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Real Exchange Rate Uncertainty and Output: A Sectoral Analysis

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Abstract: Developing countries exhibit a more uncertain economic environment than developed countries. Argentina, Brazil and Uruguay in particular, display high levels of real exchange rate uncertainty. Moreover, a succession of trade agreements among them, culminating in the creation of Mercosur in 1991 have increased intra-regional trade. This paper examines empirically the impact of real-effective-exchange-rate (REER) uncertainty on the output of 28 manufacturing sectors in Argentina, Brazil and Uruguay over 1970-2002. It provides alternative uncertainty measures that take into account the non-normality of the REER distribution by considering its higher moments (skewness and kurtosis) and different degrees of sophistication in agents' expectation formation, and estimates an augmented supply function using sectoral data on output, prices, and including these measures of REER uncertainty. Two different sets of instruments are used for domestic prices, in order to deal with the simultaneity problem that arises in the estimation of the supply function. Results suggest a negative non-negligible effect of uncertainty on output, homogeneous across countries. Interestingly, there is evidence of threshold effects, so that uncertainty affects output negatively when it exceeds some critical level. In addition, the effect is heterogeneous across sectors. This is explained by trade orientation, the intensity with which the sector trades within Mercosur and by sectoral productivity. Sectors that trade more intensively within Mercosur are more affected by REER uncertainty than those predominantly oriented to the rest of the world. Second, more productive sectors are less affected by REER uncertainty than those that are less productive.'

JEL Classification: E23, F15, F31

Key Words: Uncertainty, Exchange rates, Output growth, Regional Integration, Instrumental Variables

1 Introduction

It is a well established fact that developing countries have experienced a more uncertain economic environment than developed countries. Within developing countries, heterogeneity is quite marked, and it can be shown that Mercosur countries have a particularly high volatility record, which in turn generates a more uncertain environment.[1] At the same time several trade agreements, and then the creation of Mercosur have resulted in an increase in intra-regional trade, which has been heterogeneous across sectors and countries, but generalized, and has therefore implied an increase in exposure to markets characterized by uncertainty.[2]

The extant literature on uncertainty and productive decisions has generally focused on investment, given the irreversibility that surrounds this decision, after the pioneering work of Hartman (1972), Abel (1983), and McDonald and Siegel (1986). Their theoretical contributions have been matched by extensive empirical research. However, less attention has been put on the impact of uncertainty on output — the textbook approach that follows from the seminal work of Hawawini (1978), predicts that the output response to price uncertainty will depend on the firm's attitude to risk. The relatively low interest in the uncertainty-output link is surprising given that production is also characterized by some degree of irreversibility, as firms have to pay for inputs before output is sold, thus making any decision to produce an inherently risky investment decision. This has been argued by Greenwald and Stiglitz (1993) who develop a production model in which firms finance working capital through borrowing and face bankruptcy costs. Then, an increase in price uncertainty will induce firms to contract output, even if firms are neutral to risk, as the probability of falling into bankruptcy will increase. In Varela (2009), we adapt their model to a context in which uncertainty comes from real exchange rates and firms contract dollar-debt, and show that the contraction of output after an increase in real exchange rate uncertainty depends both on how productive the firm is and on the size of the currency mismatch in the firm's balance sheet, which in turn depends on the trade orientation of the firm.[3]

Given the aforementioned uncertain macroeconomic environment, the increase in the relative importance of Mercosur partners for the different manufacturing sectors, and the scant empirical literature on the effects of uncertainty on output, this chapters explores empirically the impact of uncertainty on the output of manufacturing sectors in Mercosur member countries, concentrating on one particular dimension of macro uncertainty: that of the Real Effective Exchange Rate (REER). In these

[1]For example, Hausmann et al. (2004) document large cross-country differences in the long run volatility of the real exchange rate between developing and developed countries. In particular, they show that the real exchange rate of developing countries is approximately three times more volatile than the real exchange rate in industrial countries. We compare series on GDP growth, CPI inflation, and nominal exchange rate depreciations for Argentina, Brazil and Uruguay, with those for Australia, Canada, New Zealand and the United Kingdom and find that for the former group of countries, the standard deviation of the series is systematically larger than for the latter — this is reported in Table 12 of the Appendix B.

[2]The heterogeneity across sectors in this process can be exemplified. For example, in Argentina, sector 311 (Food Processing) increases its participation of intra-region exports from 2.71 percent to 4.85 percent while sector 384 (transport materials) increases its share from 13.33 to 34.01 percent.

[3]This is an unpublished manuscript that corresponds to the first chapter of my DPhil thesis, available upon request.

countries the expected value of the REER and the uncertainty surrounding that expectation are key factors affecting most production decisions and not only those that imply cross-border transactions. There are three reasons for this. First, the REER has an effect on the price of tradable goods sold by manufacturers. Second, because during much of the 1980s and 1990s a large portion of firms contracted dollar-debt to finance their production plans, and third, because hedging instruments to cover against exchange rate risk have been largely unavailable. A pilot survey conducted on Uruguayan firms at the beginning of the research confirmed that the evolution and predictability of the REER are among the top concerns of manufacturers.[4]

Our contribution in this chapter is threefold. First, we identify the average effect of REER on output in the manufacturing sectors of Mercosur countries. For these purposes, we estimate an output supply function using data from 28 manufacturing sectors in Argentina, Brazil and Uruguay over the period 1970-2002, tackling the output-price simultaneity problem with instrumental-variable techniques, and using alternative sets of instruments to check the robustness of our results, whilst also allowing for heterogeneous effects across countries.[5] Second, we test for the presence of threshold effects on the relationship between REER uncertainty and output. Third, we test for sectoral heterogeneity in the output response to REER uncertainty and try to identify whether trade orientation, the intensity with which the sector trades within Mercosur, and labour productivity are drivers of that heterogeneity.

We present new evidence suggesting that REER uncertainty has negatively affected, on average, the level of output produced in the manufacturing sectors in Southern Cone countries over the period 1970-2002. Further to this, we find that the average effect masks significant specificities in the relationship. Although the effect seems to be stable when allowing for country heterogeneity in the response, there seems to be a threshold above which uncertainty affects output negatively, but below which the effect may even be positive. Moreover, those sectors that exhibit a higher exposure to export markets tend to be less responsive to REER uncertainty, although the opposite is true for those that trade intensively with Mercosur member countries. In addition, those sectors displaying a higher degree of labour productivity are less sensitive to REER uncertainty. Last but not least, we find that output is not only responsive to the first two moments of the distribution of REER (mean and variance), but also to higher moments such as skewness and kurtosis.

The remainder of the chapter is structured as follows. Section 2 describes the sources for the data used in this chapter. Section 3 documents the stylized facts that motivate this paper and the research questions. Section 4 presents the methodology to be used. Section 5 presents and discusses the results, and finally Section 6 concludes.

2 Data

To explore the empirical relation between output and REER uncertainty, we draw from the PADI dataset, complied by the ECLAC, on yearly series of sectoral output, prices, exports and labour productivity for 28 manufacturing sectors at a 3-digit aggregation, for the period 1970-2002, for Argentina, Brazil and Uruguay. REER data are also obtained from ECLAC with monthly periodicity (the REER is

[4]The importance attached to REER evolution among manufacturers and policymakers is not restricted to Uruguay, as discussed in Frieden and Stein (1999).

[5]Paraguay is excluded from the analysis as data for that economy are unavailable.

defined such that increases correspond to real depreciations and it is calculated as the weighted average of the bilateral real exchange rates, with the trading partners, where the weights are defined according to the trade share explained by each of the partner). Other macro variables used, such as GDP and population growth are obtained from the IFS database of the IMF. We use Reinhart and Rogoff (2009)'s indicator of crises "BCDI" (banking, currency, default, and inflation). Data on exchange rate regimes ('fixed', 'floating' or 'intermediate') follow the classification of Levy-Yeyati and Sturzenegger (2005). A brief description of the main series used in the analysis and some descriptive statistics is presented in Appendix A.

3 Integration and REER Uncertainty

This paper is motivated by two stylized facts: a) the increase in trade integration among Southern Cone countries during the period 1970-2005, and b) the high record of REER uncertainty exhibited over this period, by these economies. In this section we document trade integration among Mercosur member countries using export intensity indices (EII) (defined below), and REER uncertainty using three alternative measures.[6]

3.1 Trade Integration: Measurement and Evolution

The increase in trade integration among Mercosur member countries is documented using export intensity indices (EII), a measure of intra-bloc export penetration introduced by Anderson and Norheim (1993) that adjusts the traditional regional export shares, using as a parameter the relevance of the region in world exports, by simply dividing the regional export share by the region's share of the world imports.[7]

$$\left(\frac{X_{i,m}}{X_{i,w}}\right) \Big/ \left(\frac{X_{m-,w}}{X_{w,w}}\right) = EII_{i,m} \tag{1}$$

where $X_{i,m}$ are exports from country 'i' to Mercosur, $X_{i,w}$ are exports from country 'i' to the world (including Mercosur), $X_{m-,w}$ are exports from Mercosur excluding country 'i' to the world, $X_{w,w}$ are the world's total.

As can be seen in Equation 1, the EII yields the quotient of the ratio of openness of country 'i' to Mercosur and that of Mercosur to the world. If trade was frictionless and balanced, and if goods were homogeneous, then, these two ratios should be equal. If, for example, the value of Uruguayan exports to Mercosur is 10, while the value of total Uruguayan exports are 90, then trade would not be regionally biased if the weight of Mercosur in the world is one ninth, measured as the participation of Mercosur exports (excluding Uruguay) on total world exports. Thus, $EII = 1$. This will be our benchmark for comparison.

[6]In this paper we use "Southern Cone countries" and "Mercosur member countries" interchangeably referring to Argentina, Brazil and Uruguay. Only trade data are available for Paraguay. For this reason, we excluded it from the analysis in the rest of the paper.

[7]The use of export shares is avoided as these could give a misleading message. Take a scenario in which Mercosur is expanding much faster than the rest of the world economies, it will naturally account for more of everybody's exports through time, quite independently of any policy interventions aimed at increasing trade integration. Data are obtained from the Comtrade Database of the World Bank.

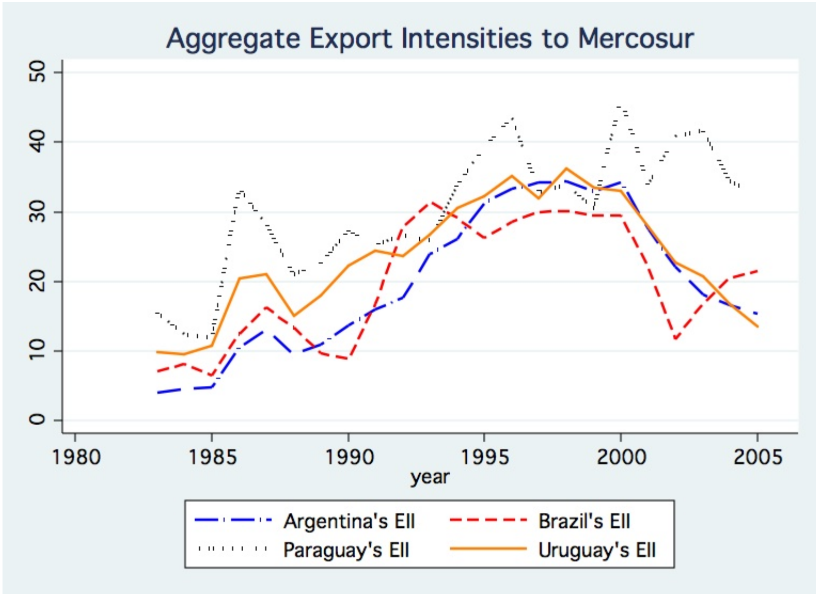

Figure 1: Mercosur - Aggregate Export Intensities (Source: Comtrade)

The evolution of the EII over the period 1983-2005 is presented in Figure 1.[8] During the nineties, the intra-bloc export intensity indices exhibit an inverted-U shape for Argentina, Brazil and Uruguay.[9].

The increase the EII exhibit for the first part of the 1990s can be attributed to a systematic decrease in intra-bloc trade protection, including reductions of both tariff and non-tariff barriers to intra-bloc trade. Plausible explanations for the trade reversal observed in the late 1990s are: a) the important rise in ad-hoc within-bloc tariff and non-tariff barriers that were imposed after 1999 — this rise corresponds to an attempt to counteract the enhanced competitiveness of the trading partners whose currencies had been devalued[10] — and b) trade agreements that Mercosur as a bloc, or each of its member countries individually subscribe with third parties will affect the relative importance of Mercosur for each of its members, thus decreasing the EII. [11]

Despite the inverted-U shape, the comparison of the average EII in the period before the formation of the trading bloc (1983-1990) and after (1991-2005) shows

[8]The choice of the period of analysis was constrained by data availability.

[9] For Paraguay the evolution of the index is irregular. This is likely to be related to problems with reported data.

[10]ECLAC (2003), for example, argues that the shocks experienced by Mercousur countries had negative effects on the integration process. An example of this is the rate of 3% on all imports that was introduced by Uruguay as a service charge of the "Banco de la Republica". It also demanded funding for accepting Argentinean exports and implemented specific import duties in 2002. These led to a complaint lodged by Argentina to the Common Market Group. On the other hand, Paraguay established an import levy in 2001, on the basis of what it refers to as the "short-comings and inadequacy" of the Group's macroeconomic coordination. (pp:74-78) Furthermore, Fernandez-Arias et al. (2002) claims that "*The Brazilian devaluation of 1999 did produce substantial protectionist pressures, as well as a drastic drop in public opinion's surport for Mercosur in these countries.*". (p.6)

[11]ECLAC (2003), for example, claims that "*the mediocre results of the Doha Round of WTO negotiations mean that more emphasis is placed on the group's external relations*" (p. 80). One example, is the complementarity agreement reached with Mexico (Economic Complementarity Agreement No 55), which laid the foundations for free trade between Mercosur and Mexico in some specific sectors. More information on this and other agreements of Mercosur with third countries can be found in ECLAC (2003).

a significant increase in the indicator.[12] At the same time, the share of Mercosur exports on world exports decreased significantly. In other words, the regional bias in Mercosur exports increased over the period 1983-2005.

