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Commodity prices in Argentina.  
What does move the wind?

1. INTRODUCTION

There is a widespread feeling that favorable winds have been blowing in the direction of many emerging economies. This tail wind has essentially two components: low international interest rates and high prices of several commodities. But in contrast to the 1990s, nowadays the emphasis is put on the second component at least in South America and, particularly, in Argentina. In the latter case, much of the recent growth performance is usually attributed to the current situation of soaring primary products prices and terms of trade.

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Commodity prices shocks are an important source of growth, volatility and uncertainty. Economic intuition tells us that the degree of exportable sector diversification is inversely linked to the macroeconomic importance of specific commodity prices. According to 2007 data, approximately one-third of Argentinean exports are primary products, and a similar percentage corresponds to agricultural manufactures like vegetable oils, soybean meal, beef, diary products, oil, or metals like cooper or aluminum. Consequently, about sixty-five percent of the export basket value depends directly or indirectly on international commodity markets.

Significant commodity dependence shapes almost every policy stance in a small and open economy. Price volatility imposes not only macroeconomic restrictions over fiscal, monetary, and exchange rate policies; but also affect consumers purchasing power, private and public savings, commercial openness strategies, agricultural policies, natural resources utilization, and investment allocation among economic sectors.

From the Argentinean perspective, commodity prices influence the economy through several channels.

Firstly, exports of primary products were historically the basic way to obtain external liquidity to finance economic growth. Because of this, economic analysis until the financial openness of the seventies focused on the behaviour of commodity prices to explain cyclical patterns and external constraints. This channel lost preeminence once the economy opened to financial markets at least from a theoretical standpoint. However, it continues to be relevant in practice since crisis were recurrent in the last thirty years and consequently, international financial restrictions were very frequent.

In the second place, the incidence of commodity prices over the fiscal stance is well-known. Even when tax structure have changed in Argentina, primary products exports are an important source of direct (export taxes) and indirect (income taxes) public sector revenues.

1 In financial open countries there is also an indirect effect of commodity prices on external finance. These affect agents’ expectations of future wealth and debt sustainability analysis in countries that mainly produce primary products. Therefore, current prices could affect both the cost (sovereign spread) and the availability of finance.
Thirdly, in contrast with other commodity producer economies, the share of this sort of exportable goods in domestic consumption basket of Argentina is highly significant. For this reason, the ups and downs of commodity prices create important distributive effects and directly bear upon poverty line calculations. This fact also differentiates Argentina from developed countries. In the latter case, volatile price of food and energy are partially ignored in monetary policy formulation which is based on the analysis of core inflation.\(^2\) Contrary, monetary policy design in Argentina cannot easily neglect these items since their shares in CPI are extremely high.

Finally, commodity prices and terms of trade are important determinants of the real exchange rate (RER). Bastourre et al. (2008) find that a one-percent increase of terms of trade generates a 0.97% appreciation of the equilibrium real exchange rate of Argentina. Escudé and Garegnani (2008) obtain similar result.\(^3\)

Despite of its real importance, the academic interest in the subject of commodity prices has changed over time. Following seminal papers of Prebisch (1950) and Singer (1950), several works have tried to assert the existence of trends and/or structural breaks in commodity prices data. But only recently this topic has recovered part of its past strength. In Frankel (2006) words commodity prices are back with a vengeance. The current nominal records of many commodity prices such as cooper, nickel or crude oil has motivated additional research on this field focusing on both the consequences for developed countries and the effects in primary goods producers economies.

In this regard, there is well documented evidence of the relevance of commodity prices and terms of trade shocks over long run growth\(^4\) and macroeconomic volatility.\(^5\) Many scholars have

\(^2\) See D'Amato et al. (2006) for a recent review of core inflation indexes published by different Central Banks.

\(^3\) Carrera and Restout (2007) find the same effect of terms of trade on real exchange rate in a panel data for South America.

\(^4\) Harberger (1950) and Laursen and Metzler (1950) pioneering works suggested that a fall in the terms of trade will reduce national income and consequently decrease savings in order to smooth consumption. Later on this effect became known as Harberger-Laursen-Metzler effect. Subsequent works of Obstfield (1982) and Kent and Cashin (2003) extended the idea, and demonstrated that longer persistence and duration of negative terms of trade shocks...
analyzed commodity dependence highlighting that is something not too different to a curse. The so called natural resource curse (Sachs and Wagner, 1995) establishes that countries with abundant natural resources tend to grow slower than natural resource-scarce economies. Economic theory has proposed no less than three explications for this phenomenon. In the first place, high commodity prices could lead to Dutch Disease effect through the previously mentioned real exchange rate link. In the second place, countries with more natural resources are probably more exposed to volatility which, in turns, impacts negatively on growth.6 Finally, commodity dependence could have adverse effects on governance.7

Related to this latter channel, commodity prices influence growth from the political economy point of view. In a period of price booms policymakers could think that the economic situation is so good as to alter it, but during depressions there are no means as to change primary products dependence even when policymakers are willing to do it.

