The 2000s commodity boom and the exchange rate in Argentina

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Abstract

I estimate the impact of the 2000s commodity boom in the major Latin American economies and find that it had different effects in Argentina than in the rest of the region. My conclusions rely on a structural vector autoregression in which the identification is conditional on a standard New Keynesian dynamic stochastic general equilibrium model. The results suggest that the exchange rate policy was more active in Argentina than in the other countries during the boom: i.e., that the Argentinean monetary authority pursued a stronger *leaning against the wind* policy than its regional counterparts. I also provide evidence that Argentina benefited from a stronger increase in output but suffered from higher inflation and volatility after the commodity shocks. Hence, these disturbances can explain part of the higher inflation observed in Argentina during the 2000s boom, as well as its greater volatility in prices and output.

Keywords: Structural VARs; commodity prices; exchange rate policy; Argentina.

JEL Classification: C32; F31; F41; Q02.

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1 Introduction

During the 2000s, the prices of commodities nearly doubled in what would be one of the three major commodity booms experienced since World War II[1]. Latin American countries are important commodity exporters, and they benefited from the boom as their export revenues increased. However, they also faced difficulties due to the boom's magnitude and duration. On one hand, there were pressures on local price levels, either because exported commodities were also consumed domestically or due to the wealth effect generated from commodity income. On the other hand, their currencies' exchange rates tended to appreciate, potentially affecting the competitiveness of these economies (the so-called Dutch disease).

Despite these challenges, the major Latin American economies exhibited strong macroeconomic performance during the boom, with high growth and low and stable inflation. However, Argentina underperformed its counterparts. If we compare the macroeconomic outcomes of Argentina with those of the rest of the Latin American countries during the 2000s commodity boom, some differences become apparent: while the country grew as the region did, its inflation was much higher and its output more volatile. These facts are demonstrated in Figure 1, which depicts Argentina's output growth and inflation rate and the average values for the rest of the region during the boom. The rest of the Latin American countries considered here are the other major economies in the region: Brazil, Chile, Colombia, Mexico and Peru[2]. For convenience, the average of these countries, rather than their individual trends, is plotted. However, the reader must be aware that all comparisons made in this article between Argentina and the average of the region still hold if the countries are considered separately.

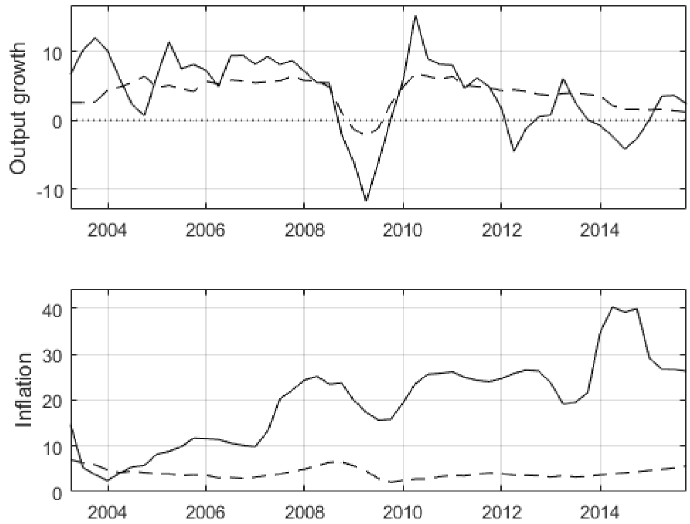
Figure 1 shows that the level of output growth in Argentina was similar to that of the rest of countries, but it was twice as volatile. As for inflation, it was five times higher and much more volatile in Argentina than in the other countries. Why was Argentinean macroeconomic outcome so much worse? One might think of two possible reasons for this: (i) either Argentina was subject to more volatile country-specific shocks, or (ii) common shocks to the region were transmitted differently in this country. In this paper, I investigate (ii) and I find that the commodity boom had a stronger impact both on output and inflation in Argentina than in the rest of the analyzed Latin American economies. As I evidence that the nominal exchange rate appreciation was weaker in that than in these other countries, these results suggest that monetary authority intervention was more

[1]Radetzki (2006) defines the three booms as the 1950-1 Korean war buildup, OPEC's 1973-4 market management and the 2000s boom, which was driven primarily by China and India's demand for raw materials. Additionally, this last boom was the longest of the three.

[2]In addition to Argentina, Venezuela is the other exceptional large Latin American economy that exhibited poor macroeconomic performance during the boom. Nevertheless, Venezuela is not analyzed here because of a lack in recent data.

aggressive in Argentina than in the rest of region during the boom. And this stronger exchange rate countercyclicality can have fostered growth in Argentina at the expense of higher inflation and volatility.

Fig. 1: Argentina (—) and rest of LA (−−).



Note: output growth is yearly percentage variations in quarterly real GDP. Inflation is transformed from monthly CPI to quarterly averages. See the Data Appendix on page 16 for details.