EII to Mercosur were also calculated at sectoral level, at 2-digit aggregation, using the ISIC-2nd-Rev classification. Figure 2 displays the evolution of these sectoral EII. The reversal in EII is also evident when looking at sectoral exports, although the overall trend is heterogeneous. Difference-in-means tests to compare the average EII over the period 1983-1990 against the average over the period 1991-2005, suggest that sectors 31, 32, 35, 38 and 39 (Other Manufacturing Industries, not included in the figures), which account for the largest portion of output in manufacturing, exhibit significant increases in the EII, indicating an increase in the geographical bias of exports. The lowest regional bias is displayed by sector 31, while sector 38 exhibits the highest. Sectors 33 (Manufacture of Wood and Wood Products, Including Furniture) and 36 (Manufacture of Non-metallic Mineral Products, except Products of Coal) are the exception, with the EII showing a negative trend over time.[13]

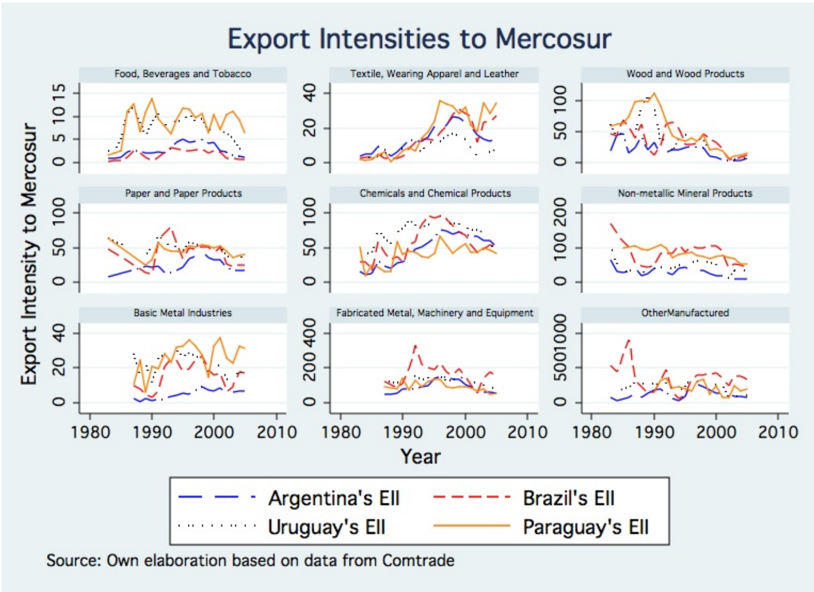

Figure 2: Export Intensities for All Sectors (ISIC-2 digit Classification (Source: Comtrade))

The size and evolution of the EII calculated at aggregate and sectoral levels reveal three patterns. First, there was an increase in the participation of Mercosur on total trade of its member countries. That this increase was not related to an increase in the importance of Mercosur in world markets, but to an increase in the importance of Mercosur for its member countries. Second, there are important regional biases, as the size of the EII is systematically larger than unity. The region is a key export destination for each of its members. Third, the picture is quite heterogeneous when looking at sectoral EII. The sectors that account for the largest

[12]The significance of the increase should be understood in the statistical sense. This comparison is performed using a difference-in-means' test. We compare the average intra-bloc EII over the period 1980-1990 against the average over the period 1991-2005. The null hypothesis is that the two values are equal.

[13]The results for sectors 34 (Manufacture of Paper and Paper Products) and 37 (Basic Metal Industries) are inconclusive as some countries have increased their intra-bloc EII while others have decreased it.

share in manufacturing do increase their regional biases in the period. In terms of the size of the bias, sector 31 shows the lowest, while 38 shows the highest.

3.2 REER Uncertainty: Measurement and Evolution

We use three alternative measures to proxy uncertainty with respect to REER changes that differ on the degree of sophistication assumed for the agent's expectation formation mechanism. The three measures assume that agents are backward-looking, and forecast using an autoregressive model. This model is estimated using monthly data on the REER as constructed by the Economic Commission for Latin America and the Caribbean. Although the assumption of backward-looking expectation formation mechanisms can be criticized, it is widely used in the literature.

Then, uncertainty surrounding that forecast is measured as the volatility of the forecast error of the past periods. Then, we use these monthly measures of uncertainty to obtain an annual one, to match the data on production and prices that will be used in the analysis that follows.

The first measure is obtained using Autoregressive Conditional Heteroscedasticity models (ARCH). In essence, the squared residuals of the series of the REER changes after being purged of its systematic component (the squared forecast errors) are assumed to be heteroscedastic. The structure of the heteroscedasticity (an autoregressive, and a moving average component) is estimated, and thus, a measure of the conditional variance of the series is obtained. This is taken to be the measure of REER uncertainty (Volat-ARCH). The relevant past volatility that determines the agents perception of uncertainty today is determined by the data.[14]

A simpler structure for expectation formation may be more appealing if there are costs of processing information. Although our second measure (Volat-RollVar) also assumes that agents forecast using an autoregressive rule, and that the forecast errors are heteroscedastic, now uncertainty with respect to REER changes is calculated as the rolling variance of the last twelve forecast errors. The difference with the first measure is twofold. First, with Volat-RollVar, we impose the lag structure that matters in determining today's uncertainty. With Volat-GARCH the choice is based on the best-fit of the model. Second, with Volat-RollVar we impose equal weights for each of the twelve months of the lag structure. With Volat-GARCH those weights are estimated by the model.

The third measure (Variance REER) assumes a naive agent with static expectations about the changes in the REER. The agent predicts no movement whatsover. As in the previous cases, REER uncertainty will be determined by the variance of the past forecast errors, but this variance will now be equal to the variance of the series of REER changes itself. Here as well, we impose a window of twelve months. Notice that if part of the REER changes are predictable, then this measure will be overestimating the forecast error, and thus, the amount of uncertainty perceived.

Given that the series of REER changes is found to be non-normal, higher moments need to be considered when characterizing the degree of uncertainty it generates, so we also include a measure of their skewness and kurtosis.[15] These measures are computed as twelve-month rolling skewness and kurtosis of the residuals of the

[14] The best-fit model for Argentina was an ARCH(2), for Brazil an ARCH(4) and for Uruguay an ARCH(4). These suggest a memory of 2 months in the conditional variance series for Argentina and of 4 months in the series for Brazil and for Uruguay.

[15] Gravelle and Rees (1992) show that when probability distributions cannot be fully characterized by parameters of location and scale, then, uncertainty generated by these variables can be understood by looking at all moments of the distribution and not only the first two.

best-fit ARIMA on the series of the REER growth, and are common for the three aforementioned measures of uncertainty.

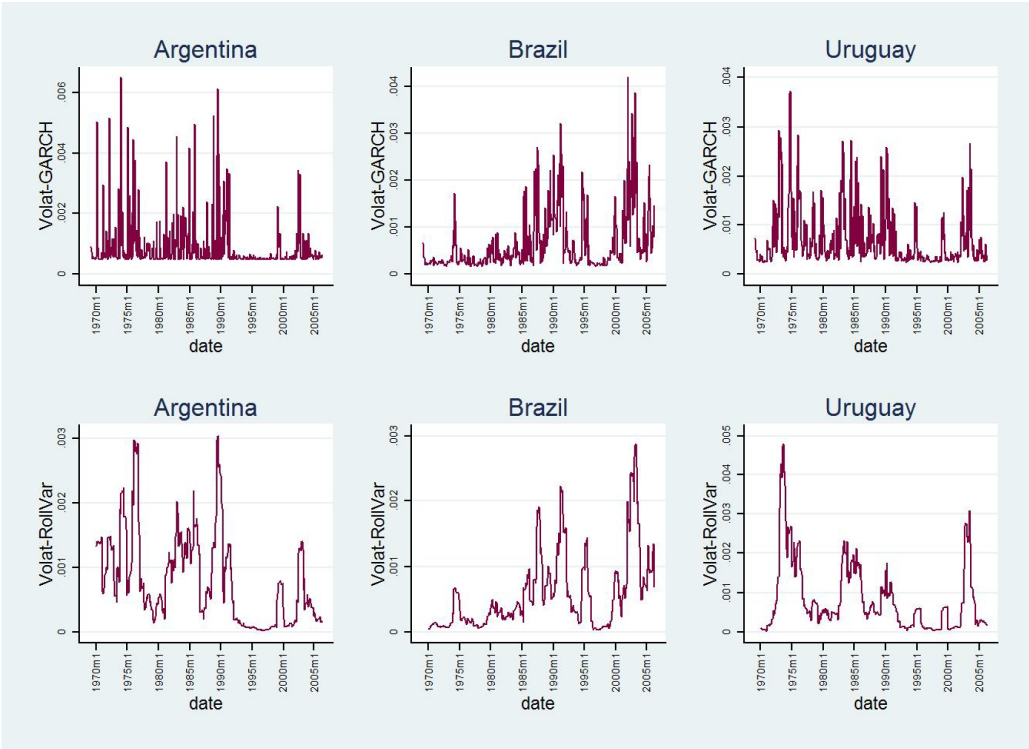

Figure 3: Conditional Variance of the REER growth

Figure 3 displays the evolution of the first two measures of uncertainty with respect to REER changes, constructed using monthly data, using the method described above, for each of the three countries considered, over the period 1969.01 to 2006.04.[16]

Averaging over the whole period, our measure of uncertainty for Argentina (the volatility of the forecast error) suggests a standard deviation from the mean equal to 3% or 2.8%, depending on whether we look at the Volat-GARCH (top) or Volat-RollVar (bottom) measure respectively. For Brazil, the standard deviation is 2.58% or 2.34% respectively and for Uruguay 2.67% or 2.93%. Given that the average of the absolute monthly changes in REER is around 4.8%, 2.25% and 2.5% for Argentina, Brazil and Uruguay respectively, the measures of uncertainty seem large, as they imply that on average, the size of the forecast error, relatively to the actual change in the REER is close to 60% for Argentina, and well above 100% for Brazil and Uruguay.[17] Even if large, these numbers are in sharp contrast with the third measure considered. The standard deviation of the growth rate of the REER, as reported in Table 10, equals, for Argentina 14.2%, for Brazil 3% and for Uruguay 6.3%. However, as argued before, it is likely that "Variance REER" is overestimating actual uncertainty.

The difference in the degree of inertia that can be observed in Figure 3 when comparing Volat-GARCH and Volat-RollVar is explained by the difference in the

[16]The conditional variance series plotted here are the author's calculations on the basis of data on REER obtained from ECLAC.

[17]These calculations are, of course, valid, under the assumption of agents forecasting using the autoregressive model described above. Descriptive statistics of the series of REER changes for the three countries are reported in Table 10 in the Appendix A.

methodology of construction. For Volat-GARCH, the estimated memory of the first measure is at most, of four months for the cases of Brazil and Uruguay, and two months for the case of Argentina, while the memory imposed on the Volat-RollVar measure is of twelve months. It is not surprising, then, that shocks to volatility appear to have a relatively shorter life when looking at the Volat-GARCH series than when looking at the Volat-RollVar series.

We have argued that REER uncertainty has been particularly high Southern Cone economies of interest in this analysis during the period 1970-2002. To investigate this matter, we ask the following question. How do Southern Cone economies fare in terms of REER uncertainty *vis-a-vis* other South American economies?

To answer the question, we calculate the same measures of uncertainty with respect to REER changes, but now for other South American countries, and perform a cross-country comparison across countries using difference-in-means tests, and comparing the magnitudes of the measures for Argentina, Brazil and Uruguay, versus that of the other countries. Table 1 shows the ratios of Volat-GARCH for country 'i' and country 'j'.[18] The intersection of the first row and first column shows the ratio in mean REER uncertainty between Argentina and Brazil ($Argentina's/Brazil's:1.39$). In this case, the difference is statistically significant at a 1% significance level. The ratio being larger than one informs us that uncertainty in Argentina has been significantly larger than in Brazil, on average, during the period of analysis. The size of the ratio and the results of the tests also suggest that the mean of Argentina's uncertainty over the whole period is significantly higher than that of any of the rest of the countries in the analysis, including the other Mercosur members. Brazilian REER growth volatility is also significantly higher than that of most of South American countries, except Argentina, Peru and Uruguay. Finally, Uruguayan REER growth volatility is significantly higher than that of all the rest of South American countries.[19] These results give empirical support to our statement, Argentina, Brazil and Uruguay have experienced a more uncertain environment with respect to REER.

Table 1: Ratios of Means of Volat-GARCH across Countries

Col Mean/ Row Mean	Argentina	Brazil	Uruguay
Argentina			
Brazil	1.390***		
Uruguay	1.262***	0.909	
Bolivia	2.512***	1.805***	1.988***
Chile	1.845***	1.326***	1.459***
Colombia	3.731***	2.688***	2.958***
Ecuador	2.114***	1.519***	1.672***
Peru	1.577***	1.134	1.248***
Venezuela	4.219***	3.030***	3.333***

Notes: '***' indicates differences are significant at 1%,
'**' significant differences at 5% and '*' significant diff. at 10%

We now turn our attention to the evolution over time of uncertainty with respect to REER in Argentina, Brazil and Uruguay. Our measures suggest that uncertainty

[18] The purpose of these tests is to be able to compare these figures in a robust way. We are not trying to test whether REER realizations of, say, Uruguay, come from the same parent population as REER realizations of Brazil. The same applies when the comparisons are made for a given country over time.

[19] The same conclusions emerge if we compare the uncertainty records using Volat-RollVar.

was larger during the 1970s and 1980s than during the 1990s and of 2000s, and the differences are significant at a 5%. No difference was found between the levels of the 1990s and 2000s. There are a number of episodes (currency crises and hyperinflation episodes) that can explain these differences by decade, the most notorious taking place in 1974, 1982 and 1989. The 1990s, by contrast, was a decade of relative stability due to the implementation of a price stabilisation plan with an exchange rate anchor which lasted until December 2001. The collapse of this last stabilisation plan did not come with extremely high records of inflation, as had happened during the 1970s and 1980s. That explains the relatively low records of uncertainty during the early years of 2000.

The top and bottom central panels of Figure 3 show the evolution of the Brazilian uncertainty, which appears to increase during the period. The period of the 1970s displayed the lowest REER volatility, exhibiting a peak around 1975. The 1980s and 1990s, which experienced two currency crises that respectively led to the implementation of the "Plan Cruzado" and the "Plan Real", and the 2000s, which experienced the shock of the Argentinean crisis, were significantly more volatile in terms of the REER than the 1970s. In turn, the first decade of the 2000 was significantly more volatile than the 1980s. The null of equal mean volatility across the 1980s and 1990s was upheld by the data.

