (all *p*-values larger than 5 percent in Table 2).

For all price pairs, it is always the speed of adjustment coefficient  $\alpha^A$  of the Bolivian prices which is sig-

nificant. For all cases, the coefficients  $\alpha^B$  could even be restricted to zero indicating that the international markets are weakly exogenous to the Bolivian markets, or more precisely, they do not show any response to price disequilibria but it is always the Bolivian prices which react. Consequently, Bolivian prices follow the international reference prices, i.e., international markets appear to be the price leaders, which is plausible given the relative sizes of the latter to the former. The values of  $\alpha^A$  range between 6.4 and 9.5 percent for the price relationships with Argentinian prices. This means that Bolivian prices eliminate 6.4 to 9.5 percent of the disequilibrium of the previous week in the current week, which corresponds to moderate to high magnitudes of adjustment. Furthermore, for Santa Cruz and La Paz, the Argentinian export price for wheat grain Granger-causes the Bolivian wholesale price for wheat flour. This underscores the influence of the foreign prices on the domestic Bolivian market and hence the price followership of domestic Bolivian prices. Consequently, price signals were only transmitted from the international reference markets to the domestic Bolivian markets and not the other way around. Bolivian prices closely followed the international prices. Thus, the policy measures implemented to curb the domestic price increase were not effective in weakening the link to international prices because domestic prices still strongly responded to shocks originating abroad.

#### 3.2 Poultry

Both price series for poultry displayed in Figure 4 are found to have a unit root and to be cointegrated at the 5 percent level of significance. The VECM yields a long-run price transmission elasticity equal to 1.205 (Table 3) which can also be restricted to unity at 5 percent. Consequently, the long-run price transmission between these two markets can be considered to be perfect. Both adjustment coefficients are significant at the 1 percent level (Table 3) which implies that both prices respond to deviations from the common long-run equilibrium at moderate rates of 6 to 9 percent. The disequilibrium response is much stronger than for wheat since per period approximately 15 percent of an equilibrium error in total are corrected by both markets.

Next, we assess whether the export bans had an effect on the price dynamics. We expect that trade prohibitions of durations of only one month are not likely to cause permanent structural change in the price relationship. Structural change in this context would imply that the long-run, the short-run or both relationships between Cochabamba and Arequipa poultry wholesale prices differ significantly between the pre-intervention



**Table 2:** VECM estimates of the restricted wheat flour models

Market A — Market B	$\alpha^A$	$\alpha^B$	$\beta^B$	$\beta_0$	$p$ -value <sup>§</sup>	$p$ -value <sup>¶</sup>	Granger-causality	Road distance (km)
La Paz <sup>†</sup> – US FOB <sup>‡</sup>	–0.044***	0	1.000	–0.659***	0.637	0.613		
Santa Cruz <sup>†</sup> – Argentina FOB <sup>‡</sup>	–0.094***	0	1.000	0.678***	0.452	0.462	A←B***	561
La Paz <sup>†</sup> – Argentina FOB <sup>‡</sup>	–0.064***	0	1.000	0.739***	0.196	0.342	A←B**	907
Cochabamba <sup>†</sup> – Argentina FOB <sup>‡</sup>	–0.064***	0	1.000	0.743***	0.126	0.504		905
Sucre <sup>†</sup> – Argentina FOB <sup>‡</sup>	–0.090***	0	1.000	–0.715***	0.577	0.374		521

Note: All coefficient estimates are given for the restricted models, that is  $\beta^B = 1$  and the maximum number of exclusion restrictions on the remaining parameters. The unrestricted estimates of  $\beta^B$  are from the top to the bottom 0.914, 1.130, 1.198, 1.248 and 1.102. Significance at the \* 10 percent, \*\* 5 percent and \*\*\* 1 percent level. Granger-causality results are only given if they were significant at the 5 percent level. Road distance to the closest Argentinian border town for the actually used trade routes (LITEBOL, 2004).

<sup>†</sup> Wholesale price of wheat flour.

<sup>‡</sup> Export price of wheat grain.

<sup>§</sup>  $p$ -value for the Wald test of restricting to unity, that is, for testing for perfect price transmission.

<sup>¶</sup>  $p$ -value for the maximum number of exclusion restrictions on the adjustment and short-run dynamics parameters.