My results were obtained using a semistructural vector autoregression (VAR) in which innovations to commodity prices are partially identified with contemporaneous zero restrictions. The selection of variables included in the VAR comes from the responses observed in a prototypical New Keynesian (NK) dynamic stochastic general equilibrium (DSGE) model of a small open economy. According to this model, to identify a commodity disturbance, the following variables are needed: commodity price variations, output growth, inflation, nominal exchange rate variations and the nominal interest rate. Additionally, by assuming that the first structural shock in the VAR is an innovation to commodity prices, the responses observed in the VAR match those in the DSGE model, in the sense that all variables respond on impact. This methodological approach has the advantage of *letting the data speak* for themselves, as the estimation is performed using a reduced-form model, while the economically relevant shock is supported by a widely accepted theory (the prototypical DSGE model). While this formally supported structural VAR approach is widely used, to the best of my knowledge, it has not often been applied to Latin American countries in general or Argentina in particular.

The remainder of the paper is organized as follows: Section 2 provides a selective review of the related literature; Section 3 describes the empirical methodology; Section 4 presents and interprets the empirical results; and, finally, Section 5 provides a summary of the results and the main conclusions.

2 Literature review

This paper is mainly related to the literature studying the impact of commodity prices or, in more general terms, terms of trade (TOT) effects in developing countries. Additionally, as my evidence can be interpreted as policy-driven exchange rate reactions, this article is also related to a second line of inquiry that addresses exchange rate regimes in emerging economies.

Regarding the first line of research, there is an extensive literature that investigates the relevance of commodity prices and TOT shocks in emerging markets. I will only mention a few of them that I consider important influences to the present article: Blejer (1983) studied the effect of foreign prices on domestic price variability and found that the former had an important effect on the latter in Argentina due to its large share of traded commodities. Regarding the impact on activity, the influential work of Mendoza (1995) used a calibrated business cycle model and found that TOT disturbances can explain the bulk of the output fluctuations in developing countries. Consistent with these results are those of Kose (2002), who extends Mendoza's by splitting the production function into a exportable primary good and a non-traded final good, and Agénor et al. (2000), who search for business cycle regularities in these economies and find that the TOT and output fluctuations are strongly positively correlated. Similar conclusion are reached by Loayza & Raddatz (2007) via a a cross-country panel, semistructural VAR. Finally, Camacho & Perez-Quiros (2014) use a reduced-form Markov-switching model that allows for non-linearities and find that commodity price shocks are procyclical, although this depends on the size and sign of the shock, as well as on the state of the economy.

Additionally, there are other articles in which the TOT or commodity prices' effects on macroeconomic aggregates are conditional on the adopted exchange rate regime, which leads us to the second strand of literature related to the present work. The seminal contribution of Friedman (1953) was followed by several works that confirmed the argument that flexible exchange rates have better insulating properties than fixed rates. For developing countries, Broda (2001) and Broda (2004) use a panel VAR to find that TOT shocks explain approximately 10% of output volatility in the case of floating regimes, while the corresponding figure for pegged currencies is 30%. Similar results are obtained by Lanteri (2008) and Lanteri (2011), who employ a structural VAR and a structural VEC, respectively, to study Argentina.

Despite the solid conclusions in academia in favor of floats, emerging countries have hardly ever adopted a truly floating regime: Central Banks have sold foreign reserves aggressively to avoid large depreciations and have bought actively to prevent important appreciations. On the one hand, strong intervention to avoid currency devaluations has been called *fear of floating* by Calvo & Reinhart (2002). On the other hand, aggressive interventions to impede strong appreciations have been called *fear of appreciation* by Levy-Yeyati et al. (2013). In fact, Levy-Yeyati & Sturzenegger (2005) finds that *de jure* floats are better described as *de facto* dirty floats.

Most Latin American countries adopted a countercyclical exchange rate during commodity boom. While Levy-Yeyati et al. (2012) argues that this *leaning against the wind* policy had the objective of accumulating reserves, Frenkel & Rapetti (2012) and Ahumada & Cornejo (2015) contend that it served the development of the country by avoiding the Dutch disease. Additionally, Daude et al. (2016) claims that the countercyclical exchange rate policy should rather be regarded as the desire on the part of the monetary authority to maintain real exchange rate stability in an attempt to reduce macroeconomic and financial volatility.

This paper attempts to contribute to these two lines of research: on one side, my goal is to present a quantitative assessment of the effects of the commodity boom in Argentina. On the other side, I seek to derive some policy lessons from the comparison of the effects the boom had in Argentina *vis a vis* other comparable nations in the region.

3 Methodology

To analyze the effects of commodity shocks, the following structural moving average (MA) model is used[3]:

$$x_t = \Theta(L) w_t \tag{1}$$

where x_t is a $Kx1$ vector of endogenous stationary variables, Θ are h matrices of KxK dimension (with h as the desired horizon of the impulse response function – IRF), L is the lag operator, and w_t is a $Kx1$ vector of structural shocks, in the sense that they are mutually uncorrelated and have an economic interpretation. If $\Theta(L)$ is invertible, then

[3] The methodology is based on Lutkepohl (2005) and Kilian & Lutkepohl (2017).