In the case of Uruguay, the 1970s also experienced a peak of uncertainty around 1975 - this peak is the highest for the whole period, and it should be noted that unlike the Brazilian case, this peak was preceded and followed by relatively high levels of uncertainty, whereas the 1980s were hit by a number of high uncertainty episodes, some of domestic origin and some "imported": the currency crisis that affected a number of Latin American countries in 1982 and the hyperinflation episodes of the neighbour countries in 1986 and 1989. This can be observed in the top and bottom right-hand side panels of Figure 3, and it is also reflected in the statistical tests. The 1970s and 1980s were significantly more uncertain than the 1990s and 2000s in terms of the REER. The relative calmness of the 1990s is probably a consequence of a long-lasting price stabilisation plan based in a nominal exchange rate anchor, that was only abandoned in 2002 after the Argentinean collapse hit the Uruguayan economy severely, both on the trade and financial fronts. Differences between the 1970s and 1980s and between the 1990s and 2000s were not found to be statistically significant.[20]

Measures of Conditional Skewness and Kurtosis. The measures of conditional skewness and kurtosis of the residuals of the best-fit ARIMA on the series of the REER growth are calculated using a window of 12 months, and are common for the three measures of uncertainty. They are reported graphically in Figure 4. Symmetry in the distribution of Brazilian REER growth cannot be rejected while for Argentina and Uruguay the series are right-skewed, with a longer tail on the 'depreciation' side. The kurtosis indicator suggests non-normality of the series of REER growth.[21] Peaks in kurtosis are inevitably associated with episodes of exchange rate jumps or hyperinflation (1974, 1980, 2001 for Argentina; 1985, 1994 for Brazil; 2002 for Uruguay). The measure of kurtosis is significantly higher for Argentina and Uruguay than for Brazil, which suggests that more of the variation in the REER is due to extreme adjustments for Argentina and Uruguay than it is

[20] Table 11 in the Appendix A shows the ratios of the volatility of decade 'i' and decade 'j' for each Mercosur country.

[21] The null of normality is rejected at 99% significance.

the case for Brazil.

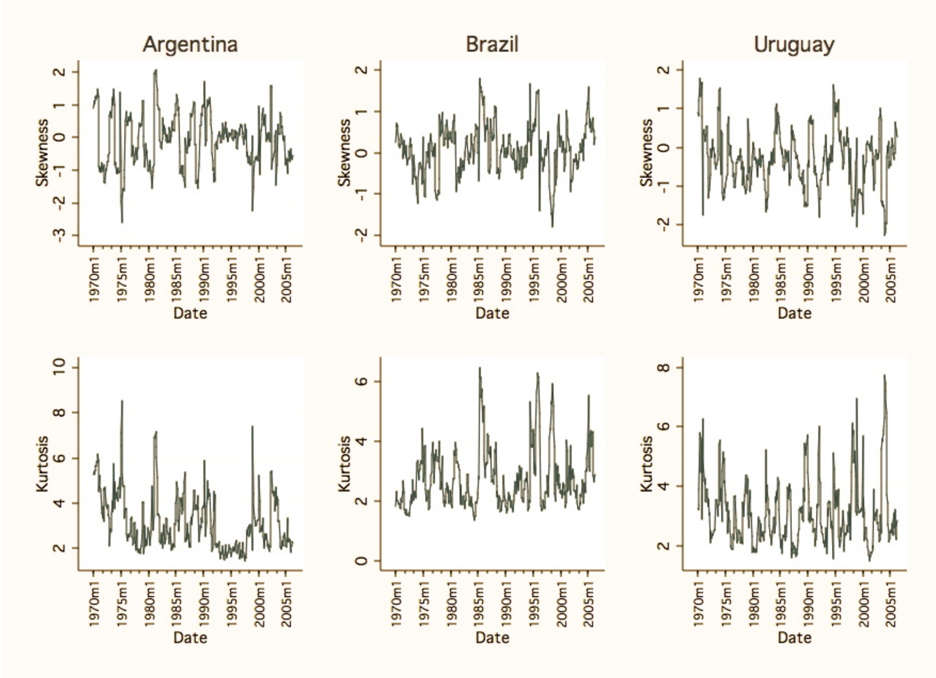

Figure 4: Conditional Skewness and Kurtosis of the REER

3.3 Research Questions

Given the two documented phenomena: that Mercosur countries have experienced an increase in integration over time, and that they exhibit a particularly high record of REER uncertainty, in what follows, the chapter attempts to answer these research questions:

1. What has been the impact of REER uncertainty on manufacturing output in Southern Cone countries over the period 1970-2002?
2. Has this impact been heterogeneous across countries?
3. Is the effect of REER uncertainty on output stable across different levels of uncertainty, or are there thresholds above which the effects change significantly?
4. Are there sectoral heterogeneities in the effect of REER uncertainty on output? Can the heterogeneity be accounted for differences in trade integration, and in particular, for differences in the export intensity to Mercosur?

4 Methodology

4.1 Baseline Model

To answer the research questions above, we specify a supply function and estimate it using the data described in Section 2 with yearly periodicity. Our baseline model relates real sectoral output supplied with real relative sectoral prices, real effective exchange rates, alternative measures of real exchange rate uncertainty (as described above), a measure of misalignment of the real exchange rate, an indicator of crises, dummies controlling for different exchange rate regimes, sector-country fixed effects and year dummies, as presented in equation (2):

$$\begin{aligned} q_{tij} &= \alpha_{ij} + \alpha_t + \beta_1 p_{tij} + \beta_2 reer_{tj} + \beta_3 reerUncert_{tj} + \\ &\quad + \beta_4 reerSkew_{tj} + \beta_5 reerKurt_{tj} + \beta_6 reerMisal_{tj} + \\ &\quad \beta_7 BCDI_{tj} + \beta_8 Floating_{tj} + \beta_9 Interm_{tj} + u_{tij} \end{aligned} \tag{2}$$

where q_{tij} is the value in constant domestic currency units (base year is 1985) of output produced at time t by sector i and country j, α_{ij} are country-sector fixed effects, α_t are time dummies, p_{tij} is a relative price index at time t for sector i, in country j, $reer_{tj}$ is the real effective exchange rate of country j at time t, $reerUncert_{tj}$ is our measure of REER uncertainty of country j at time t, $reerSkew_{tj}$ is a measure of REER skewness and $reerKurt_{tj}$ is a measure of REER kurtosis of country j at time t, $reerMisal_{tj}$ is a measure of REER misalignment, $BCDI_{tj}$ is the Reinhart and Rogoff (2009) indicator of crises that goes from zero to four, and considers banking, currency, default and inflation crises.[22] $Floating_{tj}$ and $Interm_{tj}$ are dummies constructed on the basis of the exchange rate regime classification of Levy-Yeyati and Sturzenegger (2005) into floating, intermediate and fixed regimes (baseline is a fixed exchange rate regime).

Our dependent variable, q_{tij} is the sectoral level of output. Much of the research that examines the effects of REER uncertainty on productive decisions focuses on investment — stressing its condition of irreversibility, or on international trade flows.[23] We look at the output effects because the output decision is also characterized, to a certain extent, by irreversibility, because of regulations in the labour markets, and because firms have to pay for inputs before output is sold. In addition, and because the dollarized condition of the economies under consideration, the potential effects of REER uncertainty is not limited to those that engage in international trade, or not even to those producing tradable goods.

While sectoral prices and the real effective exchange rate are correlated, each variable attempts to capture different effects. The indicator of sectoral prices will capture competitive effects in a broader way than real exchange rates. For example it will capture the effect of changes in international prices of the relevant goods. Therefore, we expect $\beta_1 > 0$. On the other hand, given that sectoral prices are averaged across different economic activities that fall together in a three-digit 'sector', as classified by the international standard industrial classification (ISIC), the indicator may contain more noise than signal, so the with the inclusion of the real exchange rate — which is a variable of reference to manufacturers in these economies, we may be capturing some competitive effects. In addition to this, there are other potential effects associated with the REER. In the context of economies in which dollar-debt is substantial, movements in the real exchange rate may affect output supplied by affecting the net wealth of the firms, and then, their ability to obtain credit, as suggested by Bernanke and Gertler (1989) and Cespedes et al. (2004). For these reasons the expected sign of β_2 is ambiguous.

[22] $BCDI = 0$ if at a given period, in a given country, there are no banking, currency, default or inflation crises. $BCDI = 4$ if at a given point in time the country experiences the four types of crisis.

[23] The literature on uncertainty and investment was reviewed in Chapter **??**. Some of the most influential papers on uncertainty and trade flows are those of Ethier (1973), Hooper and Kohlhagen (1978), McKenzie (1999), and Byrne et al. (2008).

The inclusion of the BCDI indicator attempts to capture the fact that banking, currency, default and inflation crises have substantial effects on the payment system of the economy, severely affecting the availability of credit. Notice that we control for REER movements, and this variable also captures something similar: currency crises. With respect to this type of crisis, what we expect this indicator to capture is the effect of large movements, picking up non-linearities. Given that REER uncertainty tends to be high during crises, the proper identification of the crises effect is key to be able to isolate a pure uncertainty effect. For this variable, we expect a negative coefficient.

Dummies for different exchange rate regimes, as classified by Levy-Yeyati and Sturzenegger (2005), attempt to capture output effects that these may have, independently of the other covariates. Their inclusion is important, as different regimes may affect both uncertainty and output. The measure of misalignment attempts to capture the effect that large downward departures from a 'perceived' equilibrium (an appreciated REER), may delay output expansions, as agents may expect a realignment. β_6 is expected to be positive.

The country-sector fixed effects, α_{ij}, attempt to capture the effects of omitted regressors that are country-sector specific, but time-invariant, such as factor intensities, institutional arrangements, special regulatory treatments, et cetera. The time dummies, α_t attempt to capture the effects of omitted regressors that are country-sector invariant, but time-specific, such as global trends in energy prices, productivity shocks in the manufacturing sector, generalised increases in trade, et cetera.

To these determinants, we add measures of uncertainty described above. We report empirical experiments in which the three alternative measures are considered. These measures of uncertainty are constructed using a macro indicator of the real effective exchange rate. One concern that arises is that, if some sectors trade predominantly with a subset of countries with which bilateral real exchange rates are particularly volatile, while others trade predominantly with other subset with which bilateral real exchange rates are particularly stable, the using a macro measure of uncertainty may be a crude approximation. Two possible solutions were considered. First, we could have constructed sectoral measures of uncertainty on the basis of the sectoral price indicators. We discarded this possibility because our sectoral price indicators are likely to contain significant noise, for the reasons outlined above. Moreover, the use of sectoral real exchange rates to construct a measure of uncertainty is problematic in the presence of sectoral policies in the form of non-tariff barriers, quotas, et cetera, that may differ across countries. These will make them poor indicators of competitiveness, and undermine the importance of a measure of uncertainty calculated on their basis. In addition to this, data on sectoral prices have annual periodicity and start in 1970. The identification of an autoregressive forecast equation and the calculation of the variance of the forecast error as a measure of uncertainty would imply losing some years at the beginning of the sample period. For these reasons, we did not pursue this strategy. Second, we could have used aggregate prices, but construct sectoral real effective exchange rates, by giving sector-specific weights for the bilateral real exchange rates, based on the trade destination structure of each sector. This is a more appealing strategy. However, the trade data required to calculate the appropriate weights since 1970, with a three-digit disaggregation were not available. In fact, these data are the basic input for the calculation of the EII reported in Section 3.1, and they are only available at a one-digit level since 1980, and only since 1985 for most sectors at a two-digit level. Therefore, and in order to avoid losing almost half of our sample, we decided to use our macro measure of uncertainty in the analysis that follows. In addition, and to tackle this possible source of misspecification, we use the EII to adjust this macro measure for different levels of exposure to uncertainty — the method will be described in Section 4.3, and report the results in Section 5.3.3.

4.2 Threshold Model to Explore Non-Linearities

The specification in equation (2) assumes that REER uncertainty and changes in output are linearly related. A reason to cast doubt on the validity of a linear relationship is related to balance-sheet effects associated with future REER changes. In economies in which firms have important currency mismatches in their balance sheets, high and low uncertainty may affect output decisions differently. There may be a threshold above which further increases in uncertainty may increase the bankruptcy risk, and then induce firms to act more cautiously, and postpone their plans to increase output. What is more, in countries in which the Central Banks have frequently committed to fixed exchange rates, uncertainty generated after the collapses of the regimes may trigger additional channels through which output is affected, related for example, to the loss of credibility of the government's announcements.

The existing literature on the existence of threshold effects in the relationship of uncertainty and productive decisions has been explored in the context of investment decisions, where the seminal work of Sarkar (2000) triggered research on the presence of non-linearities or threshold effects of uncertainty on investment. The 'real options' approach to the analysis of investment under uncertainty, pioneered by McDonald and Siegel (1986) states that an increase in uncertainty depresses investment as it increases the critical investment trigger. Sarkar argues that increases in uncertainty also affect the probability of investing, and this effect cannot be unambiguously determined analytically (Sarkar, 2000, p.223). By using numerical results to illustrate the uncertainty-investment relationship, he finds an inverted u-shape. Their main result is that an increase in uncertainty may increase investment. Subsequent empirical work has often found that data supported threshold effects. For example Serven (2003), using aggregate data on investment for 61 developing countries spanning the years 1970 to 1995, finds that it's only 'high' real exchange rate uncertainty that depresses investment, while the effect of low uncertainty is positive although not well determined. Lensink and Murinde (2006) use firm-level data for the UK over the period 1995-1999 and find evidence of an inverted u relationship between investment and uncertainty regarding stock market returns. More recently, and with a focus on six Latin American countries, Clausen (2008) finds threshold effects of uncertainty on investment. While the effect of high uncertainty is unambiguously negative, that of low uncertainty is positive on investment in Chile and Mexico. To test for threshold effects of uncertainty with respect to REER changes, on output changes, we estimate the following models.

$$\begin{aligned} q_{tij} \quad = \quad & \gamma_{i-} * \delta_j + \beta_1 p_{tij} + \beta_2 reer_{tj} + \beta_3 reerUncert_{tj} + \beta_4 reerUncert^2_{tj} + \\ & + \beta_5 reerSkew_{.tj} + \beta_6 reerKurt_{.tj} + \beta_7 reermisal_{.tj} + \beta_8 BCDI_{tj} \\ & + \beta_9 Floating_{tj} + \beta_{10} Interm_{tj} + u_{tij} \end{aligned} \tag{3}$$

$$
\begin{aligned}
q_{tij} &= \gamma_{i-} * \delta_j + \beta_1 p_{tij} + \beta_2 reer_{tj} + \beta_3 LowUncert_{tj} + \beta_4 HighUncert_{tj} + \\
&+ \beta_5 reerSkew._{tj} + \beta_6 reerKurt._{tj} + \beta_7 reerMisal._{tj} + \beta_8 BCDI_{tj} \\
&+ \beta_9 Floating_{tj} + \beta_{10} Interm_{tj} + u_{tij} \qquad (4)
\end{aligned}
$$

The model of equation (18) allows us to test for an inverted-u shape relationship between uncertainty and output, while the model in (19) allows us to identify whether two different slopes for "high" and "low" uncertainty may fit the model better than imposing a single one.