**Table 3:** Estimates of the restricted poultry model

Market A — Market B	$\alpha^A$	$\alpha^B$	$\beta^B$	$\beta_0$	$p$ -value <sup>†</sup>	$p$ -value <sup>‡</sup>
Cochabamba – Arequipa	–0.088***	0.062***	1.000	0.279***	0.075	0.369

Note: All coefficient estimates are given for the restricted models, that is  $\beta^B = 1$  and the maximum number of exclusion restrictions on the remaining parameters. The unrestricted estimate of  $\beta^B$  is 1.205. Significance at the \* 10 percent, \*\* 5 percent and \*\*\* 1 percent level.  $P$ -values are given for the Wald test of restricting to unity, i.e., testing for perfect price transmission in the long run.

<sup>†</sup>  $p$ -value for the Wald test of restricting  $\beta^B$  to unity, that is, for testing for perfect price transmission.

<sup>‡</sup>  $p$ -value for the maximum number of exclusion restrictions on the adjustment and short-run dynamics parameters.

and the post-intervention periods. The bootstrapped  $p$ -values of the sample-split Chow test shown in Figure 6 do not fall below the dashed line of the 5 percent significance level for a longer period. Two punctual drops occur before and after the implementation of the second export ban in June 2008. As Juselius (2008, ch. 9) emphasises, such a test result does not provide evidence against the stability of the VECM parameters and thus does not suggest that the price system was subject to a structural break.

Figure 6 strongly suggests that the export prohibitions did not impact the price relationships. In addition, considering the high degree of price transmission determined between the Peruvian and the Bolivian markets, it is likely that consumers in Bolivia did not benefit from the export prohibitions either.

### 3.3 Sunflower oil

All series depicted in Figure 5 are found to possess a unit root. Cointegration between the Bolivian prices

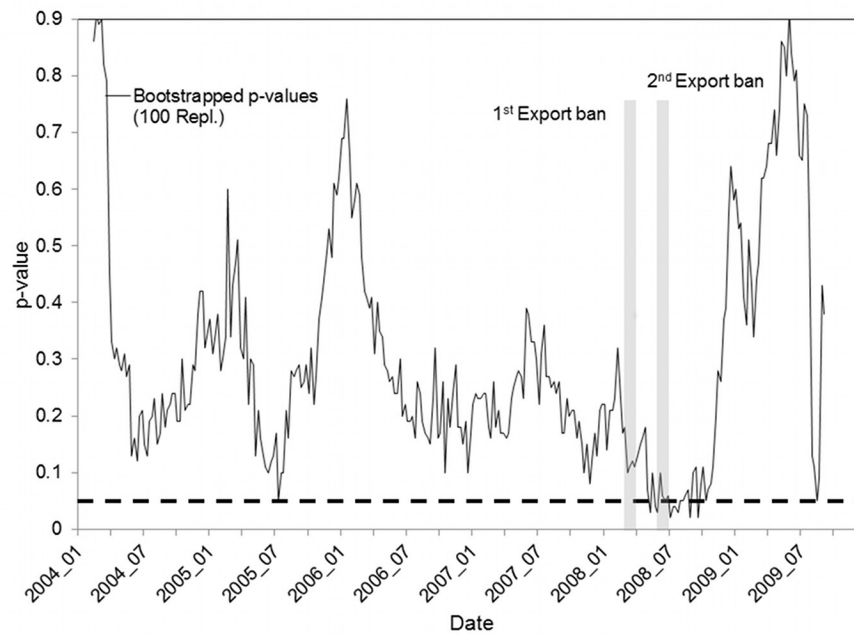
represented by Ex Works (EXW) prices from Santa Cruz and the four international reference prices was only found for the Argentinian FOB price. No evidence for cointegration with European export prices or Peruvian wholesale prices was found (Table 4).

**Table 4:** Johansen Trace test results for sunflower oil

Price pairs	$p$ -value
Santa Cruz <sup>†</sup> – Europe FOB <sup>‡</sup>	0.110
Santa Cruz <sup>†</sup> – Argentina FOB <sup>‡</sup>	0.002
Santa Cruz <sup>†</sup> – Arequipa <sup>§</sup>	0.150
Santa Cruz <sup>†</sup> – Trujillo <sup>§</sup>	0.282

The tests were performed including a constant. The  $p$ -values are given for the null hypothesis of no vs. the alternative of at least one cointegration relationship. Lag-lengths are selected according to the Hannan-Quinn criterion.

Note: <sup>†</sup> Ex Works price for refined oil. <sup>‡</sup> Price of crude sunflower oil. <sup>§</sup> Wholesale price of refined sunflower oil.