(1) has the following structural VAR (p) representation[4]:

$$\begin{aligned}
&B(L)x_t = w_t \\
&(B_0 - B_1L - B_2L^2 - ... - B_pL^p)x_t = w_t \\
&B_0x_t - B_1x_{t-1} - B_2x_{t-2} - ... - B_px_{t-p} = w_t \\
&B_0x_t = B_1x_{t-1} + B_2x_{t-2} + ... + B_px_{t-p} + w_t
\end{aligned} \tag{2}$$

where $B(L) = \Theta(L)^{-1}$.

We can express (2) in its reduced form as:

$$x_t = A_1x_{t-1} + A_2x_{t-2} + ... + A_px_{t-p} + u_t \tag{3}$$

where $A_i = B_0^{-1}B_i$ (with $i = 1, \dots, p$) and $u_t = B_0^{-1}w_t$ are *iid* reduced-form residuals with covariance matrix Σ_u, and B_0 is the impact matrix[5]. There are two important decisions to make for estimating (3) and computing the IRFs: we need to decide, first, which variables to include in x_t and, second, which restrictions to impose on B_0 such that orthogonal disturbances can be recovered from the reduced-form residuals. Here, I based both decisions on the dynamics observed in the model of Lubik & Schorfheide (2007), which is a prototypical DSGE NK model for a small open economy.

Next, I provide both a description of the model and a simulation of a TOT shock. The model features a dynamic IS curve:

$$\begin{aligned}
y_t =& E_ty_{t+1} - [\tau + \alpha(2-\alpha)(1-\tau)](R_t - E_t\pi_{t+1}) - \rho_z z_t \\
&- \alpha[\tau + \alpha(2-\alpha)(1-\tau)]E_t\Delta q_{t+1} + \alpha(2-\alpha)\frac{1-\tau}{\tau}E_t\Delta y^*_{t+1}
\end{aligned} \tag{4}$$

where $0 < \alpha < 1$ is the import share; τ is the intertemporal elasticity of substitution between home and foreign goods; y_t is aggregate output; π_t is the CPI inflation rate; Δq_t are changes in the TOT, defined as the relative price of exports in terms of imports, and follow an AR(1) process; R_t is the nominal interest rate; y_t^* is an AR(1) exogenous process representing world output; and z_t is an AR(1) technology process with ρ_z as persistence parameter. The price dynamics follow an open economy NK Phillips curve:

$$\pi_t = \beta E_t\pi_{t+1} + \alpha\beta E_t\Delta q_{t+1} - \alpha\Delta q_t + \frac{\kappa}{\tau + \alpha(2-\alpha)(1-\tau)}(y_t - \bar{y}_t) \tag{5}$$

[4] The invertibility of $\Theta(L)$, i.e., the fundamentalness condition, implies that the structural MA has a reduced-form VAR representation. This comes down to ensuring that the information at the econometrician's disposal is sufficient to recover the structural shocks from the data. In this work, I do not formally address the fundamentalness condition. The interested reader can consult Alessi et al. (2011).

[5] Although the estimation includes a constant vector, it is not included in (3) for expository purposes.

where $0 < \beta < 1$ is the household discount factor, and $\kappa > 0$ is the slope of the Phillips curve that captures the degree of price stickiness. Potential output, defined as output in the absence of nominal rigidities, is as follows:

$$\bar{y_t} = \frac{-\alpha(2-\alpha)(1-\tau)}{\tau} y_t^* \tag{6}$$

The monetary authority sets the interest rate according to the following policy rule:

$$R_t = \rho_R R_{t-1} + (1-\rho_R)(\phi_\pi \pi_t + \phi_y y_t + \phi_e \Delta e_t) + \varepsilon_t^R \tag{7}$$

where e_t is the nominal exchange rate, $\phi_\pi, \phi_y, \phi_e \geq 0$ are the policy coefficients, $0 < \rho_R < 1$ is the persistence parameter, and ε_t^R is an exogenous money shock. In addition, relative PPP holds:

$$\pi_t = \Delta e_t + (1-\alpha)\Delta q_t + \pi_t^* \tag{8}$$

where π_t^* is an AR(1) world inflation shock[6]. The model is simulated with Dynare using the parameter values of the benchmark posterior distribution obtained by Lubik & Schorfheide (2007) with data from Canada[7]. According to the model's IRFs, plotted in Figure 2, a positive TOT shock increases output and decreases inflation on impact because of a nominal appreciation. As the monetary authority responds to the exchange rate, the interest rate is reduced, which further increases output and raises inflation. In the following section, the reader will find that the VAR estimates generate responses that are qualitatively similar to those generated by the DSGE model, except for inflation on impact.