4.3 Interacted Model to Explore Sectoral Heterogeneity

To disentangle some of factors that are behind the relationship between REER uncertainty and output, and so being able to answer research questions (2) and (4), we also estimate an interacted model, that takes the generic form of equation (5):

$$
q_{tij} = \alpha_{ij} + \alpha_t + \mathbf{X}\gamma + \beta_1 reerUncert_{tj} + \beta_2 reerUncert_{tj} * Z_{tij} + \beta_3 Z_{tij} + u_{tij} \qquad (5)
$$

where $\mathbf{X}$ is a matrix containing all the controls of equation (2), γ is a vector of the associated coefficients, and Z_{tij} is the hypothesized determinant of the relationship between REER uncertainty and output, which are also allowed to have level effects on the dependent variable. In particular, we consider three variables to interact with the REER uncertainty, and discuss their roles in the estimable equation in what follows. The first two are introduced in the analysis as potential determinants of the output sensitivity to uncertainty, while the last one is introduced as an adjustment for the macro measure of uncertainty considered here.

Trade Orientation We measure trade orientation as the share of sectoral output that is exported, and try to identify whether sectoral differences in this respect, explain differences in the output response to changes in uncertainty with respect to REER changes. The effects are *a priori* ambiguous. Thinking in terms of the standard textbook approach, one would expect that — as long as firms are averse to risk — sectors with a higher exposure to export markets are going to be more sensitive to REER uncertainty than those whose output is mainly oriented to the domestic markets, because REER will influence a larger portion of the price received.

On the other hand, in the context of Southern Cone economies, in which the degree of debt dollarization is significant, REER uncertainty affects output through another mechanism, that operates through the firms' financial structure, as discussed in Chapter **??**. Because firms exhibit mismatches in their balance-sheets, REER movements affect disproportionately their liabilities. Higher uncertainty increases expected bankruptcy costs, and induce, even among risk-neutral firms, output contractions. In this case, a higher exposure to export markets contributes to match the currency of denomination of the firm's assets with that of liabilities, and therefore provides a mechanism to insulate firms' output decisions from REER uncertainty.

Labour Productivity For each sector, we measure labour productivity as the quotient of the total wage bill and the value of output. We also calculate the distance to the 'frontier' of productivity, given by that of the corresponding sector in the United States' economy. Assuming an association between productivity and profitability of the sector, these data would help us test the hypothesis of whether higher profitability helps insulating output from REER uncertainty (we use this proxy in the the absence of data on sectoral profitability). As argued in Chapter 1, in the presence of dollar-debt, the output of those firms with higher liquidity, or current profits, was going to be less sensitive to increases in REER uncertainty than that of firms with lower liquidity balances, since, for the latter type, the increase in uncertainty would increase expected bankruptcy costs by more, meaning that the output response will be correspondingly larger than for the former type. Even without dollar-debt, more profitable firms will face better prospects for adjustment than less profitable ones, in the event of adverse competitiveness shock arising from movements in the REER.

Export Intensity with Mercosur Markets This is measured using the EII described and reported in Section 3.1. There are several reasons why we include the EII in the interacted model.

1. **Misspecification.** The use of a macro measure of REER uncertainty may introduce a source of misspecification in the model of equation (2). A large portion of the REER uncertainty is generated within Mercosur economies — which, as discussed above, tend to be relatively volatile. For this reason, the use of a common uncertainty measure across sectors, regardless of the intensity with which they trade with the volatile region may be misleading. In an attempt to control for this, we adjust our macro measure of uncertainty by multiplying it to our indicator of export intensity to Mercosur markets.

   Ceteris paribus, if those sectors trading more intensively within Mercosur are exposed to more uncertainty, the estimated coefficient on the interaction term will be negative.

2. **Adaptation to High Uncertainty.** It is possible that the EII may not only act as an adjustment factor to the measure of uncertainty, but also as a determinant of the output sensitivity to REER uncertainty. One hypothesis that emerged from the pilot survey we performed on a small number of manufacturers in Uruguay is that firms that trade intensively with the volatile region may adapt their production processes to better cope with uncertainty. Most firms expressed that to cope with uncertainty, they introduced shorter-term labour contracts, incorporate short notice termination clauses in agreements so that long-term commitments are avoided, and maintain relatively higher liquid assets.[24] This might imply that EII decreases the sensitivity of output to uncertainty. However, it could also be argued that if these firms have already adjusted to better cope with uncertainty, and now face further increases in uncertainty, they may find themselves with fewer instruments to use. Instead, those that have not yet adapted their production processes, as they predominantly trade with the low-volatility region, may have a wider range of margins to adapt and decrease their vulnerability to REER shocks, in the face of increases in uncertainty. Hence, the effect of EII on the output-uncertainty relationship is ambiguous.

[24] It is worth mentioning that although forward contracts would allow hedging nominal exchange rate risk, these have been largely unavailable in the countries considered, over the period of analysis. In the last few years, the markets have developed to some extent. However, firms tend to claim that the costs associated to these instruments are significantly high.

3. **Lower Ability to Diversify Export Markets.** Even if REER uncertainty was faced homogeneously by all firms, independently of where they exported, it would be plausible to expect that those firms that have a more diversified export market structure — or are more capable of diversifying, will be less vulnerable to uncertainty shocks. Now, it could be argued that if the high EII with Mercosur are related to trade protection that firms within certain sectors obtain, and if this trade protection is associated with relatively low productivity, then in a context of REER uncertainty, firms producing in protected sectors will find it more difficult to diversify, and so, will be more cautious than the non-protected ones. An example may be illustrative. Firms in the Uruguayan automobile sector export almost exclusively to Mercosur countries under a special regime that incorporates substantial protection. Instead, meatpackers in Uruguay tend to have their export destinations largely diversified, and face international competition. In the event of high REER uncertainty with their main trading partner, it would be reasonable to expect a more cautious behaviour of producers in the automobile sector than that of meatpackers, as the latter are likely to be able to re-orientate a larger portion of their output to a new market, in a faster way than the former. If this is the prevalent mechanism, then a higher EII would increase the sensitivity of output to uncertainty.

   Another line of argument to explain the capacity of diversifying the export destination structure is related to the type of goods produced by a firm, irrespective of productivity or protection levels. As argued by Rauch (1999), when trading differentiated products, proximity, common languages, and cultural similarities may be very important in matching international buyers and sellers. This may explain why trading of this type of goods by Mercosur firms is predominantly concentrated within the region. In addition, the author presents evidence suggesting that the search costs associated with trading differentiated goods are higher than those associated with homogeneous goods, which result in the former type of goods being traded mostly where the costly networks are already in place. For goods such as bovine meat, or milled rice, that are rather homogenous and tend to trade in organised exchanges, the re-orientation of export destination is likely to be easier than for goods such as bicycles or cars, for example. A quick inspection of the EII calculated and reported in Section 3.1 shows that these tend to be larger for sectors that produce goods that could be considered as "differentiated", so one could expect that those sectors exhibiting high EII, may find re-orientation more difficult because of the type of product they produce, and so may be more vulnerable to REER uncertainty. Therefore, if this channel is predominant, one would expect the coefficient on the EII interaction with REER uncertainty to be negative, to capture this vulnerability effect.[25]

The estimation of both (2) and (5) presents a number of challenges. These are presented in what follows, along with the strategy pursued here to deal with them.

[25] Byrne et al. (2008) find some evidence that exchange rate uncertainty affects exports of differentiated goods, but it does not for homogeneous goods, when looking at US trade over the period 1989 to 2001.

4.4 Dynamics

Given that the time period is relatively long (1970-2002), we tested for non-stationarity of the series of output and prices and found some evidence of non-stationarities. Non-stationarity makes a specification in levels problematic and would call for a panel cointegration analysis. The literature on this subject is still being developed and subject to controversy. In addition, most of the statistical theory supporting it looks at the case in which $T/N \to \infty$ (where T is the time dimension, and N is the number of groups), while in our case the number of groups (three countries, twenty-eight sectors) is substantially larger than the number of periods (thirty-three).[26]

For these reasons, we opted for estimating the relationship in growth rates (which are all stationary). Conceptually, is worth stressing that as we estimate all models considering growth rates, the relationship of interest becomes the impact of uncertainty with respect to the rate of growth of the real exchange rate, on the rate of growth of industrial output. Methodologically, by taking growth rates, we are introducing a serially correlated error term in the model. The presence of serial correlation would make standard errors look smaller than they really are, thus rendering inference invalid. To control for this, we re-estimate the models using heteroscedasticity and autocorrelation consistent (HAC) standard errors. The estimator we use for the covariance matrix is the Newey and West (1987) (Bartlett kernel function) specification.[27]

4.5 The Estimator

Ordinary Least Squares or Instrumental Variables? If all the right-hand side variables in equation (2) were independent of the error term, and the errors were independent and identically distributed, then, the ordinary least-squares estimator (OLS) would provide the best linear unbiased estimator of the vector of parameters $\boldsymbol{\beta}$ (actually, the model in equation (2) is a two-way fixed-effect).

However, it is likely that sectoral output is jointly determined with sectoral prices. Then, supply shocks, for example, will affect both equilibrium price and quantity in the market, and both variables will be correlated to the error term by construction. Price endogeneity makes the OLS estimator of β, $\hat{\beta}_{OLS}$ inconsistent. Consider, for simplicity of exposition, that the only explanatory variable is p, so that the estimable equation turns into $q_{tij} = \beta p_{tij} + u_{tij}$. Then, $\hat{\beta}_{OLS} = (p'p)^{-1}p'q = \beta + p'u$. Because $p'u \neq 0$, the expected value of estimator equals the true parameter plus a bias, which does not tend to zero as the sample size increases.

The solution to this source of inconsistency lies in finding an “instrument” (Z), that affects sectoral output only through its effect on prices. How good a solution to the problem of endogeneity is provided by the instrument depends on whether the instrument is “valid” (i.e., it is exogenous to the market), and “relevant” (i.e. it matters for the process of production). These two conditions imply that $Z'u = 0$ and $Z'p \neq 0$ respectively.

Two Stage Least Squares or GMM? Two alternative estimators that address the inconsistency problem arising from endogeneity by using instrumental variables

[26] See Baltagi (2008) for a detailed discussion.

[27] It is worth mentioning that this estimator of the covariance matrix needs large samples to perform well.

are the two-stage least squares (2SLS-IV), and the Generalized Method of Moments (GMM-IV) estimators.

The estimation with instrumental variables (IV) can be seen as the application of least squares in two stages. In the first, each of the right-hand side variables in equation (2) are regressed on the instruments, Z, and a matrix of fitted values, $\hat{\mathbf{p}}$, is obtained. In the second stage, the dependent variable, q is regressed on $\hat{\mathbf{p}}$, and a vector of instrumental variables estimates, $\hat{\boldsymbol{\beta}}_{IV}$, is obtained.

Alternatively, IV estimation can be seen as a Generalized Method of Moments optimization problem. Following the exposition of Baum et al. (2007), with exogenous instruments Z (i.e.: $Z'u = 0$), then L instruments give a set of L moments:

$$g_i(\beta) = Z_i' u_i = Z_i'(q_i - p_i\beta) \tag{6}$$

where g_i is $L \times 1$. The exogeneity condition means that at the true value of β, the L moment or orthogonality conditions will be satisfied:

$$E(g_i(\beta)) \tag{7}$$

There is a sample moment corresponding to each of the L moment equations, so for a given estimator $\hat{\beta}$, these L sample moment can be written as:

$$\bar{g}(\hat{\beta}) = \frac{1}{n}\sum_{i=1}^{n} g_i(\beta) = \frac{1}{n}\sum_{i=1}^{n} Z_i'(q_i - p_i\hat{\beta}) = \frac{1}{n} Z'\hat{u} \tag{8}$$

Then, the idea behind GMM is to choose $\hat{\beta}$ that brings $\bar{g}(\hat{\beta})$ as close to zero as possible. If, as in our case, the number of instruments is larger than the number of explanatory variables (i.e.: $L > K$, so the equation is overidentified), there are more equations than unknowns and it will not be possible to find $\hat{\beta}$ that sets all moment conditions to zero.[28] In this case, a weighting matrix W is used to construct a quadratic form in the moment conditions. So, the GMM objective function is now:

$$J(\hat{\beta}) = n\bar{g}(\hat{\beta})' W \bar{g}(\hat{\beta}) \tag{9}$$

So, the GMM estimator for β is the $\hat{\beta}$ that minimises $J(\hat{\beta})$:

$$\hat{\beta}_{GMM} = argmin_{\hat{\beta}} J(\hat{\beta}) = n\bar{g}(\hat{\beta})' W \bar{g}(\hat{\beta}) \tag{10}$$

Solving the set of first order conditions, the IV-GMM estimator is obtained:

$$\hat{\beta}_{GMM} = (p'ZWZ'p)^{-1} p'ZWZ'q \tag{11}$$

Hansen (1982) shows that when the weighting matrix, W chosen is equal to S^{-1}, where S is the covariance matrix of the moment conditions, then, the most efficient estimator is obtained ($S = E[Z'uu'Z] = lim_{N\to\infty}[Z'\Omega Z]$). S is then the optimal weighting matrix. If the residuals from 2SLS are used to derived a consistent estimator of S, then, the feasible and efficient IV-GMM estimator is:

$$\hat{\beta}_{FEGMM} = (p'Z\hat{S}^{-1}Z'p)^{-1} p'Z\hat{S}^{-1}Z'q) \tag{12}$$

If the errors are independent and identically distributed, then the optimal weighting matrix is proportional to the identity matrix ($\sigma_u^2\mathbf{I}$) and IV-GMM equals the standard $2SLS$ estimator.

[28] The instruments to be used in our context will be presented below.

As argued by Baum et al. (2007), GMM should be preferred to IV in the presence of heteroscedasticity of unknown form, as in this case, the IV-GMM estimator that uses as a weighting matrix an estimate of the inverse of S, computed from the $2SLS$ residuals, will be more efficient than the 2SLS estimator.[29]

Or back to Ordinary Least Squares? It has been pointed out that though consistent, both the 2SLS and the GMM estimators may perform poorly in small samples, as they are biased, and less precise than OLS. Our decision of preferring an IV estimator is guided by economic theory. In the context of the manufacturing sectors of the three countries analysed here, it is reasonable to think, as argued above, that sectoral output and prices are simultaneously determined. We also use a statistical test to determine whether p should be treated as endogenous. The 'C' test considers if the null hypothesis of exogeneity of p is upheld by the data. In essence, the test compares OLS and IV estimates and explores whether the differences in the estimates are systematic. If they are, the null is rejected, suggesting a bias of OLS, and IV should be preferred. We report the C test-statistic after the estimation output of each model considered.