Even good luck has been mentioned as a main factor driving economic performance of primary producers countries. Diaz Alejandro (1984) proposed the commodity lottery idea which emphasized that, from a historical perspective, the exportable resources of each country were basically determined by geography and previous experience with global integration. But later economic development was a result of the economic, political and institutional attributes of each commodity. In fact, the long run temporal behaviour of commodities is far from being homogeneous. As examples of this heterogeneity, consider the prices growth rates of the following commodities8 over the period 1900-2000 according to Ocampo and Parra (2003): lamb 399%; beef

result in lower investment rates and higher saving.


7 Lane and Tornell (1996) and, Tornell and Lane (1999).

8 All these commodity price figures are deflated by the Manufacturing Unit Value (MUV) index developed by the United Nations.
135%; tobacco 100%; cotton -66%; rice -67%; and rubber -94%.

Above mentioned reasons partially explain why the study of both the stochastic properties of commodity prices, i.e. trends, volatility and cyclical properties; and their economic determinants has been a major issue for many economists during the last sixty years. In addition, this also helps to appreciate why explaining and forecasting commodity prices continue being a relevant concern for policymakers.

Provided that commodity prices have an important role for an open economy, our next step will be to answer a related question: What moves the wind? Which are the global macroeconomic determinants of the prices of the main commodities exported by Argentina? To this end, we employ a vector error correction model (VECM) to explore links among prices and its drivers.

The rest of the study is organized as follows. In the next section we describe macroeconomic determinants of commodity price movements. We also briefly survey the empirical work done in this area. In the second section we analyze time series properties of Argentinean terms of trade and commodity prices. Following this, we present the empirical model to be estimated and the results. Our focus will be posed on both, the economic long run relationships among the considered variables and the short run responses of commodity prices to several shocks. The paper ends with conclusions and policy recommendations.

2. DRIVERS OF COMMODITY PRICES

In one of the most controversial thesis in the field of international economics of the past century, Prebisch (1950) and Singer (1950) claimed that, contrary to the classical view, primary products prices would fall relative to those of the industrial products.⁹ Since productivity had tended to growth faster in industry than in agricultural or mining sectors during 1876-1947, Prebisch argued that there existed a fundamental asymmetry in the international division of labor: while countries at the “centre” would had

⁹ The classic wisdom due to Ricardo and Mill was that because of diminishing returns of land the relative price of agricultural products was bound to rise in the long run.
kept all the gains of its productivity increases, the periphery would had conceded the benefits of its own technological progress.

For a developing country with a non-diversified and traditional export structure it is straight that exists a positive link between terms of trade and commodity prices. For this reason, much of the empirical research on the Prebisch-Singer hypothesis is not a direct test over terms of trade per se, but instead a test on the time series properties of primary products. By and large, this has been the common way to empirically study commodity prices.\textsuperscript{10}

Other important branch of this literature states that it does not make sense to discuss long run trends since in the short and medium term volatility dominates by far the behaviour of commodity prices. According to Deaton (1999), what commodity prices lack in trend, they make up for in variance. Cashin and McDermott (2002) find that volatility of commodity prices has increased notably since Bretton Woods breakdown at the beginning of the seventies.

But contrary to focus on time properties of prices series as such, a smaller group of scholars has raised a different question: Are there some macroeconomic determinants of commodity prices? These papers emphasize the impact of fluctuations in the value of the dollar on the real value of primary commodities. The pioneering model of Ridler and Yandle (1972) uses comparative static analysis in a single-good model to demonstrate that an increase in the value of the dollar (i.e. a real appreciation) should result in a fall in dollar commodity prices. Moreover, the magnitude of this negative elasticity should be less than one in absolute value.

\textsuperscript{10} There are many papers that analyzed long run behaviour of commodity prices. Grilli and Yang (1988) devised several series for the period 1900-1986, and found that non-fuel primary commodities prices had felt 0.6% per year, relative to manufactures. Among others, the works of Cuddington and Urzúa (1989); Powell (1991); Bleaney and Greenaway (1993); Lutz (1999), Cashin and McDermott (2002); and Ocampo and Parra (2003) tried to confirm or reject Grilli and Yang (1988) results. The general picture that emerges from these papers is that negative growth rates tend to prevail in the very long run. However there is not a clear consensus. While some works argue in favor of a trend that moves at a constant pace, other papers stress the existence of structural negative shifts that are not fully recovered during the upward phase of commodity prices cycles.
since a 100% general appreciation will cause a 100*(1-νi)% change in commodity i, where νi measures the relative significance of USA as a producer and consumer of this good.11 This is the so called denomination effect that have been discussed many times since then.