The dynamics observed in Figure 2 will define which variables to include in the estimation of (3)[8]. However, there are two differences in the data I use for the estimation of (3) with respect to those used by Lubik & Schorfheide (2007) in their estimation of the model (4)-(8): first, I use commodity prices instead of TOT, as the goal of the paper is precisely to estimate the effects of the commodity boom. In this sense, I assume that increases in commodity prices have similar dynamics to rises in TOT, which seems reasonable since export prices are driven primarily by commodities in Latin America. Second, industrial production (IP) or economic activity indexes are used as the output measure, meaning that the VAR estimation can be at a monthly rather than the quarterly frequency that

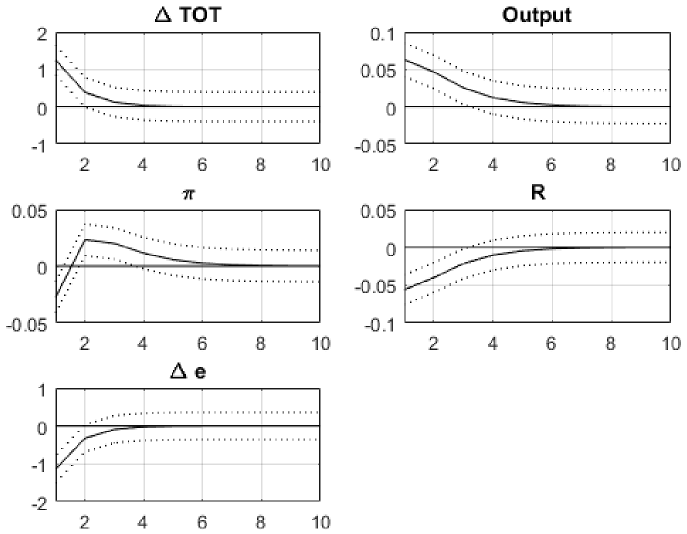
[6] π_t^* can also be interpreted as deviations from relative PPP.

[7] Dynare is an application hosted by Matlab software and developed by Adjemian et al. (2011). This application linearizes the system (4)-(8) around the steady state, finds the solution with the Sims (2002) method and provides statistics and IRFs.

[8] Some readers might wonder why a SVAR approach is used instead of a fully structural analysis that can be implemented by estimating the system (4)-(8) using Argentinian data. The reason is that the DSGE model relies on assumptions that might not apply in the case of Argentina: i.e., there was no inflation targeting during the analyzed years, such as the targeting implied by the monetary rule (7). It is then preferable to use the DSGE model only to select the VAR variables and restrict the impact matrix B_0.

would be available if GDP were used. Increasing the number of observations is advisable given the short time period analyzed, which allows greater precision in the estimation. In addition, it is reasonable to consider private agents, as well as the central bank, responding within the month to commodity price shocks in countries that are mainly commodity exporters, as my case studies are.

Fig. 2: DSGE IRFs. Effects of a one-standard-deviation TOT shock with 68% (···) confidence bands



Consequently, in (3), $x_t \equiv [\Delta cp_t \quad \Delta y_t \quad \pi_t \quad R_t \quad \Delta e_t]'$, with $\Delta cp_t, \Delta y_t, \pi_t, R_t$ and Δe_t being the yearly changes in commodity prices, yearly growth rate in the IP Index, yearly CPI inflation, nominal interest rate and yearly variations in the nominal exchange rate, respectively (see the Data Appendix on page 16 for details). I obtain six different estimations of (3), one for each country: Argentina, Brazil, Chile, Colombia, Mexico and Peru. To select the lag order, I use a maximum lag of 18 months and follow Ivanov & Kilian (2005), who recommend the Akaike information criterion for monthly VARs. I estimate (3) with OLS and, once stationarity is verified, the process is considered in its MA reduced form:

$$x_t = \Phi(L)u_t \tag{9}$$

where $\Phi_h = J\mathbf{A}^h J'$, $\mathbf{A}$ is the companion matrix, and $J := [I_K : 0 : \cdots : 0]$. Considering that $\Theta_h = \Phi_h B_0^{-1}$, we can recover the structural shocks from (9) once we know B_0. The approach adopted here is to impose the dynamics observed in Figure 2: i.e., all variables respond on impact to the shocks, as is common in a DSGE framework. One simple way of achieving this is by performing a Cholesky decomposition of the covariance matrix $chol(\Sigma_u) = B_0^{-1}$ and assuming that the first structural shock in w_t is an innovation in commodity prices. The Cholesky identification is appealing in this case because both orthogonality and an economic interpretation of the structural shock are achieved simultaneously. In addition, this identification does not constrain the sign of the response as would be the case under a *sign restrictions* scheme. In this sense, we are *letting the data speak* in a minimally restrictive environment. If we assume that the impact matrix is $\Theta_0 = \Phi_0 B_0^{-1} = I_K B_0^{-1} = B_0^{-1}$, the responses in the first period are as follows:

$$\underbrace{\begin{bmatrix} \Delta cp_t \\ \Delta y_t \\ \pi_t \\ R_t \\ \Delta e_t \end{bmatrix}}_{\mathbf{x}_{t=0}} = \underbrace{\begin{bmatrix} \theta_{11} & 0 & 0 & 0 & 0 \\ \theta_{21} & \theta_{22} & 0 & 0 & 0 \\ \theta_{31} & \theta_{32} & \theta_{33} & 0 & 0 \\ \theta_{41} & \theta_{42} & \theta_{43} & \theta_{44} & 0 \\ \theta_{51} & \theta_{52} & \theta_{53} & \theta_{54} & \theta_{55} \end{bmatrix}}_{\Theta_0 = B_0^{-1}} \underbrace{\begin{bmatrix} w_t^1 \\ w_t^2 \\ w_t^3 \\ w_t^4 \\ w_t^5 \end{bmatrix}}_{w_{t=0}} \tag{10}$$