Our Choice In the analysis what follows, we use the GMM-IV estimator, as tests suggested the presence of heteroscedasticity.[30] For the actual estimation we use the Stata package 'xtivreg2' (Schaffer (2005)), which requests the two-step feasible efficient GMM estimator and corresponding variance-covariance matrix. As it will see in what follows, the C-statistics suggest that, as suggested by economic theory, prices are endogenous and instrumental variables are needed in most of the models reported below.

4.6 Instruments

We use alternative sets of instruments for the "troublesome" variable, i.e.: sectoral prices, and compare results in order to investigate the credibility of our estimates. The first instrument is given by US sectoral price changes. These are likely to be independent of industrial output of Mercosur countries, while they will have an effect on domestic sectoral price changes, given the tradable nature of the goods produced in the manufacturing sectors we are considering. Second, we use lagged values of sectoral price changes. Given that our periodicity is annual and that the production processes in manufacturing are relatively shorter than in other sectors of the economy, lagged price changes are likely to influence output changes through their effect on current price changes only. In both cases we include the growth rate of population as a shifter of the demand curve. We report two additional diagnostic tests for the GMM-IV estimation, and discuss the results. First, a test of "relevance" of the instruments. This is given by the joint significance of the excluded instruments in the first-stage of the GMM-IV procedure (Kleibergen and Paap statistic (KP)). A "large" value of the KP suggests that the instruments are correlated with the troublesome variable, which implies our instruments are relevant to explain sectoral prices. The rule-of-thumb for "large" being when the F-statistic$\geq$10.

[29]The author argues that even in the absence of heteroscedasticity, GMM is no worse asymptotically than the IV estimator. However, reasonable estimators of the optimal weighting matrix — key to the efficiency of GMM — are only obtained with very large sample sizes.

[30]We performed Pagan and Hall (1983) tests. These tests whether there is heteroscedasticity in the estimated regression, related to one or more indicator variables.

Second, a test of the overidentifying restrictions of model, or "validity" of the instruments (Sargan-Hansen test). This consists of regressing the residuals from the GMM-IV regression on all instruments (excluded and included). The null is that all instruments are uncorrelated with the the error term, and its rejection would cast doubt on the validity of these instruments. This is because that rejection would be suggesting that the exclusion restriction may be inappropriate as the instrument exerts a direct effect on the dependent variable, instead of only affecting it via its effect on the troublesome regressor.

4.7 Cross-Sectional Dependence

Cross-sectional dependence arises when, in a panel, the errors are correlated across groups: $E(e_{it}e_{jt}) \neq 0$. The consequences may be serious, as explained in Baltagi (2008), since pooling may provide little gain in efficiency over single equation estimation, and estimates can be biased. In our panel, a likely source of cross-sectional dependence arises from the fact that the countries included in our panel are of very different dimensions, and during the period of analysis there has been a reduction in trade protection among them. These changes in trade policy may have contributed to an adjustment in the patterns of production within the bloc, and the adjustment in one sector in a country, may have affected the sector in another country. An example will be illustrative: say that after a reduction in tariffs between Argentina and Brazil, there is a structural change in production following comparative advantage, so that output of food and beverages in Argentina increases (and falls in Brazil), while the output of automobiles increases in Brazil (falling in Argentina). If there is a portion of that adjustment that is not driven by sectoral price changes or by changes in other factors captured in the controls we include in the model, then, inevitably, it will appear in the errors, making them correlated across groups, with the implications on efficiency and bias of the estimator mentioned above.

For these reasons, we first test for cross-section dependence using the Breusch-Pagan test. This is based on the following statistic:

$$CD = T \sum_{i=j}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \tag{13}$$

where N is the number of groups, T is the number of periods, $\hat{\rho}$ is the sample estimate of the pairwise correlation coefficient of the residuals, and these are obtained as in:

$$\mathbf{e}_{it} = \mathbf{q}_{it} - \hat{\boldsymbol{\alpha}}_i - \hat{\boldsymbol{\beta}}_i^{'} \mathbf{X}_{it} \tag{14}$$

with $\hat{\boldsymbol{\alpha}}_i$ and $\hat{\boldsymbol{\beta}}_i$ is the vector of estimates of the parameters computed using a regression of $\mathbf{q}$ on an intercept and a matrix $\mathbf{X}$ containing all the regressors in the model described in equation (2) for each group (country) separately. Under the null hypothesis of no cross sectional dependence, $CD \sim \chi^2_{N(N-1)/2}$. If the null is rejected, we use Seemingly Unrelated Regressions (SUR) techniques.

4.8 Country Heterogeneity

If in the true model, the responsiveness of output to uncertainty (β) is country specific, as below:

$$q_{jt} = \alpha_j + \beta_j reerUncert_{jt} + u_{jt} \tag{15}$$

but we estimate a common slope:

$$q_{jt} = \alpha_j + \beta reerUncert_{jt} + w_{jt} \tag{16}$$

where j is the country, and t is the time period, then, the error term will be: $w_{it} = (\beta_i - \beta)x_{it} + u_{it}$, and $X'w_{it} \neq 0$, rendering the estimator of β inconsistent.

Given that our panel includes three countries of different characteristics and that the time dimension of the data is relatively large, we treat the heterogeneity by running separate regressions and examining parameter stability across countries.

4.9 Outliers.

In the empirical analysis that follows, we excluded those observations for which the dependent variable lied more than 5 interquartile ranges away from the median.

5 Results

Here we report and discuss the results from estimating the models presented in Section 4. In Section 4.1 we start by estimating the most parsimonious model (described in Section 5.1). We test whether the identified uncertainty effect on output growth is robust to the inclusion of a variable that captures changes in REER misalignments with respect to an "equilibrium" value. In addition, we examine how robust results are to the choice of instruments, by using a different set and comparing results. Then, we explore whether there is evidence of country-heterogeneity in the parameters.

In Section 5.2 we present the results of estimating the threshold model presented in Section 4.2, as in equations (18) and (19). These models will allow us to understand the non-linearities at work in the output growth-REER uncertainty link.

In Section 5.3, we discuss the results of estimating the three interacted models proposed in Section 4.3, using export orientation, labour productivity and Mercosur EII. These three variables enter the estimable equation in levels and interacted with REER uncertainty. In this way, we are able to identify any direct effect they may exert on output growth, plus indirect effects that they may exert by affecting the vulnerability of sectoral output to REER uncertainty. Consider, for example, the EII. It could turn out, for instance, that the level coefficient was positive, while the interaction coefficient was negative. This would mean that high EII *in itself* was growth-enhancing, but at the same time it raised the vulnerability of the sector, meaning that a rise in uncertainty would have a particularly larger depressing effect on growth.

Initially, we investigate the effects of augmenting the baseline model by adding the level and interaction of export orientation, labour productivity and Mercosur EII separately (in Sections 5.3.1, 5.3.2, and 5.3.3, respectively). The reason for examining the effects of each of these variables separately at first, is that labour productivity and EII are only available for a subset of observations. This means that when including them, we substantially lose degrees of freedom in the estimation. By including one at a time, we can scrutinize the effect of each one, with as many observations as possible.

Finally, we augment the baseline model including together the three aforementioned variables in levels and interacted with uncertainty. This implies losing all observations from 1970 until 1980, and for some sectors, until 1986. We then interpret the results and compare them with those obtained when each was included separately.

5.1 The Baseline Model

In this section we test the hypothesis of whether REER uncertainty exerts a negative effect on the growth rate of industrial output, and whether this effect is heterogeneous across countries. Table 2 presents GMM-IV estimates of equation (2) in growth rates using three alternative uncertainty indicators. In all cases, country-sector fixed effects and time dummies are included, as well as dummies controlling for different exchange rate regimes. To control for correlations within groups in the errors, we clustered standard errors at country and 2-digit sector level.

Coefficients for continuous variables are reported in elasticity form, those on the uncertainty measures are semi-elasticities, and those on categorical variables are impact effects. Column (1-3) report results when alternative measures of uncertainty

are included. The price coefficient is positive and of a plausible size, suggesting that output supplied is inelastic to prices, but not always well-determined, while the coefficient on growth of the REER is close to unity and very well determined in all cases, suggesting that output supplied is unit-elastic to real depreciations, on average and *ceteris paribus*.
Clearly, sectoral prices and REER are correlated, given the tradable nature of the manufactured goods produced considered here. However, as already argued, sectoral prices contain information that is more idiosyncratic to the sector than REER. An example is the evolution of world prices of the relevant goods. The fact that output seems to be more responsive to REER than to sectoral price changes is somehow puzzling. A likely explanation for this is that, due to averaging over different economic activities grouped under the same three-digit sector, the price series contain more noise than signal, relative to the REER series, that probably exert a rather homogeneous competitive effect across tradables, and that in the context of Southern Cone economies is considered by manufacturers as the emblematic indicator of competitiveness.

Another interesting element in these results, is that given the positive coefficient on the REER, the effect of competitiveness of REER depreciations seems to dominate over possible balance-sheet, or other negative effects on output that arise from depreciations.[31] This is likely to be related to the fact that these balance-sheet effects are captured in the Reinhart and Rogoff (2009)'s BCDI indicator of crises. In fact, the coefficient on the BCDI is well determined and yields a negative coefficient. *Ceteris paribus*, the outbreak of each of the crises that are captured on the index decreases output growth on average, by about $4-5\%$. This is a sizable and plausible effect. Banking and sovereign default crises are associated with disruptions in the payment system of the economy, with important consequences on the availability of credit. Currency crashes in economies with dollarised liabilities trigger harmful balance-sheet effects, which may further affect credit availability. High inflation is associated with relative price distortions, and may significantly affect real revenue when there are lags between sales and payment. Take as an example, the case of Argentina in 2002, where the index takes value 4. All other things equal, our model predicts a reduction in industrial output of about 22%.[32]

The point estimate for the effect of REER Uncertainty on output is always negative, irrespective of the measure of uncertainty considered, but it is well-determined only for the Roll-Var measure. A number of conclusions can be reached by looking at these results. First, the effect is better determined when using the Roll-Var measure. This measure differs from the GARCH measure in two respects: (a) it implies that agents forecast in a less sophisticated way, and (b) it implies a longer memory of agents (12 months instead of 3-4 months with GARCH). The reason behind the better performance seems to be the longer horizon it considers, as we tried a modified version of RollVar with a 4 month window, and the effect was similar in size, but only significant at 10%. Second, *ceteris paribus*, when RollVar doubles, output falls, on average, by 2.45%, while if it is the REER variance, output contracts by less than half percent.[33] These differences are reasonable, given that the latter measure

[31] Many explanations have been given for the finding of contractive depreciations, since Diaz Alejandro (1963). Operating through the supply side, these are the mentioned balance-sheet effects arising when liabilities are dollarised, and the increases in production costs arising from difficult-to-substitute imported inputs.

[32] The effect is calculated as: $e^{-0.05\times 4}-1$.

[33] The elasticity is calculated as $\hat{\beta} \times Roll\bar{V}ar$. $Roll\bar{V}ar = 7.4E04$.

probably overestimates "true" uncertainty, as discussed in Section 3. Not all of the variance in the REER can be attributed to uncertainty, and thus affect behaviour.[34]

Columns (4-5) report results of estimating equation (2) when uncertainty is defined in a broader way, including measures of the third and fourth sample moments. Tests of joint significance on the conditional variance, skewness and kurtosis suggest that their effect on output is different from zero, both when the conditional variance measure is the GARCH or the RollVar one. A closer look, however, casts doubt on the relevance of adding the third and fourth moment of the distribution of the REER in these models. The kurtosis is significant at 5% only when the measure of conditional variance is of short memory (GARCH), but only significant at 10% in the specifications that include Roll-Var. Given that the kurtosis is calculated on a window of 12 months, and that it is significantly correlated with the GARCH conditional variance measure ($\rho_{Kurt,GARCH} = 34\%$)), the role being played by the kurtosis may be just capturing the longer horizon that agents consider. That would explain why the kurtosis becomes less well determined when the long-memory RollVar measure is incorporated.[35]

5.1.1 REER Uncertainty or Misalignment?

During a pilot survey we conducted in the early stages of this research among manufacturing firms in Uruguay, managers pointed out REER uncertainty as a serious impediment for planning production. However, in our small sample of firms surveyed, managers tended to use the terms 'REER uncertainty' and 'REER misalignment' interchangeably. The reason for the association is likely to be related to the fact that agents find it more difficult to predict future movements of exchange rates, when they perceive them to be misaligned with respect to an "equilibrium value". Under those circumstances, a wider spectrum of exchange rate movements are likely and the confidence in any point estimate will fall. Another interpretation is that agents plainly confuse the terms, and their concern is with misalignments and not with mean preserving changes in uncertainty. Because we are interested in identifying a pure uncertainty effect, we decided to perform a robustness check, by controlling for changes in the degree of misalignment of the REER with respect to a long-run value.

The concept of REER misalignment with respect to an equilibrium value, however, is an elusive one, given that the equilibrium level is unobservable. For the purposes of our robustness check, we use a simple statistical procedure to decompose the REER series into a long-run and a cyclical component that relies on the Hodrick-Prescott (HP) filter, due to Hodrick and Prescott (1997). Strictly, this

[34]Diagnostics are reported the bottom of the table. The low values of the Hansen statistic lead to a non-rejection of the null of no correlation of the residuals with the instruments, suggesting instrument validity. The size of the K-P suggest that instruments are relatively weak, and that caution should be put at drawing conclusions. The relatively large values for the C-statistic suggest that IV methods are needed. The low value of the Cross-Sectional Dependence Breusch-Pagan test (CSD) indicates no evidence of cross-country dependence in this data.