**Fig. 6:** Sample-split Chow test for poultry  
Source: Authors' calculations.

The Bolivian vegetable oil sector in Santa Cruz (oilseed processors and producer organisations) focuses on export prices from Argentina as international reference prices. The Association of Oilseed and Wheat Producers from Santa Cruz uses price data from the trading exchange in Rosario, Argentina, when communicating international reference prices to the affiliated producers in order to support them in the negotiation process with the oilseed processing companies (ANAPO, 2009; Carazas, 2009). This explains the highly significant cointegration of the sunflower oil price in Santa Cruz and the Argentinian reference price.

The model for the dynamics of the Bolivian and Argentinian prices yields a long-run price transmission elasticity  $\beta^B$  close to 1 (Table 5). The null hypothesis of perfect price transmission cannot be rejected, which implies that price shocks on the Argentinian market are passed through completely to the domestic Bolivian price. The estimated adjustment coefficient  $\alpha^A$  implies a moderate reaction to disequilibrium shocks. The Argentinian price appears to be weakly exogenous which is plausible since it is much larger than the Bolivian market. The Granger-causality test strengthens the evidence that the direction of the price transmission is from the Argentinian export market to the Bolivian domestic market.

Hence, the Argentinian price is the common factor driving the market pair and price shocks in the Bolivian market only have transitory effects. The impulse response functions in Figure 7 illustrate this point. Shocks in the Santa Cruz price do not trigger any significant response in the Argentinian price (lower panels) while a shock in the Argentinian price has a permanent effect on itself and the Bolivian price (upper panels).

Bolivian prices for sunflower oil appear to be strongly influenced by the dynamics on the international reference market between 2003 and 2009. Consequently, price shocks on the Argentinian market were fully transmitted to the Bolivian prices during the 2007-2008 food crisis as well.

As for the poultry price model, the results of a sample-split Chow test (Figure 8) suggest that the export ban not did alter the price dynamics and, therefore, did neither benefit consumers nor cause harm to producers and oilseed processors in the long-run. In the short-run, however, the picture is different. Figure 5 reveals that the export-prohibition of March/April 2008 did not lead to an immediate decline of the Ex Works price level for sunflower oil at Santa Cruz, but rather cut off a price spike that could be observed in the other reference markets.

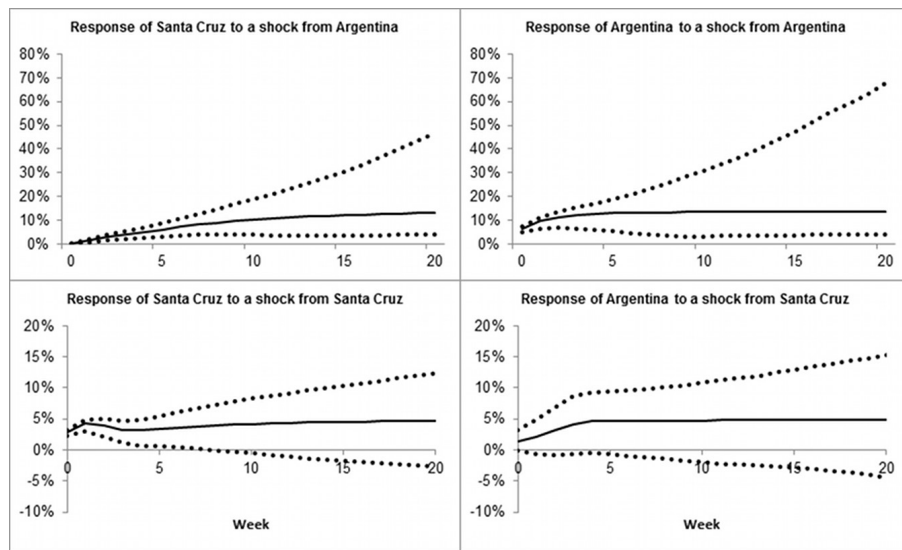
**Table 5:** VECM of the restricted sunflower oil model

Market A — Market B	$\alpha^A$	$\alpha^B$	$\beta^B$	$\beta_0$	p-value <sup>†</sup>	p-value <sup>‡</sup>	Granger-causality
Santa Cruz – Argentina FOB	-0.110***	0	1.000	-0.472***	0.518	0.632	A←B***

Note: All coefficient estimates are given for the restricted models, that is  $\beta^B = 1$  and the maximum number of exclusion restrictions on the remaining parameters. The unrestricted estimate of  $\beta^B$  is 0.949. Significance at the \* 10 percent, \*\* 5 percent and \*\*\* 1 percent level.