In (10), w_t^1 is interpreted as a commodity shock, whereas the other disturbances $w_t^2, \ldots, w_t^5$ do not have an economic interpretation and are, thus, left unidentified. This semi-structural or partial identification is common practice in the VAR literature (see Kilian (2011)). It implies that the unidentified shocks cannot contemporaneously affect the prices of commodities, which seems reasonable considering that, even if Argentina and the other Latin American countries analyzed here are large players in some commodity markets, they are nevertheless price takers. This identification scheme is similar to that employed by Edelstein & Kilian (2009) to analyze oil price shocks in the US. Kilian & Vega (2011) provide empirical evidence that supports the identifying assumption of predetermined oil prices for the US. In this sense, I am postulating that commodity prices in Latin American countries can be assumed to be an exogenous and predetermined variable, just as oil prices are in US.

Once the impact matrix is obtained, it is possible to calculate the IRFs, the accumulated responses and the variance decompositions with:

$$\begin{aligned} \frac{\partial \mathbf{x}_{t+i}}{\partial w_t'} &= \Theta_i \\ \Xi_n &= \sum_{i=0}^{n} \Theta_i \\ \omega_{jk,h} &= \sum_{i=0}^{h-1} (e_j' \Theta_i e_k)^2 / MSE[x_t(h)] \end{aligned} \tag{11}$$

respectively, where e_k is the k-th column of I_K, and

$$MSE[x_t(h)] = \sum_{i=0}^{h-1} \Theta_i \Sigma_u \Theta_i'$$

is the predictor that minimizes the forecast mean squared errors. The diagonal elements of this matrix are to be used in (11). Next, I use bootstrapping methods to characterize the extent of uncertainty around the estimates. Specifically, I generate 10,000 bootstrapped series by taking random draws of estimated residuals and feeding them back into the estimated series. For every bootstrapped series, there is a B_0 impact matrix that I use to generate the response distributions.

Finally, I take the average of the IRFs, the accumulated responses and the variance decompositions for Brazil, Chile, Colombia, Mexico and Peru to generate mean responses among these countries. In the following section, I compare the effects in Argentina with those in the other Latin American countries[9]. The reader should be aware that these comparisons still hold if the other Latin American countries are taken separately or if their IRFs are instead obtained using a Panel VAR[10].

4 Evidence

In Figures 3 to 6, I show the short-run IRFs, the accumulated responses and the variance decompositions to a 10% commodity price shock in Argentina and in the rest of the countries: Brazil, Chile, Colombia, Mexico and Peru. My goal is to verify whether the effects of the commodity shocks were significantly different between Argentina and the rest of Latin America and can, thus, help to explain the distinct macroeconomic results shown in Figure 1. As the reader will see, I find evidence suggesting that increases in commodity prices contributed to the higher inflation level and larger output and price volatilities observed in Argentina during the analyzed period.

Figure 3 shows the effects that commodity shocks had on output growth for Argentina and the rest of the countries considered. The first row shows that the impact was stronger in Argentina than the rest of the region. Thus, this evidence can explain part of the higher output volatility observed in Argentina. In particular, output increases to a maximum of 1% by the 4^{th} month, while the peak effect in the rest of Latin America is 0.6% around the same period. The influence of the disturbance is significant in all of the economies until the 8^{th} month.

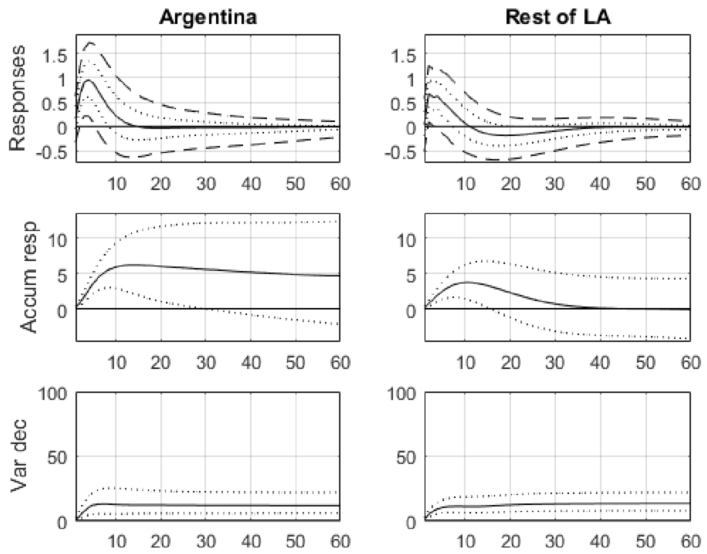
Regarding the accumulated response, the second row of the graph shows that it is clearly stronger in Argentina than in the other countries, which indicates that there were

[9]The Matlab routines I programmed to generate the results are available upon request.