[35]It could be argued that REER growth is endogenous in this specification. If larger exports lead to growth in output, and to substantial inflows of foreign exchange, then the REER would appreciate, *ceteris paribus*. We argue this is not likely to be the case, as we are working here with sectoral data at 3-digits, which means that each sector explains a small portion of total exports. As a robustness check, we excluded from the estimation sample the observations corresponding to the sector that explains, by far, the largest portion of exports in the three countries: 311. The exclusion of these observations does not alter the results reported here, as can be seen in Table 18 of Appendix B.

method does not allow us to determine misalignment with respect to value of the REER that, for example, secures internal and external balances for the economy, or that is consistent with purchasing power parity, or that is aligned with the values of long and medium term fundamentals. It simply allows us to decompose the REER series into a slow-moving long run trend (τ_t) and a transitory deviation or cycle (ζ_t) component, assuming that on average, over the sample of analysis, the variable has been on "equilibrium". The extraction of the trend is performed by minimising the variance of the ζ_t component subject to a given "smoothness" of the trend τt, as in equation (17):

$$min_{\tau_t} \sum_{t=1}^{T} (reer_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau t) - (\tau_t - \tau_{t-1})]^2 \tag{17}$$

where λ is the noise-to-signal ratio, and acts as a penalty attached to the volatility of the trend component. We apply the HP filter to our monthly data of the REER, and set $\lambda = 14400$.[36] Then, we construct our measure of misalignment, by extracting τ from the series of REER, and include it in the analysis. A note of caution is in order, when interpreting results. As argued above, this is an 'atheoretical' method, and there is no reason for the long run trend extracted here to be in line with an "equilibrium" REER that emerges from other methodologies that rely on different theoretical models.[37] In addition, our measure does not allow us to identify the sources of the misalignment (e.g: transitory factors, random disturbances or misalignment of the fundamentals). Also, from a purely statistical perspective, this filter assumes that agents know the future, since the extraction of τ_t relies on the knowledge of τ_{t+1}. Acknowledging its limitations, and given that the purposes here are to provide a robustness check, we chose this avenue as it is relatively simple to calculate and frequently found in the literature.[38]

Columns (6-7) report results when measures of REER misalignment changes are incorporated as explanatory variables. The coefficients are practically unchanged with the inclusion of the REER misalignment measure, and those on the misalignment measures are statistically insignificant and very small.[39]

5.1.2 Are Results Robust to the Choice of Instruments?

In Table 3 we try to replicate the results reported in Table 2, but using US prices instead of lagged prices, as instruments for sectoral domestic prices.[40] The price effect on output produced is systematically positive and generally statistically significant and with magnitudes in the range (0.35-0.54), suggesting that output is relatively inelastic to price changes. The rest of the estimated coefficients is robust to the choice of the instruments, which enhances the credibility of our results.[41]

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[36] This value is commonly used in the literature.

[37] For a review on these methods see MacDonald (2007)

[38] See for example: Goldfajn and Valdes (1999) or Goldfajn and Werlang (2000)

[39] Cottani et al. (1990) also used a measure of REER misalignment in addition to one for REER instability to explain GDP growth, export growth and investment at a macro level, and find a negative and significant effect on the first two dependent variables. Dollar (1992) combines a measure of misalignment of the REER with one of its variability to construct an index of outward orientation, and find that index to be highly correlated with GDP growth.

[40] The number of observations is now increased, as we have one more year in the sample.

[41] Although all diagnostics point to this set of instruments as the best (Hansen suggests validity, KP are in general above 10, suggesting that these instruments are stronger than the previous set, and C-stats that IV procedures are necessary), a negative estimated coefficient for US prices in the

5.1.3 Country Heterogeneity

The conclusions drawn above rest on the validity of the restriction of identical parameters across countries. Given that the time dimension of our panel is reasonably long, we can investigate whether the data upholds this restriction. We re-estimate (2) separately for each country in the panel and compare the estimated coefficients (Table 4). The general picture is largely unchanged, with the exception of the estimated coefficients on the REER and the misalignment of the REER, where substantial country heterogeneity is found. The output elasticity with respect to REER changes seem to be significantly larger in Argentina and Uruguay than in Brazil. This is likely to be explained by the lower degree of openness of the latter economy. Regarding the misalignment, when the REER is below the equilibrium value, one would expect that firms delay increases in output, thus pushing sectoral output changes downwards. This mechanism is supported by the sign of the coefficient in the case of Argentina, but not in the case of Brazil, where the misalignment variable yields a negative coefficient, though of small magnitude.

In terms of our parameters of interest, although the point estimates for the effects of REER Uncertainty on output differ, these differences are not statistically significant. We used these country-specific estimates to plot the estimated effect of REER uncertainty on output over time ($\hat{\beta}_{uncert} \times reerUncert$). This is displayed in Figure 5 for each of the countries under analysis. The effects are calculated against a baseline of zero uncertainty, which means that all series in the graph must be negative. Two elements emerge from the visualization of the graph. First, that the effects of uncertainty on output are not negligible. There are several episodes during our sample in which these have induced, on average, a reduction in output of more than 5%. Second, that the effects of uncertainty have been larger in Argentina and Uruguay, which is a direct product of their larger record of uncertainty relative to Brazil, given that the estimated sensitivities are similar.

first stage of the IV procedure is puzzling. We find comfort in the large invariance of the estimated coefficients in the reduced form to the set of instruments used, and use lagged prices as instruments in the rest of the paper.

Table 2: Output Response to REER Uncertainty Using Lagged Prices as Instrument

Dep. Var.:	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Growth Ind Output	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Growth of Rel Prices	0.26*	(0.13)	0.14	(0.12)	0.30**	(0.13)	0.29**	(0.14)	0.17	(0.13)	0.31**	(0.14)	0.19	(0.14)
REER Growth	0.88***	(0.03)	0.89***	(0.03)	0.89***	(0.04)	0.87***	(0.04)	0.88***	(0.03)	0.88***	(0.04)	0.89***	(0.03)
REER Uncert GARCH	-19.17	(17.86)					-4.91	(19.89)			-8.47	(19.42)		
BCDI	-0.05***	(0.01)	-0.04***	(0.01)	-0.05***	(0.01)	-0.05***	(0.01)	-0.04***	(0.01)	-0.06***	(0.01)	-0.05***	(0.01)
Dummy Floating	-0.00	(0.02)	-0.01	(0.02)	0.00	(0.02)	0.00	(0.02)	-0.01	(0.02)	-0.00	(0.02)	-0.01	(0.02)
Dummy Interm	0.00	(0.02)	-0.01	(0.02)	0.00	(0.02)	-0.00	(0.02)	-0.01	(0.02)	-0.01	(0.02)	-0.01	(0.02)
REER Uncert RollVar			-29.55***	(8.35)					-23.61**	(9.50)			-22.91**	(9.91)
Variance REER					-0.25	(0.19)								
REER Skewness							0.03***	(0.01)	0.03**	(0.01)	0.03**	(0.01)	0.02**	(0.01)
REER Kurtosis							-0.02**	(0.01)	-0.01*	(0.01)	-0.01**	(0.01)	-0.01*	(0.01)
REER Misalignment											0.01	(0.01)	0.01	(0.01)
Observations	2563		2563		2563		2563		2563		2563		2563	
Time Dummies	✓		✓		✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓		✓		✓	
Clustered SE	C&S		C&S		C&S		C&S		C&S		C&S		C&S	
Hansen Overid Test	1.201		0.341		1.285		1.392		0.478		1.497		0.612	
K&P Statistic	4.637		6.816		4.230		4.101		5.779		4.216		6.346	
C Statistic	5.576		2.909		5.788		6.375		3.548		6.814		4.019	
CSD B-Pagan	3.650		2.793		4.752		2.958		2.633		3.155		2.752	

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Hansen Overid and the C tests are distributed χ^2_1, the K&P statistic is distributed χ^2_2.
The Breusch Pagan test of Cross Sectional Dependence (CSD) is distributed χ^2_3. Critical Values at 5% significance for χ^2_1=3.84, for χ^2_2=5.99 and for χ^2_3=7.81.

Table 3: Output Response to REER Uncertainty Using US Prices as Instrument

Dep. Var.:	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Growth Ind Output	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Growth of Rel Prices	0.48**	(0.21)	0.35*	(0.18)	0.51**	(0.21)	0.53**	(0.23)	0.40**	(0.20)	0.54**	(0.24)	0.43**	(0.21)
REER Growth	0.82***	(0.06)	0.84***	(0.05)	0.82***	(0.06)	0.79***	(0.07)	0.82***	(0.06)	0.80***	(0.07)	0.82***	(0.06)
REER Uncert GARCH	-17.30	(19.96)					-1.26	(23.70)			-4.14	(23.07)		
BCDI	-0.04***	(0.01)	-0.03***	(0.01)	-0.04***	(0.01)	-0.05***	(0.01)	-0.04***	(0.01)	-0.05***	(0.01)	-0.04***	(0.01)
Dummy Floating	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)
Dummy Interm	-0.01	(0.02)	-0.01	(0.02)	-0.01	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)
REER Uncert RollVar			-28.51***	(9.60)					-21.31*	(10.97)			-20.46*	(11.67)
Variance REER					-0.27	(0.26)								
REER Skewness							0.04**	(0.02)	0.03**	(0.02)	0.04**	(0.02)	0.03**	(0.02)
REER Kurtosis							-0.02**	(0.01)	-0.01*	(0.01)	-0.02*	(0.01)	-0.01*	(0.01)
REER Misalignment											0.01	(0.01)	0.01	(0.01)
Observations	2646		2646		2646		2646		2646		2646		2646	
Time Dummies	✓		✓		✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓		✓		✓	
Clustered SE	C&S		C&S		C&S		C&S		C&S		C&S		C&S	
Hansen Overid Test	0.084		0.005		0.140		0.162		0.003		0.194		0.018	
K&P Statistic	10.016		14.719		8.849		8.520		12.095		8.222		10.843	
C Statistic	19.031		11.499		17.275		20.897		13.430		22.059		15.141	

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The Hansen Overid and the C tests are distributed χ^2_1, the K&P statistic is distributed χ^2_2. Critical Values at 5% significance for χ^2_1=3.84 and for χ^2_2=5.99.

Table 4: Country-Heterogeneous Response of Output to REER Uncertainty

Dep. Var.:	Argentina		Brazil		Uruguay	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	-0.098	(0.092)	-0.026	(0.069)	0.077	(0.268)
REER Growth	1.049***	(0.031)	0.504***	(0.037)	0.967***	(0.197)
REER Uncert RollVar	-20.604*	(10.666)	-21.824**	(8.580)	-26.508**	(12.809)
REER Skewness	0.056***	(0.011)	0.046***	(0.009)	-0.018	(0.022)
REER Kurtosis	-0.007	(0.006)	0.026***	(0.007)	-0.022**	(0.011)
BCDI	-0.064***	(0.010)	-0.059***	(0.006)	-0.017	(0.040)
REER Misalignment	0.047***	(0.014)	-0.004***	(0.001)	-0.015	(0.014)
Observations	923		890		859	
Time Dummies	✗		✗		✗	
Sector FE	✓		✓		✓	
Hansen Overid Test	2.299		4.735		0.009	
K&P Statistic	19.444		21.499		5.777	
C Statistic	0.277		0.034		0.696	

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Hansen Overid and the C tests are distributed χ_1^2, the K&P statistic: χ_2^2. C.V. at 5% significance for χ_1^2=3.84 and for χ_2^2=5.99.

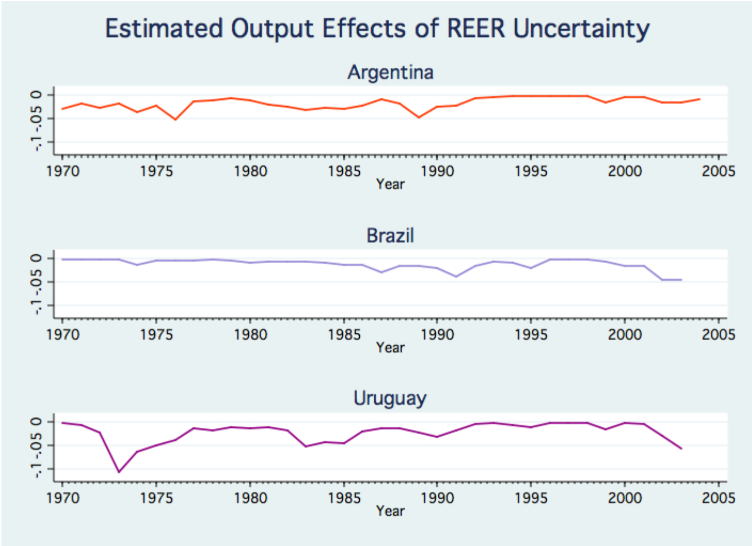

Figure 5: Plot of Estimated Effects of REER Uncertainty on Output

5.2 Threshold Effects

To test for threshold effects of uncertainty with respect to REER changes, on output changes, we estimate the models described in equations (18) and (19):

$$\begin{aligned} q_{tij} &= \gamma_{i-} * \delta_j + \beta_1 p_{tij} + \beta_2 reer_{tj} + \beta_3 reerUncert_{tj} + \beta_4 reerUncert^2_{tj} + \\ &\quad + \beta_5 reerSkew._{tj} + \beta_6 reerKurt._{tj} + \beta_7 reermisal._{tj} + \beta_8 BCDI_{tj} \\ &\quad + \beta_9 Floating_{tj} + \beta_{10} Interm_{tj} + u_{tij} \end{aligned} \tag{18}$$

$$\begin{aligned} q_{tij} &= \gamma_{i-} * \delta_j + \beta_1 p_{tij} + \beta_2 reer_{tj} + \beta_3 LowUncert_{tj} + \beta_4 HighUncert_{tj} + \\ &\quad + \beta_5 reerSkew._{tj} + \beta_6 reerKurt._{tj} + \beta_7 reerMisal._{tj} + \beta_8 BCDI_{tj} \\ &\quad + \beta_9 Floating_{tj} + \beta_{10} Interm_{tj} + u_{tij} \end{aligned} \tag{19}$$

Equation (18) allows for the identification of an inverted-U shape relationship with a linear and a quadratic term for uncertainty. Equation (19) allows for two different linear relationships between output and uncertainty, depending on whether the latter is 'low' or 'high'. We consider 'high' the episodes that are in the upper quintile of the distribution of REER uncertainty, and examine the sensitivity of the results by allowing the break between low and high uncertainty to take place at 20 different percentiles in the the upper quintile.

Column (1) of Table (5) reports the results of estimating equation (18). The hypothesis of an inverted-u shape relationship between uncertainty and output is upheld by the data. Uncertainty affects output in a non-linear fashion. The effect is positive for relatively low levels of uncertainty, while it becomes negative for relatively higher levels. The turning point seems to be around the 75-80th percentile of the distribution of uncertainty. On the basis of this result, we determined "high uncertainty" to correspond to the episodes in the upper quintile of the distribution, and investigated the robustness of the results to different breaking points within the 5th quintile. Figure 6 depicts the estimated effects of low and high uncertainty, along with their confidence intervals at 95% confidence, for the 20 different breaking points. It is possible to see that the estimated effects of low and high uncertainty are significantly different. While the former are generally positive, the latter are negative. In addition, the effects of high uncertainty seem to be more precisely estimated (a narrower interval) and seem to be quite stable irrespective of the choice of the breaking point. Column (2) reports the results of estimating equation (19) when the break for high uncertainty being at the 90th percentile of the distribution. In line with the quadratic specification, we find the effect of REER uncertainty to be different depending on whether we considered 'low' or 'high' uncertainty.[42]

[42]Both the AIC and the BIC favoured these models to that of equation (eqrefeq:quadratic.