<sup>†</sup> p-value for the Wald test of restricting to unity, that is, for testing for perfect price transmission.

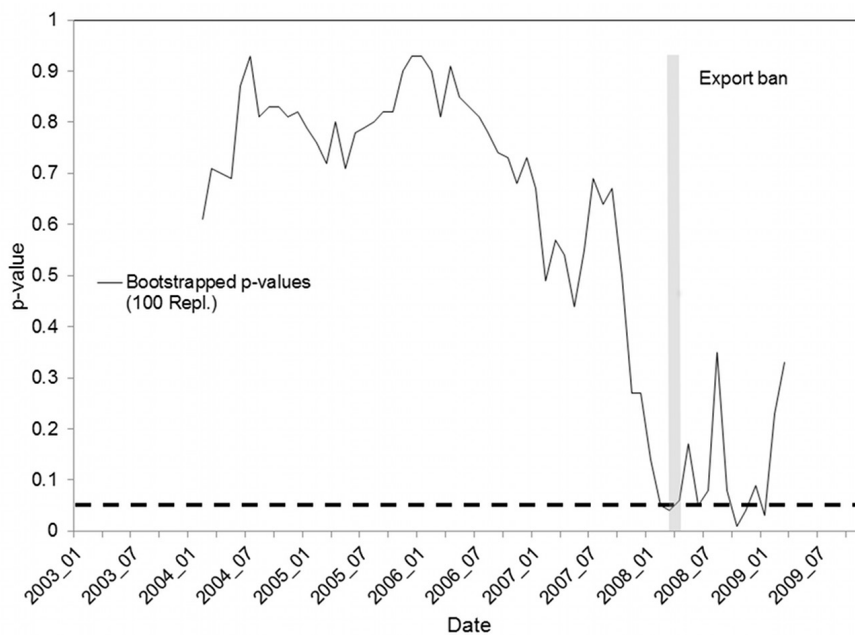
<sup>‡</sup> p-value for the maximum number of exclusion restrictions on the adjustment and short-run dynamics parameters.



**Fig. 7:** Impulse response functions for sunflower oil

Source: Authors' calculations.

Note: The solid lines denote the point estimates of the price response to a one-unit shock in the respectively relevant world market price. The dotted lines denote the upper and lower borders of the 95 percent confidence interval around the point estimates.



**Fig. 8:** Sample-split Chow test for sunflower oil

Source: Authors' calculations.

## 4 Discussion

The international 2007–2008 food crisis hit Bolivia at a time in which a new socialist government was trying to implement profound agricultural reforms. Furthermore, the country was affected by domestic political conflicts between the new government and political forces opposing the envisaged reforms, and by the political struggle about regional autonomy issues and the distribution of tax revenues from gas exports. Our analysis suggests that the agricultural trade policy measures taken were little effective in contributing to food security, particularly in the long-term perspective.

Since the onset of the crisis, wheat flour was imported on a large scale by the Bolivian government from Argentina and distributed at preferential prices, first only to the national bakery sector in the departmental capitals in order to subsidise the production of bread and later also directly to consumers and other food industries. The Bolivian governmental intervention however was not, or only to a very limited extent, successful. The results show that throughout the entire period perfect price transmission between the Argentinian and the Bolivian wheat markets existed, with Bolivian prices being determined by the international reference prices. Thus, the government's interventions apparently have failed to shield Bolivian consumers of wheat flour from the price shocks of the international reference market.

Although we do not have counterfactuals on the intensity of price relationships without the implemented measures during this period, the results obtained for the observed setting draw a surprisingly clear picture on the effectiveness of the policies. The estimation results point to the conclusion that a broad impact on market prices was not achieved, and it remains an open question to which degree the subsidised wheat flour, initially only transferred to the national bakery sector for the elaboration of bread, actually benefited consumers. Concerning the aforementioned second and third channels about how consumer prices could be stabilised through the interventions (i.e. re-sale of subsidised wheat flour at Bolivian wholesale markets and subsidised wheat flour lowering the demand of conventionally imported wheat flour, thus leading to price decreases), the policies did not lead to such a price stabilisation. Not only was price transmission found to be perfect in the long run, Bolivian wheat flour prices also appeared to rapidly follow the world market prices and were even partly Granger-caused by them. In light of the homogeneous nature of wheat flour and the clear net import situation of Bolivia during this period, this may not be surprising. Since the

Bolivian tariffs on imports for Argentinian wheat flour are *ad valorem*, the tariff exemption did not affect the price transmission.