A second driver of commodity prices proposed by literature is the world income. Dornbusch (1985) for instance, sets out a two country model to describe external influences on relative commodity prices. Market cleaning equilibrium requires that the sum of domestic (USA) and foreign demand (D and D*) equals global supply (S) which is assumed exogenous. In turns, each demand depends on both relative domestic prices measured in its respective currency ($\frac{P}{P}$ and $\frac{P^*}{P^*}$) and income levels (Y and Y*):

$$S = D\left(\frac{P}{P}, Y\right) + D^*\left(\frac{P^*}{P^*}, Y^*\right)$$

(1)

The general solution due to full arbitrage in commodity markets is:

$$\frac{P}{P} = H(\frac{P}{P}, \frac{P^*}{P^*}, H; S) \quad H_1, H_2 > 0; H_3 < 0$$

(2)

Thus, commodity prices denominated in dollars are positively related to domestic and foreign activity and negatively influenced by the U.S. effective real exchange rate ($\frac{P^*}{P^*}$).12

11 It could be argued that it is not consistent to use a partial equilibrium model for each good without considering all possible commodity prices interactions. It would not be correct to compute, for instance, the effect of the real exchange rate of the dollar on the price of copper holding the price of aluminum constant, and then to calculate the effect of the same change on the price of aluminum holding the price of copper constant (Gilbert, 1989). This led Chambers and Just (1979) to a multi-commodity generalization of Ridler and Yandle (1972) model. In this context, the assumption of gross substitutability in production and consumption is sufficient to assure that the dollar exchange rate to commodity prices elasticity remain within the unit interval.

12 As in the case of the Ridler and Yandle (1972) model it could be showed that the elasticity of commodity prices to real exchange rate would be less than one in absolute value. To reach such result take the partial derivative of expression (1) with respect to the real exchange rate to have:

$$\frac{\partial \ln \left(\frac{P}{P} \right)}{\partial \ln \left(\frac{P^*}{P^*} \right)} = -\frac{\beta^*}{(\frac{P^*}{P^*} + \beta^*)}$$

(2')
Apart from real exchange rate and industrial production, a third variable has been suggested as a determinant of commodity prices, namely the real interest rate.

Explaining the excess of co-movement among commodity prices with respect to fundamentals, Pindyck and Rotemberg (1987) consider that these movements are the result of herd behaviour in financial markets since its participants could believe that all commodities tend to move together. The authors claim that, as storable assets, commodities are affected by expectations. Interest rate might affect the investment or harvest in a number of commodities changing future supplies and so current prices. It could also affect expectations about future economic activity and then future commodity demands which, again, impacts on current prices.

As part of a North-South interdependence model, Beenstock (1988) points out two components of commodity demand, a flow one that reflects consumption of raw materials in the production process, and a stock one related to speculative activity. Supply of commodities negatively depends on the price of oil because energy is required in the production process. Therefore, relative commodity prices are a positive function of total demand and price of oil and a negative function of the change in the nominal interest rate.

Frankel (2006) remarks that rising interest rates are transmitted to commodity prices through three channels: i) by increasing the incentive for extraction (or production) today rather than tomorrow; ii) by decreasing the desire of firms to carry inventories; and iii) by encouraging speculators to shift out of commodity contracts and into treasury bills. The three channels of transmission work to reduce spot prices of commodities. In fact, this author argues that recent nominal records in some commodities could be a signal that monetary policy has been loose.

\[ \eta \] and \( \eta' \) are the domestic and foreign price elasticities of commodity demand and \( \beta \) and \( \beta' \) are the shares of home country and the rest of the world in total demand. As it is clear from (2') the left side elasticity should be a fraction. Moreover, if demand elasticities are the same commodity price response to USA real exchange rate is proportional to the importance of USA as global buyer in that good.
2.1 The empirical evidence. Where do we stand?

Considering the models previously reviewed, the conclusion about commodity prices determinants is straightforward. They should rise with global income, and fall with real exchange rate appreciation of the dollar and with real interest rates. However, these theoretical predictions have not been mirrored in empirical studies.

After revisiting empirical research it is attained three general conclusions. In the first place, the number of estimations is not too large and the majority of them are from the eighties, where these literature had its momentum. In the second place, methodologies employed are not fully comparable. Finally, both the dependent variables and the explanatory variables are dissimilar.

The most puzzling result up to now refers to the value of the real exchange rate elasticity of commodity prices. Most of the empirical studies found a negative coefficient as theory predicts, but its absolute value is higher than one. Several explanations have been proposed for this result. Dornbusch (1985) has pointed out that there could be measurement problems with the real exchange rate. Besides, Gilbert (1989) has suggested that the widely used IMF MERM index is inappropriate since it assigns excessive weight to the Canadian dollar. More recently, De Gregorio et al. (2005) have found that USA RER elasticity of copper price also overshoots its theoretical value, but they have not proposed a full explanation to this fact.