[10]I obtain Panel VAR IRFs using the BEAR 3.0 toolbox of the European Central Bank and find no significant differences with the average IRFs reported below.

permanent effects in the output *level* in the former. In Argentina, it accounts for a 5% increase in the long run *growth* and is significant for more than two and a half years, while in the rest of the economies, there is almost no significant effect beyond the first year. This greater accumulated response in Argentina could be the result of a more aggressive intervention in the exchange rate market to prevent the local currency from appreciating. In fact, nominal exchange rate appreciation was weaker in Argentina than in the other countries after a commodity shock, as presented below. This suggests that the Argentinean Central Bank might have had pursued a stronger *leaning against the wind* policy, probably to avoid the Dutch disease.

Fig. 3: VAR IRFs. Effects of a 10% increase in commodity prices on output growth: median (—) with 68% (···) and 95% (−−) confidence bands

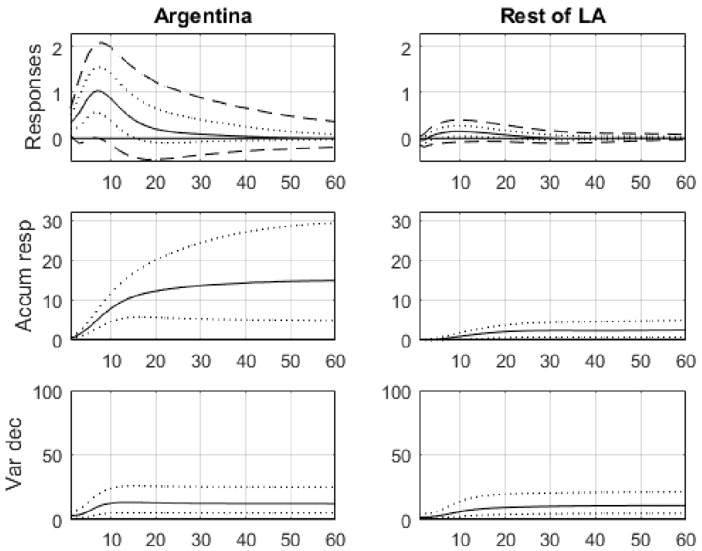


In the third row of the figure, I plot the forecast error variance decompositions of the disturbance, i.e., the contribution of commodity shocks to predict output fluctuations in my case studies. The estimates indicate that commodity innovations explain approximately 13% of output variations in Argentina by the end of the first year and a similar amount in the rest of the countries by the third year. This is, changes in output in the short run are somewhat more influenced by commodity shocks in Argentina than in the other economies. Although these disturbances can explain a moderate share of output fluctuations, their influence would probably be stronger if GDP were used instead of IP as the output measure.

Figure 4 reflects that there were significantly different effects of commodity shocks in Argentinean prices *vis a vis* the other countries. Specifically, the first and second rows of the figure show that IRFs and accumulated responses were much stronger in Argentina. Thus, this is evidence suggesting that the much higher level of inflation and greater price volatility observed in Argentina, as shown in Figure 1, were substantially due to the stronger influence of commodity shocks on Argentina's price levels.

Note that export taxes were implemented in Argentina in an effort to reduce the inflationary effects of commodity prices. These taxes were raised from 3% to 35% during the boom and became an important source of government revenue[11]. In addition, export taxes might have acted as a buffer on local inflation when subjected to commodity price shocks. Warr (2002) and Piermartini (2004) explain that such taxes often reduce domestic prices if the taxed commodity is also consumed domestically, as is the case in Argentina. Hence, the effects on prices might have been even stronger were it not for the export taxes.

Fig. 4: VAR IRFs. Effects of a 10% increase in commodity prices on inflation: median (—) with 68% (···) and 95% (−−) confidence bands



The first row of Figure 4 shows a peak effect in Argentina of 1% in the 8^{th} month and of 0.15% for the rest of the region. Interestingly, the effect on impact is much stronger in Argentina than in the other countries: approximately 0.3% within the same month as the shock in the former, while it is only significantly different to 0 from the 6^{th} month in the latter. This seems consistent with the weaker exchange rate appreciation on impact observed in Argentina than in the other countries, as shown below[12].

[11]For a discussion of the role of export taxes in emerging nations, see Gómez-Sabaini (1990) and Hwang & Mai (1999).