In consequence, the policy interventions by the Bolivian government appear to have had at best very limited impacts on the domestic wheat flour market, hence only benefiting (a part of) the consumers which had direct access to subsidised bread. Particularly the poor population living in rural areas far away from the larger Bolivian towns, difficult and costly to be reached, are likely to not have benefited from these adopted consumer-oriented policies. This part of the Bolivian population is particularly dependent on bread prepared from wheat flour distributed through the wholesale market network located in the larger Bolivian towns. Thus, against the pronounced goal of promoting food security in the country, the measures have to be considered little effective. If the actual (and unstated) objective of the government, however, has been of political nature, for example to prevent social unrest in politically relevant urban areas, the measures might well have met this goal. The extension of the target group for subsidised wheat flour to consumers and other food industries in late May 2009 did not alter this situation.

With respect to poultry, the nominal wholesale price in Cochabamba was far below the Peruvian wholesale price level between 2004 and 2009 on average. Nonetheless, in the face of rising prices, the Bolivian government implemented temporary export bans and tariff exemptions. In spite of these measures, our analysis confirms that price transmission between the two markets was complete and that price shocks in the Peruvian market were fully transmitted to Bolivia. A structural break test reveals that the two Bolivian export prohibitions in 2008 did not alter the long-run price dynamics between the wholesale prices of the major export and import markets of Cochabamba and Arequipa. The two temporary bans for poultry can hence be considered as rather political measures in order to demonstrate to consumers (and voters) that at least some action against the raising food price level was taken. Longer lasting export prohibitions in the future, however, could well lead to greater distortions and harm the Bolivian-Peruvian trade in poultry. Accordingly, the measures were criticised by producers and exporters as threatening an infant market being developed in Southern Peru and thus counteracting the development of Bolivian agricultural exports and thus the creation of employment in the Bolivian food sector. The demonstration of some action against the rising poultry prices to the consumers may have been of higher political benefit to the government.



In the case of sunflower oil, the Bolivian government's reaction to the situation on the world market consisted of a temporary export ban, export quotas and tariff exemptions for imports. In contrast to the strongly distortive character of these measures, however, the results of our analysis show that between 2003 and 2009 price shocks of the Argentinian export market were fully transmitted to Bolivia. The export prohibition did not change the long-run relationship between Argentina and Bolivia, but at least cut off a price spike that was observed in the Argentinian, Peruvian and European reference markets.

Indeed, only about 30 percent of Bolivia's vegetable oil production is consumed domestically. Vegetable oil could not be exported just at the moment when record prices would have been achieved from the world market which caused considerable profit losses to the private sector, in particular for the agroindustrial and oilseed processing companies of the Eastern lowlands. The choice of the export prohibition presented one of the most distortive measures which could have been taken. The government's proclaimed goal of cutting off price spikes on the national market for vegetable oils in order to alleviate price pressure on net-food buyers, temporary export taxes, for example, could have come to similar outcomes without creating large profit losses, liquidity problems and planning insecurity to producers and oil millers during the harvest campaign. With the measures chosen, the threat of an increasing perception of trading partners that Bolivian exports are unreliable could again harm the development of the sector.

In the short run, such measures might represent an option which could be partly successful in forcing the desired price developments on the national market. In the long run, however, such a policy framework would, while serving to a better or worse extent the interests of the poor population, provide strong disincentives for domestic agricultural production, for increased employment in the sector and for investment. It thus counteracts the government's goal of decreasing poverty and food insecurity in the country according to the National Development Plan.

In spite of the landlocked location of Bolivia and the implementation of a number of distortive policy measures during the 2007-2008 food price crisis, robust econometric evidence is found that Bolivia's agricultural markets were highly integrated with world markets during this period. This finding appears to be plausible since price developments on the domestic markets of wheat flour, poultry and sunflower oil were strongly affected by the crisis. This high level of integration with

international markets is both a chance and a challenge for Bolivia, a country which is both a large net-exporter of agricultural commodities and a country with many poor households which are net-food buyers. Creating adequate conditions which not only promote the livelihoods of the poor, but also the development of the agricultural sector and the food industry in order to encourage further agricultural investment, create employment, boost national food production and reduce food insecurity in the country are viewed as essential.

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