Both demand and supply modelling has been also problematic. In a general equilibrium setting, prices and quantities should be modeled simultaneously. However, the empirical literature has followed basically two strategies. The first one is to estimate pure demand side models. In this case, industrial production of developed countries has been the preferred proxy. Alternatively, some authors have included supply side proxies as well. Borenstein and Reinhart (1994) for instance, consider two supply factors in their empirical specification: industrial production of former Soviet Union, and a dummy variable for the debt crisis of the eighties. Gilbert (1989) includes debt services as a supply shift variable.13

13 The idea is that debt crisis endogenously created incentives to increase commodity supply and as a consequence prices plummeted over the period 1982-85.
Regarding real interest rates, Frankel (2006) verifies a negative coefficient of the real USA interest rate, a variable which according to him represents global monetary policy. This result was established in previous works of Gilbert (1989) and De Gregorio et al. (2005). Pindyck and Rotemberg (1987) find also a negative link between nominal interest rates and various commodities prices.

Shedding light in this scarce empirical literature is another reason to explore the links between the prices of the main commodities exported by Argentina and the determinants postulated by theoretical models.

3. THE STYLIZED FACTS OF THE PRICES OF ARGENTINEAN COMMODITIES

As part of the world trend described in the introduction, the issue of terms of trade and commodity prices has recovered a central place in the economic debate in Argentina. However, many times this debate rest on ideas that are not totally supported by the data. For instance, it has been occasionally said that current terms of trade are the highest of the Argentinean history, but this is not true from a long run view as we will see in this section. Moreover, short run analysis usually is focused only on nominal prices making not connection with real prices, as if both variables were the same.

In order to clarify ideas it will be helpful to start the empirical analysis by describing both general trends and recent outcomes in commodity prices and terms of trade.

A lengthy series of the Argentinean terms of trade is drawn in Figure 1. The first notable feature is its high volatility.

Regarding long run trends, we detect four phases. From 1875 to the crisis of the 30s there is roughly a period of decaying terms of trade. Around the Second World War we observe a recovery of the terms of trade explained by sharp commodity prices increases. Then, from 1940 to approximately 1970 terms of trade remained low. During the 1970s they peaked as a consequence of the oil shocks. However, these events did not structurally altered the behaviour of the series and so they acted more as an jump shift rather than as a step shift. Hence, from 1973 to 1986 volatility prevailed.
Only from 1987 on we identify an upward trend with some degree of persistence. This latter period have raised an important controversy.

As we previously mentioned, some observers suggests that current terms of trade are in a extraordinary unique situation, while others states they are only exhibiting a recovery after the negative shock suffered around the years 2000-2001. When historical data is analyzed, we conclude that recent fluctuations have been relatively small, and that stable and slightly rising terms of trade are not a novel characteristic in Argentinean economy but an outcome that have been taken place during the last twenty years.

Being the most volatile component of the terms of trade series, commodity prices dynamics is different to some extent. We will concentrate in the 1986-2007 period where it is observed the mentioned rising terms of trade cycle. The analysis of the prices of the main commodities of Argentina will be conducted using the variable IPCom8 which is a summary measure of the eight principal international commodities that Argentina exports. A full description of this index is done in the section A of the Appendix along with the remaining variables that take part in the empirical model (section B of the Appendix).

In Figure 2 the IPCom8 index is depicted both in nominal and real terms.

We could distinguish again four phases in Figure 2. Firstly, a rising nominal and real prices cycle between 1986 and 1989.
From 1989 on there is a second phase of relative steady nominal prices and slightly decaying real prices which finishes with a new peak at the end of 1996.

**FIGURE 2. IPCom8 INDEX, 1986Q1-2007Q4**

The Asian crisis and the subsequent period of financial turmoil produced a turning point, and we observe a sharp decrease in both commodities prices series in the middle of 1997. As in the case of the debt crisis of the eighties it could be argued that international financial restrictions endogenously boosted supply of commodities. In the short run this supply increase could be explained by less domestic absorption in developing countries and a reduction in commodity stocks. In the medium term, it is expected to observe rising production levels.

In a third phase prices went down until the first quarter of 1999. From then on they remained below the historical means up to the second quarter of 2003.

The last cycle had two periods of strong growth with a short correction between the third and four quarters of 2004.

According to Figure 2, the level of the nominal IPCom8 in 2007 was 43% higher than the respective mean of the whole period. This figure decreases to 12% when real prices are considered. Indeed, they show currently a peak but they are not too different to those observed in 1995-97, and they are clearly lower than the prevailing ones during 1988-91. Summarizing, commodity prices are undoubtedly passing through a positive cycle, although the belief of a historical unique boom does not seem supported by the data.

SOURCE: Authors’ calculations based on IMF and Central Bank of Argentina data.
While terms of trade changed their trend in 1986, real commodity prices only took off in 2002 in a persistent way. This is an interesting fact since both export prices are deflated, by imports prices in the former and USA GDP deflator in the latter. Probably, the explanation for this behaviour lies in the differentiated evolution of the denominators. It could be argued that Argentinean import prices have been influenced by a process of commodification of some manufactures. This idea, originally introduced by Singer (1971) and Sakar and Singer (1991), implies that manufactures are not immune to falling relative prices. Wood (1997), Kaplinsky (2005) and Kaplinsky and Santos-Paulino (2005) suggest that some categories of manufactures have experimented decaying prices, predominantly those in which China has become a major exporter. In fact, nominal prices of Argentinean imports have remained practically unchanged during the last ten years, a period in which China and other developing countries increased their sales towards this country. In the opposite direction, USA GDP deflator has experimented a steadily low growth.