[12]If we compare the qualitative effect of commodity innovations in the VAR with that derived from the

The second row reports the accumulated responses. They indicate that the long-run effect in Argentina was considerably larger than that in the rest of the region. Specifically, the results indicate that in Argentina, there was an accumulated effect of 10% immediately after the first year, evincing an important pass through of commodity to local prices. Over longer term horizons, the effect increases to approximately 15%, while the long-run effect in the rest of the region is, at the most, barely 2%. This evidence indicate that the price *level* was much more affected in Argentina than in the other countries.

The third row of Figure 4 plots the variance decomposition of the inflation associated with commodity innovations. The bulk of variations in prices do not come from the analyzed shock, although some differences found are noteworthy. In particular, the change in Argentinean prices is almost twice as large in the short run: it is 13% by the end of the first year in Argentina, while it is 7% for the rest of the region.

The first row of Figure 5 shows that the exchange rate response in Argentina was much weaker than in the rest of the region. This implies that the monetary authority in Argentina might have targeted a stable nominal exchange rate at the expense of a higher impact on output and inflation, as shown in Figures 3 and 4. In effect, the appreciation is more than twice as strong in the Latin American average than in Argentina. While in the latter case, the nominal exchange rate appreciates at most by -1.5% in the 3^{rd} month, in the former it appreciates by -3.2% at that same month. It is also more persistent in Latin America than in Argentina: it is significant for eight months in the former but only for five in the latter.

The accumulated responses of the exchange rate to the innovations in commodity prices are plotted in the second column of Figure 5. It is evident that the accumulated appreciation was much stronger in the rest of Latin America compared with that in Argentina. In particular, the maximum accumulated appreciation by the end of the first year is -10% for Argentina, but the corresponding figure for the other countries is nearly twice as large. Over longer horizons, the point estimates indicate -5% appreciation for Argentina and a -13% in average for the rest of the economies. In addition, the accumulated response is significantly different from 0 for two years for all of Latin America, but this is the case for only nine months in Argentina.

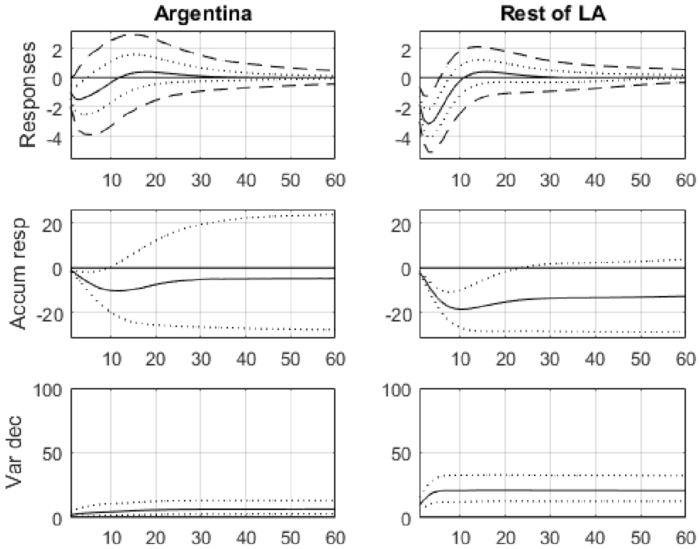
The third row of Figure 5 plots the variance decomposition and indicates that commodity shocks contributed considerably more to fluctuations in the exchange rate in the other Latin American countries than in Argentina. While in the latter it amounted to a maximum of 6% by the 3^{rd} year, in the former, it had reached 20% by the 6^{th} month.

Finally, the first row of Figure 6 shows the IRFs of the interest rate when subjected to an innovation in commodity prices. The response in the short run is quite different

DSGE model when subjected to a TOT shock, we find some differences. In particular, Figure 2 shows a negative effect on impact due to a strong nominal appreciation, such that relative PPP (8) holds. Regarding the VAR response in Figure 4, the weak appreciation observed below in my case studies is consistent with a rise in short-run inflation.

in Argentina than in the rest of the countries. Specifically, interest rate in the former is significantly reduced in the short run, which suggests there was a policy reaction to appreciations in the nominal exchange rate[13]. The second row shows that the long-run response is almost insignificant for all countries. Regarding the variance decomposition of the third row in the graph, the fluctuations in the interest rate attributable to commodity shocks were higher in Argentina until the 7^{th} month but stronger in the other countries at longer horizons. For the infinite horizon ($\approx$ 10 years), it accounted for 6% in Argentina and 14% in Latin America.