Table 5: Thresholds

Dep. Var.:	(1)		(2)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	0.26*	(0.14)	0.28**	(0.14)
REER Growth	0.88***	(0.03)	0.87***	(0.03)
REER Uncert RollVar	64.30***	(21.08)		
Sq REER Uncert Roll Var	-27806.21***	(5326.84)		
REER Skewness	0.02**	(0.01)	0.03***	(0.01)
REER Kurtosis	-0.01**	(0.01)	-0.01*	(0.01)
BCDI	-0.04***	(0.01)	-0.05***	(0.01)
REER Misalignment	0.01	(0.01)	0.01	(0.01)
Dumm Floating	-0.02	(0.02)	-0.03*	(0.02)
Dumm Intermed.	-0.03	(0.02)	-0.03	(0.02)
Low Uncert			37.69**	(16.11)
High Uncert			-28.00***	(10.25)
Observations	2563		2563	
Time Dummies	✓		✓	
Sector-Country FE	✓		✓	
Clustered S.E.	C&S		C&S	
Hansen Overid Test	1.471		2.190	
K&P Statistic	5.914		5.123	
C Statistic	4.787		3.946	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

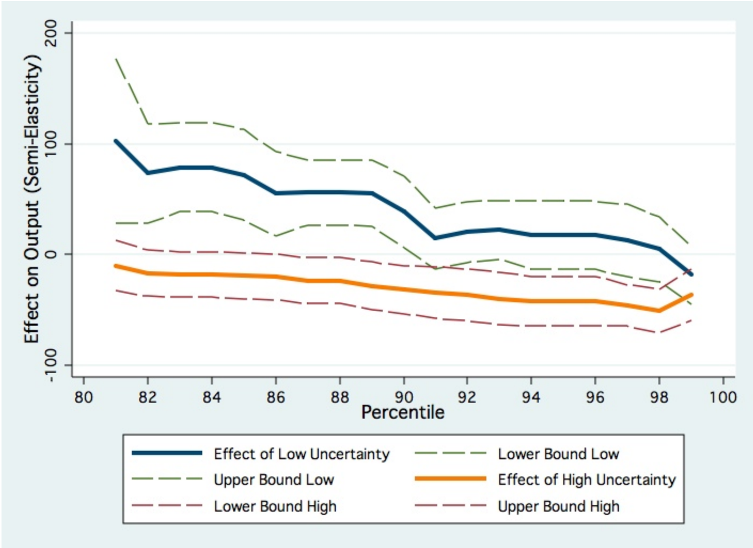

Figure 6: Threshold Effects of REER Uncertainty on Output

5.3 Sectoral Heterogeneity

The baseline estimation results proposed above pools across industries, imposing a common responsiveness of output to REER uncertainty. As sectors exhibit different characteristics, it is interesting to explore whether differences in characteristics affect the vulnerability of sectoral output changes to REER uncertainty. Here we explore three possible triggers of heterogeneity: trade orientation, productivity and the intensity with which they trade with Mercosur countries. We examine their direct effects on output, and their indirect effects, through the output growth vulnerability to REER uncertainty.

5.3.1 Trade Orientation

Differences in trade orientation by sector may explain some of the heterogeneity in the responsiveness of sectoral output to REER uncertainty, although the effects are *a priori* ambiguous. The standard textbook approach would suggest that those sectors that are more exposed to international trade are going to be more sensitive to REER uncertainty than those whose output is mainly oriented to the domestic markets. This is because real exchange rates (and their variations) are going to explain a larger portion of the price received by firms in tradable sectors, and uncertainty about the price to be received will induce an output contraction if firms in those sectors are averse to risk. However, in economies in which firms contract dollar-debt, REER uncertainty affects output through the firms' financial structure — (see Chapter 1 for a full discussion). With dollar-debt, the less the firms export, the larger the currency mismatch in their balance-sheets, and the more sensitive sectoral output will be to REER uncertainty, even if firms are risk-neutral. Given the theoretical ambiguity, we test empirically whether differences in exposure to international trade determine differences in the sensitivity to REER uncertainty, and allowing for a level effect of the measure of exposure to international trade on output changes, by estimating equation (5), with Z_{tij} being the ratio of sectoral exports to sectoral output, as in equation (20):

$$\begin{aligned} q_{tij} \quad = \quad & \alpha_{ij} + \alpha_t + \mathbf{X}\gamma + \beta_1 reerUncert_{tj} + \beta_2 reerUncert_{tj} * Exp/Output_{t-1,ij} + \\ & + \beta_3 Exp/Output_{t-1,ij} + u_{tij} \end{aligned} \tag{20}$$

A specific challenge here is that output appears both on the left and the right hand side of the equation given the way the measure of export exposure is constructed. This means that shocks affecting output due to, say, measurement error, will lead to biased estimates of our coefficients. We address this problem in three alternative ways. First, we use the lagged exports/output measure, and interact this lag with the uncertainty measure. Results are reported in column 1 of Table (6). Conditional on the effects of the other covariates, the effect of REER uncertainty on output is heterogeneous across sectors, and depends on the ratio of exports/output. The effect of uncertainty on output changes is found to be negative, but it becomes smaller, the larger the exported proportion of output is. The level effect of the lagged ratio of exports/output is insignificant.

Second, we consider averages of sectoral export/output instead of just the contemporaneous measure, and interact this average with the uncertainty measure. If measurement error is imperfectly correlated over the years, then, by averaging, we reduce its importance. Results of estimating equation (20) using this approach (taking 5-year averages) are reported in Column 2. In line with the previous results, we find that those sectors that have been exporting a larger portion of their output are less sensitive to REER uncertainty. In addition, they seem to grow less, on average and *ceteris paribus*. We used 10-year averages, and the results point to the same direction (reported in Column 3). The level effects of export orientation on output changes, when using averages are now negative, suggesting that more open sectors have been less dynamic. The third approach consists of using a discrete measure of exports/output that indicates in which quartile of the distribution of exports/output the sector is. For these purposes we construct quartile dummies. The $i-th$ dummy will take value 1 if the sector is in the $i-th$ quartile and zero otherwise. We interact the dummies with the uncertainty measure. In this way, output does not enter directly on the right-hand side of equation (20). In addition to this, we exclude from the estimation those observations that move from one quartile to another in a given year. Results are reported in Column 4. REER uncertainty seems to decrease output of those sectors that are in the lowest quartile of the distribution of the export/output ratio. For the second and third quartile, the point estimate is negative, but not well-determined. It is worth mentioning that when using this approach, given that we exclude those sectors that change quartile from one year to the next, the sample size is reduced by more than 20%. As in the first approach, the level effects of export orientation on output changes are statistically insignificant, for all the quartiles.

Table 6: Trade Orientation

Dep. Var.:	(1)		(2)		(3)		(4)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	0.19	(0.14)	0.27*	(0.15)	0.26*	(0.15)	0.15	(0.18)
REER Growth	0.88***	(0.03)	0.87***	(0.03)	0.87***	(0.03)	0.89***	(0.04)
REER Uncert RollVar	-38.54***	(9.64)	-38.82***	(10.17)	-39.99***	(10.68)	23.62	(23.69)
REER Skewness	0.02**	(0.01)	0.02**	(0.01)	0.02**	(0.01)	0.01	(0.01)
REER Kurtosis	-0.01*	(0.01)	-0.01	(0.01)	-0.01	(0.01)	-0.00	(0.01)
BCDI	-0.04***	(0.01)	-0.05***	(0.01)	-0.05***	(0.01)	-0.04***	(0.01)
REER Misalignment	0.01	(0.01)	0.01	(0.01)	0.01	(0.01)	0.01	(0.01)
Dummy Floating	-0.01	(0.02)	0.00	(0.02)	0.00	(0.02)	-0.01	(0.02)
Dummy Interm	-0.01	(0.02)	0.00	(0.02)	0.00	(0.02)	-0.01	(0.03)
Uncert*Lagged Exp/Out	17.00***	(5.04)						
L.Exp/Out	0.00	(0.01)						
Uncer*5-y Ave Exp/Out			9.05**	(4.51)				
5-y Ave Exp/Out			-0.01***	(0.00)				
Uncer*10-y Ave Exp/Out					9.30**	(4.08)		
10-y Ave Exp/Out					-0.02***	(0.00)		
Uncer*Q1 Exp/Out							-66.74**	(28.56)
Uncer*Q2 Exp/Out							-40.55	(26.84)
Uncer*Q3 Exp/Out							-46.65	(31.08)
Q1 Exp/Out							0.04	(0.04)
Q2 Exp/Out							0.02	(0.03)
Q3 Exp/Out							0.03	(0.03)
Observations	2563		2563		2563		1992	
Time Dummies	✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓	
Clustered S.E.	C&S		C&S		C&S		C&S	
Hansen Overid Test	0.792		1.392		1.240		0.673	
K&P Statistic	6.527		5.911		6.177		6.752	
C Statistic	0.792		4.531		4.724		3.419	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.3.2 Productivity

It is plausible to believe that the more profitable a firm is, the less sensitive it will be to REER uncertainty. In Varela (2009), we argued that in a context in which credit was only available in dollars, the output of those firms with higher liquidity, or current profits, was going to be less sensitive to increases in REER uncertainty than that of firms with lower liquidity balances. For the latter type, the increase in uncertainty would increase expected bankruptcy costs by more, which means that the output response will be correspondingly larger than for the former type. But even if credit is not dollarised, more profitable firms will have more chances to adjust to an adverse competitiveness shock that could arise from movements in the REER than less profitable ones. Unfortunately, we do not have data on sectoral profitability. However, we do have data on labour productivity, and on labour productivity of the same sectors in the United States. Assuming an association between productivity and profitability, we test whether there exists a second source of sectoral heterogeneity in the output response to REER uncertainty, related to the level of sectoral labour productivity.

To test this proposition, we include a measure of labour productivity (the quotient of sectoral output and the wage bill), and an interaction between labour productivity and the measure of REER uncertainty, and estimate equation (21):[43]

$$\begin{aligned} q_{tij} &= \alpha_{ij} + \alpha_t + \mathbf{X}\gamma + \beta_1 reerUncert_{tj} + \beta_2 reerUncert_{tj} * LabProd_{tij} + \\ & \quad + \beta_3 * LabProd_{tij} + u_{tij} \end{aligned} \tag{21}$$

Like when exploring the role of trade orientation in determining the heterogeneity of the output response to REER uncertainty, in equation (21) output appears both on the left and the right hand side of the equation, given the way the labour productivity measure is constructed. We approach the problem as before.

We use the distance to the productivity frontier (DistFrontier) as an alternative to labour productivity. The frontier is assumed to be labour productivity exhibited by USA manufacturing sectors (eq. (22)). DistFrontier defined as: $(LP_{i,t,USA} - LP_{i,t,j})/LP_{i,t,USA}$ (where $LP_{i,t,j}$ is the labour productivity of sector 'i', in period 't', in country 'j'). As above, endogeneity is a problem. We deal with it in the same way as before, dividing the distribution of the distance to the frontier in four quartiles and interacting each of the four quartile dummies with the uncertainty measure.

$$\begin{aligned} q_{tij} &= \alpha_{ij} + \alpha_t + \mathbf{X}\gamma + \beta_1 reerUncert_{tj} + \beta_2 reerUncert_{tj} * DistFrontier_{tij} \\ & \quad + \beta_3 DistFrontier_{tij} + u_{tij} \end{aligned} \tag{22}$$

Table (7) reports the results from estimating equation (21) using alternative approaches. Column 1 shows the results of when we include labour productivity in levels and an interaction of labour productivity with the uncertainty measure in the model. Conditional on differences arising due to other covariates, those sectors exhibiting higher labour productivity tend to exhibit higher growth rates, as the level effect of labour productivity is positive and significant. In addition to this level effect, productivity also affects the vulnerability of sectors to REER uncertainty. The more productive the sectors are, the lower the effect of REER uncertainty on output, as the interaction term is very well-determined and positive. The size of the estimated parameters of interest is, however, surprising. Calculated at the average level of productivity, the effects of uncertainty on output are positive ($= -32.49 + 142.28 \times 7.06$).

[43] Clearly, labour productivity is an imperfect measure of productivity. The choice is mainly motivated by data constraints.

The estimates become plausible once we control for the endogeneity problem using the approaches outlined above. Column 2 shows the results of using 10-year productivity averages instead of the contemporaneous productivity level. Here again, sectoral output changes become less vulnerable to REER uncertainty, the larger the average labour productivity is. Figure 7 shows the marginal effect of uncertainty on output growth at different levels of labour productivity. At the average, the marginal effect equals: $-51.12 + 3.85 \times 7.06 = -23.95$. This is slightly more than half the size of the effect faced by low-productivity sectors, in the first decile of the distribution ($-51.12 + 3.85 \times 2.70 = -40.71$). Sectors in the top 30 percent of the distribution of labour productivity seem not to be affected by REER uncertainty, as the marginal effect becomes statistically insignificant. The level effect of average productivity on output changes is not well-determined. Column 3 shows the results when the quartiles of the distribution of labour productivity are interacted with the uncertainty measure. The findings are in line with the previous ones. The effects of REER uncertainty on output are negative for those sectors in the 1st and 2nd quartiles of the distribution, but not significant for those with productivity levels in the upper half of the distribution. Here again, the level effect of productivity on output changes is insignificant.

Columns 4-5 report the results of estimating equation (22). Results reported in column 4 are as expected. The estimated marginal effect of REER uncertainty on output at the mean distance to the efficiency frontier equals $-93.88 \times 0.66 = -62.27$. In addition, sectors that are further away from the frontier, tend to be less dynamic, as indicated by the negative and significant coefficient on the level of distance to the frontier. *Ceteris paribus*, an increase in the distance to the frontier by 1%, decreases the growth rate by about one-fifth of a percentage point, on average. Column 5 shows the results when quartiles dummies of the distribution of the distance to the frontier are interacted with the uncertainty measure. Although the point estimates suggest that the sectors that are closer to the frontier are less affected by REER uncertainty, the imprecision of the estimates prevent us from drawing conclusions.