4. THE EMPIRICAL MODEL

The aim of this section is to assess the role played by the factors previously analyzed on the performance of the IPCom8 index for the period 1986Q1-2007Q4.

Besides, standard determinants already studied in the literature (real interest rate, USA real exchange rate, world industrial production), we think it is important to evaluate the role of global liquidity as well.

Monetary conditions of international economy have not usually been taken into account in a direct way in the explanation of commodity price behaviour. However, some studies, like HSBC (2007) and Dooley and Garber (2002), have pointed out that global liquidity is a key variable in order to explain the remarkable growth of world economy and the recent good performance of financial assets in emerging markets. Because of these reasons, the value of commodity is likely influenced by the global liquidity level, beyond the effect captured by interest rate.

Regarding world demand, industrial production of China and main emerging Asian countries has been added to the industrial
production of developed economies. In this way, we take into account the impact of these new players in raw materials markets.

As the objectives of the paper are, on one hand, to establish if there exists a long run relationship between commodity prices and the previously pointed out global factors, and on the other, to study short run dynamics of the IPCom8 after different shocks, we estimate a vector error correction model (VECM).

The empirical model estimated takes the following expression:

$$\Delta X_t = A_0 + \Pi X_{t-1} + \sum_{i=1}^{p-1} \Delta X_{t-i} + \varepsilon_t$$

(3)

Where the vector of endogenous variables $X_t$ corresponds to the real price index of the eight main Argentinean commodities, the USA real effective exchange rate, the return of the one-year USA treasury bond, a global liquidity measure, and a world demand proxy. Details of data sources and time evolution of the respective variables are provided in section B of the Appendix.

In the long run equation we add a time trend in order to control for the Prebisch-Singer effect. As we use USA GDP implicit price index to deflate IPCom8 index and this has an important component of services and manufactures, the hypothesis would be that, given the world demand, the pass-through of rising productivity to international prices has been more intense in primary goods than in industrial goods and tradable services.

5. THE EMPIRICAL RESULTS

The first step in the VECM estimation is to determine the order of integration of the series. To this end, we have employed the standard augmented unit root test of Dickey and Fuller (1979). In section C of the Appendix we show in detail the results. There we conclude it is not possible to reject the null hypothesis of unit roots in all the variables.

Since all series are I(1), we estimate an unrestricted vector autoregressive model (VAR) with five lags, following the rule of thumb of considering the seasonal lag plus one. We check, next, the absence of serial autocorrelation and heteroskedasticity in the residuals. These results are shown in section D of the Appendix.
The Johansen (1991, 1995) methodology is employed in order to test if there exists one or more cointegration relationships among the variables. Tests based on trace and maximum eigenvalues statistics are shown in Table 1 and Table 2, respectively.

**TABLE 1. TRACE COINTEGRATION TEST**

<table>
<thead>
<tr>
<th>$H_0$</th>
<th>Eigenvalue</th>
<th>Trace statistic</th>
<th>Critical value</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0.3251</td>
<td>90.2156</td>
<td>88.8038</td>
<td>0.0394</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.2066</td>
<td>55.6169</td>
<td>63.8761</td>
<td>0.2034</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.1730</td>
<td>35.2544</td>
<td>42.9152</td>
<td>0.2347</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.1542</td>
<td>18.5413</td>
<td>25.8721</td>
<td>0.3087</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.0423</td>
<td>3.8061</td>
<td>12.5180</td>
<td>0.7700</td>
</tr>
</tbody>
</table>

**TABLE 2. MAX-EIGENVALUE COINTEGRATION TEST**

<table>
<thead>
<tr>
<th>$H_0$</th>
<th>Eigenvalue</th>
<th>Max-eigenvalue statistic</th>
<th>Critical value</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0.3251</td>
<td>34.5987</td>
<td>38.3310</td>
<td>0.1263</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.2066</td>
<td>20.3626</td>
<td>32.1183</td>
<td>0.6232</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.1730</td>
<td>16.7131</td>
<td>25.8232</td>
<td>0.4821</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.1542</td>
<td>14.7352</td>
<td>19.3870</td>
<td>0.2084</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.0423</td>
<td>3.8061</td>
<td>12.5180</td>
<td>0.7700</td>
</tr>
</tbody>
</table>

While trace test indicates the presence of one cointegrating vector at 5% statistical significance, maximum eigenvalue test does not find evidence of any long run relationship. However, Cheng and Lai (1993) assert that the former test is more robust than the latter one when residuals are not normally distributed. Consequently, we conclude there exists one cointegrating relationship among IPCom8 index and remaining drivers.

Coefficients of the estimated long run relationship and their respective p-values are presented in Table 3.