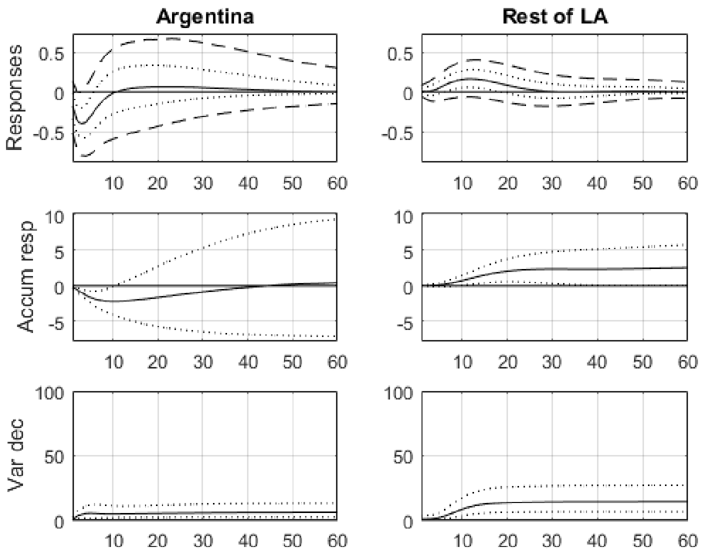
Fig. 5: VAR IRFs. Effects of a 10% increase in commodity prices on nominal exchange rate variations: median (—) with 68% ($\cdots$) and 95% ($--$) confidence bands



In sum, my results demonstrate that the commodity boom affected Argentina quite differently than the rest of the region. Argentina experienced a larger impact on output and inflation from innovations to commodity prices during the boom, while its nominal exchange rate response was weaker than in the rest of the Latin American economies. This evidence can be interpreted as stronger exchange rate countercyclicality in Argentina than in the country's regional counterparts, which can account for the higher inflation and stronger output and price volatilities observed in this country during the period of analysis. In other words, the evidence indicates that the commodity boom hit harder in Argentina because of its more active exchange rate policy.

[13]This reduction observed in the Argentinean interest rate resembles that of the DSGE estimates presented in Figure 2.

Fig. 6: VAR IRFs. Effects of a 10% increase in commodity prices on the interest rate: median (—) with 68% (···) and 95% (−−) confidence bands



5 Conclusions

In this article, I estimate the effects of commodity shocks during the 2000s commodity boom in Latin America. Specifically, I investigate whether these disturbances are related to the different macroeconomic outcomes observed in Argentina and the other major economies in the region during the boom: i.e., the higher level of inflation and greater price and output volatilities observed in Argentina. I find that innovations to commodity prices did have an important influence on the level of inflation and the greater output and prices variability observed in Argentina.

My estimates can be interpreted as differences in policy reactions across my case studies, as the results suggest that the monetary authority in Argentina might have acted more aggressively in the exchange rate market than its counterparts did. It can be then argued that this stronger *leaning against the wind* policy resulted in a weaker appreciation of the nominal exchange rate in Argentina than in the rest of the region when subjected to rises in commodity prices. The reason for this greater presumed activism by the Argentinean monetary authority in the exchange rate market was very likely to avoid the Dutch disease, as proposed in previous works. In fact, the output *level* was significantly more affected in Argentina than in the rest of the region after the increases in commodity prices during the boom. Nevertheless, there were side effects that consisted of the larger inflationary impact and greater volatility in output and prices suffered by Argentina.

Some policy implications can be derived from these results. There was a trade off in macroeconomic outcomes during the boom: either achieving higher growth at the expense of greater volatility and, especially, higher inflation or reducing inflationary pressure with a weaker boost in activity. The former was achieved by more aggressive countercyclical exchange rate policy, whereas the latter arose from efforts to allow greater flexibility in the currency. While Argentina seemed to have opted for the first outcome, the rest of the region chose the second. It remains a question for local monetary authorities to determine which stance to adopt in the future if commodity prices begin rising again.

A Data Appendix

In Figure 1, I use quarterly series for real GDP and monthly series for CPI inflation. The Latin American average plotted in Figure 1 is obtained by taking the mean values of Brazil, Chile, Colombia, Mexico and Peru. The sample period is from 2003:Q2 to 2015:Q4. The sources are the corresponding National Statistics Institutes, except for Argentina, for which CPI inflation is obtained from Cavallo (2012) between 2007 and 2015 because the official inflation estimates are known to be much lower than the true value. Official Argentinian GDP were also affected by poor statistics during the analyzed period (see Camacho et al. (2015)). However, the official estimates had been corrected by the time this paper was written.

To estimate (3), I use yearly growth rates of the commodity price index, the IP index (EMAE for Argentina), the CPI, the nominal exchange rate and the nominal interest rate. The commodity price index is the General Commodity Index taken from the IMF, which includes all commodities (farming, minerals and oil). For the interest rate, I take the monetary policy rate (for Argentina, I use the Call rate). All variables are at a monthly frequency. The data are from June 2003 to December 2015. Data sources are Argentina (INDEC, BCRA, Cavallo (2012) for CPI since 2007), Brazil (IBGE and BCB), Chile (INE and Central Bank), Colombia (Central Bank), Mexico (INEGI and Central Bank) and Peru (Central Bank). One last point deserves mention: the nominal exchange rate in Argentina, where there was an official value (with limited access to the public) and an unofficial value between 2012 and 2015. In the estimation, I use the unofficial exchange rate taken from the Argentinian newspaper Ámbito Financiero for these years. In any case, the official and unofficial exchange rates are highly correlated ($\rho = 0.9$), and selecting one over the other does not substantially affect the results.

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