Before analysing these results, impulse-response functions are computed and presented in Figures 3 to 6. Then we will discuss

14 Cholesky factorization is employed to identify the structural innovations. We have assumed that liquidity shocks of the reduced form are identical to the structural shocks. The remaining variable ordering is as follows: real interest rate, USA real effective exchange rate, world industrial production, and finally real commodity prices. As it is usual, results are measured as a percentage of
**Table 3. Long Run Relationship Among IPCOM8 Index and Its Drivers**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA REER</td>
<td>-0.7664</td>
<td>-2.2344</td>
<td>0.0295</td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>-4.7588</td>
<td>-1.9338</td>
<td>0.0583</td>
</tr>
<tr>
<td>Real Global Liquidity</td>
<td>1.4646</td>
<td>3.0264</td>
<td>0.0038</td>
</tr>
<tr>
<td>Industrial Production Index</td>
<td>-1.1327</td>
<td>-1.0893</td>
<td>0.2808</td>
</tr>
<tr>
<td>Trend</td>
<td>-0.0257</td>
<td>-3.6622</td>
<td>0.0006</td>
</tr>
</tbody>
</table>

Simultaneously both long and short run implications of our model.

From Table 2 and Figures 3 to 6, we see that determinants of commodities prices are statistically significant and their signs in both the long run relationship and in the short analysis are as expected in theoretical grounds in almost every case.

**Figure 3. Accumulated Response of Real Commodity Prices to a USA Multilateral Real Exchange Rate Shock**

Real effective exchange rate of the USA shows a negative and significative coefficient in the cointegration equation. This is consistent with previous empirical results and with anecdotal evidence change in the commodity price index after a one-standard deviation shock of each variable.
which suggests that dollar depreciations (appreciations) have been associated with rises (decreases) in real commodities prices. As theory predicts, the elasticity lies between zero and minus one. This is a striking feature of our estimations since previous works have systematically found a figure higher than one in absolute value. Regarding short run analysis, we observe an overall negative but small response.

In the long run equation, the real interest rate coefficient appears to be negative indicating that rising financial costs of inventories increase current supply and reduce spot prices. In the same way, interest rate could work as a predictor of an economical

**FIGURE 4. ACCUMULATED RESPONSE OF REAL COMMODITY PRICES TO A REAL INTEREST RATE SHOCK**

![Graph showing the accumulated response of real commodity prices to a real interest rate shock.](image)

**FIGURE 5. ACCUMULATED RESPONSE OF REAL COMMODITY PRICES TO A INTERNATIONAL LIQUIDITY SHOCK**

![Graph showing the accumulated response of real commodity prices to an international liquidity shock.](image)
slowdown which results in future supply excess that depresses current prices. Besides, short run IPCom8 index response to one standard shock in this variable exhibits an accumulated drop of approximately 1.7% after eight quarters.

International liquidity seems to be a significant determinant of prices in the long run as well as in the short run. This suggests that the current remarkable rise in dollar liquidity has put some pressure on highly tradable and competitive goods markets, even when this liquidity increase is partially sterilized by reserve accumulators countries. Also impulse response functions behave as expected. A positive shock in liquidity generates a cumulative change of about 6.6% after two years.

The impact of demand for raw materials which is approximated by the industrial production index of OECD countries plus China and main emerging Asian economies presents a non statistically significant coefficient in the long run. However, the short run impulse results positive and significant during the first five quarters, but then this effect tends to vanish.

Since our index is dominated by agricultural commodities, it is possible that this short run result is consequence of an immediate reaction to an unexpected demand increase. Supply would only be fixed in the short run, but quite flexible in the medium and long run (i.e. when the harvest is widen or new extractions are possible).

The differentiated impact of the demand on short and long
run opens a theoretical and methodological discussion regarding future extension of this research. Firstly, it is necessary to go further of the traditional determined demand models in order to take into account medium and long run reaction of the primary goods supply. The simple way of incorporating supply factors in Borenstein and Reinhart (1994) is a strand that needs to be complemented with the capacity of agricultural suppliers to react to higher prices.

Lastly, variance decomposition analysis is performed. In Figure 7 below we have drawn the share of commodity prices variance explained for each variable shock.

**FIGURE 7. VARIANCE DECOMPOSITION OF REAL COMMODITY PRICES**

We could see the more important source of shocks in this model are the financial factors: international liquidity and real interest rate. This confirms that financial factors are not only important determinants of commodity prices in the long run but also in the short run. Besides, it is worth mentioning that demand for raw materials it is significant in the very short run and its importance decays when time goes by.

5. CONCLUSIONS

High commodity prices have gained weight as an explanation of the recent growth cycle in Argentina and Latin America. If we
consider the price index of the main eight commodities exported by Argentina (IPCom8), we could see that prices in 2007 are 43% higher in nominal terms than the mean of twenty last years. In real terms, this figure is only a 12% increase. That is, nowadays, real commodity prices are similar to those observed in 1995-1997 but inferior to prevailing prices in 1988-1991. An analysis centered in the last decade shows that after suffering an abrupt fall provoked by the Asian crisis in 1997-1998, prices have experimented a sustained recovery.

In this paper we have investigated which are the key determinants of the prices of Argentina’s main commodities.

Theory indicates that commodity prices are affected negatively by USA real effective exchange rate and positively by demand of raw materials. Some models take into account real interest rates due to their effect on speculative demand: a lower interest rate stimulates speculators to buy commodities instead of financial assets. This phenomenon has been growing in recent years and could be reflecting what is called the “financialization of commodities.” As a result, commodities have increased their shares in investment fund portfolios.

Besides, authors as Prebisch (1950) and Singer (1950) have emphasized the declining trend of raw material prices with regard to industrial goods. The existence of auction markets for the former and customer markets for the latter makes that productivity growth is transferred to prices at different speeds. In our empirical model we have controlled for the Prebisch-Singer hypothesis including a time trend in the long run relationship.

Finally, we have also introduced a variable that represents real international liquidity in dollars, which complements interest rates as an indicator of the global monetary policy stance.

We have found one cointegration relationship among the determinants previously mentioned and commodity prices. In this long-run equation, all variables are significant and their signs are the expected ones. Industrial production is the only exception resulting non statistically significant.

15 According to Domanski and Heat (2006) the number of outstanding contracts on gold and commodities has more than doubled between 2003 and 2006. Bastoure (2008) uses an econometric methodology that allows to identify fundamental and speculative movements in commodity prices.
It is worth mentioning that financial factors (real global liquidity and real interest rate) appeared not only important determinants of commodity prices in the long run but also in the short run.

Hence, as a general conclusion, it emerges that most of the macroeconomic variables that determine commodity prices are the same influencing capital flows from the centre to the periphery. The USA real exchange rate, the international real interest rate and the global liquidity coordinate exogenous cycle in countries like Argentina via two channels: the commercial and the financial channel (Carrera et al., 2000; Canova, 2005). These variables induce a positive correlation between channels which increases exogenous volatility coming from the centre.

Consequently, for a developing country more international liquidity, lower interest rates and dollar depreciation generate higher commodity prices, enhance sustainability and risk perception, attract more capital flows and investment, and produce more growth alongside with inflationary and appreciatory pressures. When global economic conditions change in the centre, all of these effects turn down and it is possible to find an overshooting in commodity prices fall (Frankel, 2006).

Since international variables that determine commercial and financial cycles in an open economy are the same, it is troublesome to cushion real commercial shocks using international financial markets. If declining prices were caused by monetary tightening and dollar appreciation it would be more difficult to finance the shortfall in domestic income with external finance. This suggests that a good domestic strategy should develop domestic measures to smooth external cycles when prices are in high levels.

Regarding policy recommendations designed to such end, there are some that belong to the macroeconomic field and other that are structural.

The objective of the first ones would be to reduce volatility, smoothing transitory elements. Measures oriented to this end are, for instance: keep a flexible exchange rate; accumulate international reserve; avoid real exchange rate appreciation with respect to its long run equilibrium; implement taxes-subsidies system for exports accordingly the phase of external price cycle; establish fiscal funds to stabilize expenditure; and adopt countercyclical
regulations of short term capital flows. Among more innovative measures we could find the hedging proposals made by Caballero (2002) to create financial funds that take into account the correlation of commodities to other financial asset, and Frankel's recommendation to use an export price index as monetary policy target.

Structural policy measures should try to deal with the declining trend in prices. Thus, increasing diversification in commodity exports as well as enhancing production chains for each raw material through an industrialization process would help to reduce price volatility. Other areas of policy would focus on building infrastructure and encouraging the development of local financial instruments to diminish future uncertainty. Finally, coordination between producer countries could collaborate to stabilize markets.

Final words are again devoted to the current high prices phase. Accordingly to our analysis, is still valid to say that the force that moves the price wind is the high liquidity existing in the world, even when increasing demand of commodities from countries like China and India, and the long way that could take to this countries to catch up the developed world in terms of commodities consumption, are considered. Since international monetary conditions have changed suddenly many times in the past, it is likely that they do it once again. In other words, it is probable that an important part of the recent positive shock reflects only transitory conditions. Countries like Argentina should profit this period to minimize the costs of future reversions.

Appendix

A.1 Commodity prices index

We have constructed an index of the prices of the eight main commodities exported by Argentina (IPCom8). The following table shows the commodities considered as well as their shares in the total exports of Argentina in 2006. The weight of each commodity in the index is calculated according to these figures.

Our index contains the same products included in Index of commodity prices published by the BCRA, but differently to that
TABLE A. 1. COMPOSITION OF THE IPCOM8 INDEX

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Share in total exports</th>
<th>Price index weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybeans</td>
<td>3.8</td>
<td>13.3</td>
</tr>
<tr>
<td>Soybeans oil</td>
<td>6.0</td>
<td>20.9</td>
</tr>
<tr>
<td>Soybeans meal</td>
<td>9.3</td>
<td>32.6</td>
</tr>
<tr>
<td>Maize</td>
<td>2.7</td>
<td>9.5</td>
</tr>
<tr>
<td>Wheat</td>
<td>3.2</td>
<td>11.1</td>
</tr>
<tr>
<td>Aluminium</td>
<td>0.8</td>
<td>2.6</td>
</tr>
<tr>
<td>Metals</td>
<td>0.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Beef</td>
<td>2.4</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>28.7</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

index we use fixed weights along the whole period considered, particularly those corresponding to the year 2006. The main justification of that is that BCRA index is a chained Laspeyres index where the weights are updated every year. Since part of the evolution of that index reflects changes in shares and we want to capture the pure price effect. But more important to this is the fact that we have excluded oil and cooper in comparison with the index of the BCRA. The reason is that we want to focus on highly consolidated export sectors that are related to the traditional comparative advantages, and has room to growth in the near future.

The nominal prices are taken from International Financial Statistics (IMF). In the econometric analysis the IPCom8 is deflated by the GDP implicit price deflator of USA (IFS-IMF).

A.2 Description of the international variables

In this part, construction and sources of global commodity price determinants are explained in detail. We use quarterly data for the period 1986-2006. All variables were seasonally adjusted (except for the interest rate and real global liquidity) by the X-12 Arima method and are expressed in logarithms.

USA Multilateral Real Exchange Rate

The broad multilateral real exchange rate index series from the Federal Reserve Bank of New York was used.
Real Global Liquidity

This series is the result of the sum of the USA monetary base and international reserves held by central banks all over the world. The seasonally adjusted monetary base from the Board of Governors of the Federal Reserve System and the world total reserve series from the International Financial Statistics (IFS-IMF) were used in its construction. “001.1..SZF...” To deflate the variable the USA GDP implicit price deflator was used (“11199BIRZF...” IFS series).

Real Interest Rate

The 1-Year Treasury Constant Maturity Rate from the Board of Governors of the Federal Reserve System was utilized and deflated by the USA GDP deflator.
A developed countries plus China industrial production index was built. As there is no industrial production index for the last country, we used the industrial added value employing IFS and World Development Indicators (World Bank) data as an approximate measure. For developed economies IFS IPI series (“11066..IZF...” series) was used. Both indexes were weighted by the respective industrial added value.
A.3 Unit root tests

**TABLE A.2. AUGMENTED DICKEY-FULLER TEST OF UNIT ROOTS (p-value)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>None</th>
<th>Constant</th>
<th>Constant and trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPCom8</td>
<td>0.4602</td>
<td>0.1937</td>
<td>0.1168</td>
</tr>
<tr>
<td>USA REER</td>
<td>0.7279</td>
<td>0.3954</td>
<td>0.6943</td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>0.3003</td>
<td>0.2927</td>
<td>0.0336</td>
</tr>
<tr>
<td>Real Global Liquidity</td>
<td>0.9999</td>
<td>0.9999</td>
<td>0.2687</td>
</tr>
<tr>
<td>Industrial Production Index</td>
<td>0.9994</td>
<td>0.9786</td>
<td>0.1736</td>
</tr>
</tbody>
</table>

A.4. Unrestricted VAR residuals

**TABLE A.3. SERIAL CORRELATION LM TESTS OF THE VEC RESIDUALS**

<table>
<thead>
<tr>
<th>Lags</th>
<th>LM-Stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.95</td>
<td>0.2263</td>
</tr>
<tr>
<td>2</td>
<td>16.14</td>
<td>0.9107</td>
</tr>
<tr>
<td>3</td>
<td>20.92</td>
<td>0.6968</td>
</tr>
<tr>
<td>4</td>
<td>41.22</td>
<td>0.0218</td>
</tr>
<tr>
<td>5</td>
<td>17.54</td>
<td>0.8614</td>
</tr>
<tr>
<td>6</td>
<td>12.51</td>
<td>0.9820</td>
</tr>
<tr>
<td>7</td>
<td>25.39</td>
<td>0.4408</td>
</tr>
<tr>
<td>8</td>
<td>20.34</td>
<td>0.7289</td>
</tr>
<tr>
<td>9</td>
<td>21.23</td>
<td>0.6795</td>
</tr>
<tr>
<td>10</td>
<td>16.80</td>
<td>0.8889</td>
</tr>
<tr>
<td>11</td>
<td>26.44</td>
<td>0.3843</td>
</tr>
<tr>
<td>12</td>
<td>22.61</td>
<td>0.6002</td>
</tr>
</tbody>
</table>

**TABLE A.4. HETEROSKEDASTICITY AND NORMALITY TESTS OF THE VEC RESIDUALS**

<table>
<thead>
<tr>
<th>Normality test</th>
<th>Heteroskedasticity white test</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Jarque-Bera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistic</td>
<td>773.1402</td>
<td>1.9954</td>
<td>37.0321</td>
<td>39.0275</td>
</tr>
<tr>
<td>p-value</td>
<td>0.5625</td>
<td>0.8498</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

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