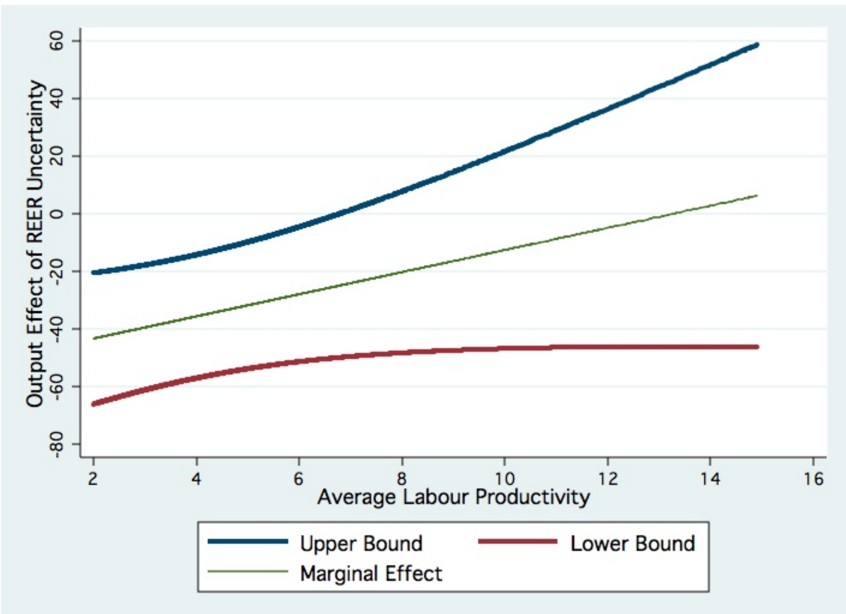

Figure 7: Marginal Effect of Uncertainty as a Function of Labour Productivity

5.3.3 Orientation to Mercosur Markets

Motivated by the fact that the main sources of REER uncertainty come from Mercosur economies, while we have used a macro-measure of uncertainty that is the same across sectors of a given country, here we try to identify whether results change when we consider sectors that exhibit high exposure and sectors that exhibit low exposure. High and low exposure are defined on the basis of the EII defined in Section 3.1. In addition, and in accordance with the discussion in Section 4.3, we adjust our macro measure of uncertainty by multiplying it to our indicator of export intensity to Mercosur markets. This adjusted measure of uncertainty will vary now at a sectoral level, using the 2-digit international standard industrial classification (ISIC).[44] The estimable equation (23) is presented below:

$$q_{tij} = \alpha_{ij} + \alpha_t + \mathbf{X}\gamma + \beta_1 reerUncert_{tj} + \beta_2 reerUncert_{tj} * EII_{ti-j} + +\beta_3 EII_{ti-j} + u_{tij} \tag{23}$$

Columns (1-2) of Table 8 report the results of estimating the baseline model separate for sectors that exhibit a low exposure to Mercosur markets (sector exhibiting, on average across the period, an EII below the median, Col.1), and those that exhibit a high exposure (sector exhibiting, on average across the period, an EII above the median, Col.2). EII were used to classify sectors into 'high' and 'low' exposure to Mercosur. So, for example, sector 311 will be classified into 'low' exposure for the

[44]This is because the EII are defined at 2-digit level.

Table 7: Sectoral Heterogeneity: Labour Productivity

Dep. Var.:	(1)		(2)		(3)		(4)		(5)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	-0.03	(0.13)	0.14	(0.13)	0.39	(0.26)	0.10	(0.13)	0.02	(0.16)
REER Growth	0.98***	(0.03)	0.93***	(0.03)	0.92***	(0.05)	0.94***	(0.03)	0.94***	(0.04)
REER Uncert RollVar	-32.49**	(15.23)	-51.12***	(13.52)	-2.37	(16.10)	40.80	(33.71)	-39.32**	(16.22)
REER Skewness	0.02***	(0.01)	0.01	(0.01)	0.00	(0.01)	0.02	(0.01)	0.01	(0.01)
REER Kurtosis	-0.00	(0.01)	-0.01	(0.01)	0.00	(0.01)	-0.01	(0.01)	-0.01	(0.01)
BCDI	-0.06***	(0.01)	-0.05***	(0.01)	-0.08***	(0.02)	-0.05***	(0.01)	-0.04***	(0.01)
REER Misalignment	0.01	(0.01)	0.00	(0.01)	-0.00	(0.01)	0.00	(0.01)	-0.01	(0.01)
Dummy Floating	-0.01	(0.02)	-0.00	(0.02)	0.04	(0.03)	-0.01	(0.02)	-0.00	(0.02)
Dummy Interm	-0.02	(0.03)	0.01	(0.02)	0.06	(0.04)	-0.00	(0.02)	-0.02	(0.02)
Labour Productivity	0.01**	(0.00)								
Uncert*L.Prod	142.28***	(37.37)								
Average L.Prod.			0.00	(0.00)						
Uncert*AveL.Prod			3.85*	(2.16)						
Qtiles LP					-0.01	(0.01)				
Uncert* 1st Qtile. LP					-53.93*	(31.91)				
Uncert* 2nd Qtile. LP					-46.76*	(23.89)				
Uncert* 3rd Qtile. LP					23.64	(24.35)				
Dist.to Frontier							-0.18***	(0.06)		
Uncert*Dist. to Frontier							-93.88**	(40.17)		
Qtiles Dist Frontier									0.00	(0.01)
Uncert* 1st Qtile. Dist.									29.24	(21.41)
Uncert* 2nd Qtile. Dist.									26.18	(16.48)
Uncert* 3rd Qtile. Dist.									16.68	(14.77)
Observations	2235		2514		1931		2570		2048	
Time Dummies	✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓	
Clustered S.E.	C&S		C&S		C&S		C&S		C&S	
Hansen Overid Test	1.054		0.303		2.787		0.039		1.39	
K&P Statistic	1.709		7.340		6.061		6.807		12.823	
C Statistic	0.248		3.530		4.254		3.150		0.340	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

whole period of analysis 1970-2002, even when the EII are only available for the period 1980-2002. The validity of this approach relies on sectors not to changing significantly the intensity with which they trade with the neighbour countries over the years. Conditional on the effects of the other covariates, REER uncertainty affects negatively the output of those sectors that are mainly oriented to Mercosur, while the effect on those that display a low export intensity is not significantly different from zero. We then estimate equation (23) in which the macro measure of uncertainty is adjusted using the sectoral EII, and in which the EII also enters in levels. Results are reported Column 3 of Table 23. The estimated effect of the uncertainty on output should be read as $\hat{\beta}_1 + \hat{\beta}_2 \bar{EII}$. Results suggest that, conditional on the effects of the other covariates, this estimated effect is larger for sectors with more exposure to Mercosur. On the other hand, the level effect of EII on output changes is not well determined, suggesting no specific growth pattern associated to those sectors that trade predominantly with Mercosur, conditional on the other covariates. As argued in Section 4.3, there are a number of channels through which EII may exert significant effects in this model. In an attempt to better understand which channels are at work, we first investigated whether there is an association between the intensity with which sectors trade intensively within Mercosur, and their productivity. We found that this is the case, as the correlation of the EII with the distance to the US frontier is 0.15, and statistically significant at 1%. We then modified equation (23), and incorporated the distance to the US frontier in levels, and interacted with uncertainty in order to control for the fact that the effect of the EII may be concealing a productivity effect. The new estimable equation is (24):

$$\begin{aligned} q_{tij} &= \alpha_{ij} + \alpha_t + \mathbf{X}\gamma + \beta_1 reerUncert_{tj} + \beta_2 reerUncert_{tj} * EII_{ti-j} + \beta_3 EII_{ti-j} \\ &\quad + \beta_4 reerUncert_{tj} * DistFrontier_{tij} + \beta_5 DistFrontier_{tij} + u_{tij} \end{aligned} \tag{24}$$

Results are reported in Column 4 of Table 8. The estimated effects of distance to the US, and its interaction with uncertainty are similar to those found in Section 5.3.2. Displaying higher-than-average distance to the productivity frontier has a direct effect on output growth — decreasing it with respect to the average, plus an indirect effect, increasing the vulnerability of the sector to REER uncertainty.[45] In addition, the estimated effect of the adjusted measure of uncertainty on output ($\hat{\beta}_1 + \hat{\beta}_2 \bar{EII}$) exhibits the same pattern: the effect on output is larger for sectors with more exposure to Mercosur. Also, the direct effect of EII on output changes is insignificant.

Putting the focus on the effects that EII and distance to the frontier exert on the vulnerability of sectoral output growth to REER uncertainty, we calculate the locus where the effect of uncertainty on output is zero, by setting $\hat{\beta}_1 + \hat{\beta}_2 EII + \hat{\beta}_3 DistFrontier$ equal to zero. Given the estimated coefficients, the slope is negative ($-\hat{\beta}_3/\hat{\beta}_2 < 0$). This is plotted in Figure 8. The higher the orientation to Mercosur, the closer to the productivity frontier the sector has to be for REER uncertainty to have no effect on output growth. For sectors that exhibit combinations of EII and distance to the frontier that are above the locus, the estimated effect of uncertainty on output is negative. If we take, for example, the sector exhibiting the median EII and distance to the frontier, the effect of uncertainty is close to zero.

The fact that when including distance to the frontier in the model, the effect of EII remains significant suggests that the adjustment to the macro uncertainty meas-

[45] Although the size of the coefficients is larger than those found in the previous section, the confidence intervals at 95% overlap.

ure with the sectoral EII may be necessary to reflect different degrees in exposure to uncertainty.

Finally, we estimate our model including the lagged export/ouput ratio, the distance to the frontier, and the EII together, both in levels and interacted with the measure of REER uncertainty, as in equation (25):

$$\begin{aligned} q_{tij} \quad = \quad & \alpha_{ij} + \alpha_t + \mathbf{X}\gamma + \beta_1 reerUncert_{tj} + \beta_2 reerUncert_{tj} * EII_{ti-j} + \beta_3 EII_{ti-j} \\ & + \beta_4 reerUncert_{tj} * DistFrontier_{tij} + \beta_5 DistFrontier_{tij} \\ & + \beta_6 reerUncert_{tj} * Exp/Output_{t-1,ij} + \beta_7 Exp/Output_{t-1,ij} + u_{tij} \end{aligned} \tag{25}$$

Results are reported in Column 5 of Table 8. Results are largely unchanged with respect to those obtained when each of the interactions was scrutinized in isolation,

Table 8: Mercosur Export Intensity

Dep. Var.:	(1)		(2)		(3)		(4)		(5)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	-0.12	(0.27)	0.20	(0.14)	0.04	(0.15)	0.03	(0.14)	0.02	(0.14)
REER Growth	0.94***	(0.07)	0.89***	(0.04)	0.65***	(0.04)	0.66***	(0.04)	0.67***	(0.04)
REER Uncert RollVar	-23.93	(14.72)	-30.13***	(11.53)	23.74	(27.60)	149.27**	(62.66)	138.80**	(64.02)
REER Skewness	0.02	(0.02)	0.03**	(0.01)	0.00	(0.01)	0.01	(0.01)	0.01	(0.01)
REER Kurtosis	0.00	(0.01)	-0.02*	(0.01)	0.04***	(0.01)	0.04***	(0.01)	0.04***	(0.01)
BCDI	-0.02*	(0.01)	-0.06***	(0.01)	-0.07***	(0.02)	-0.07***	(0.02)	-0.07***	(0.02)
REER Misalignment	0.00	(0.01)	0.01	(0.01)	0.00	(0.01)	0.00	(0.01)	0.00	(0.01)
Dummy Floating	-0.04	(0.02)	0.01	(0.02)	-0.08**	(0.04)	-0.08**	(0.04)	-0.07*	(0.03)
Dummy Interm	-0.06***	(0.02)	0.02	(0.02)	-0.06*	(0.04)	-0.05	(0.04)	-0.05	(0.03)
Uncer*EII					-0.46**	(0.19)	-0.39**	(0.20)	-0.28*	(0.16)
Merco EII					0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
Uncert*Dist to Frontier							-167.74**	(74.55)	-186.86***	(71.84)
Dist to Frontier							-0.30***	(0.11)	-0.32***	(0.12)
Uncert*Lagged Exp/Out									12.74*	(7.09)
L.Exp/Out									0.00	(0.01)
Observations	1006		1557		1530		1530		1530	
Time Dummies	✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓	
Clustered S.E.	C&S		C&S		C&S		C&S		C&S	
Hansen Overid Test	0.138		3.15		5.014		4.517		4.843	
K&P Statistic	6.782		3.234		0.442		0.466		0.506	
C Statistic	0.632		1.218		2.044		2.236		2.213	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

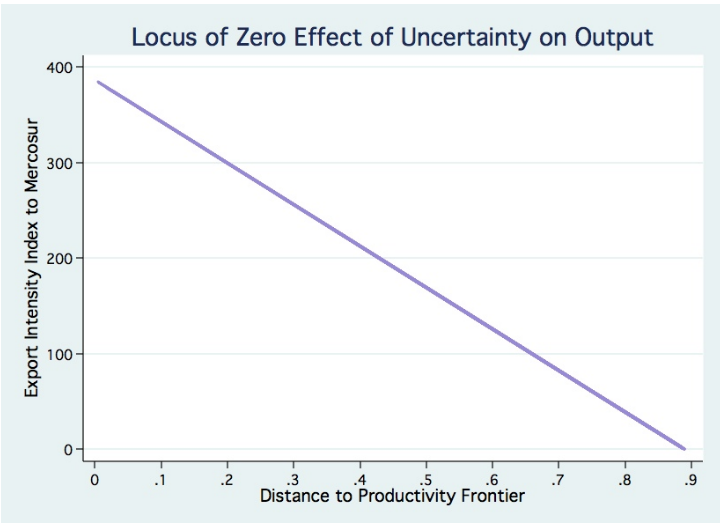

Figure 8: Locus of Zero Effect of Uncertainty on Output

when looking at significance, sign and size of the effects. While trade orientation and EII exert no significant direct effect on output growth, distance to the frontier significantly decreases output growth. Further to this, the indirect effects on output growth that operate through the vulnerability of the sector to REER uncertainty are also in line with those previously found. It is worth mentioning that the point estimate of the interaction of REER uncertainty and EII decreases as we sequentially add the other covariates, although the confidence intervals for that interaction term in the models reported in Column 3, 4 and 5 overlap.

However, the estimated effects reported in this section should be interpreted cautiously, because the diagnostic tests suggests that instruments are weak and not valid for these specifications. This may be related to the fact that because the EII are only available for two thirds of the sample period considered, we substantially lose degrees of freedom in the estimation of these models.

6 Conclusions

This chapter adds to the empirical literature on the effects of uncertainty on productive decisions. The existing literature has generally focused on the relationship between uncertainty and investment, while scant attention has been put on the effects on output. Given that production takes time, the payment for inputs occurs before output is sold, which makes output decisions, in effect, risky investment decisions.

The chapter draws on the case of Southern Cone countries over the period 1970-2002 and focuses on REER uncertainty. Southern Cone countries have exhibited a particularly high record of REER uncertainty over the period, and in addition, they have become more interlinked from a trade perspective. This latter phenomenon has further increased their exposure to uncertainty. The focus on the REER is particularly relevant in the context of these economies where the expected value of the REER and the uncertainty surrounding that expectation are key factors that are constantly in the lobbying agenda of manufacturers, and in the speeches of policy-makers. This is because of the effect the REER has on the price of tradable goods sold by manufacturers, because during much of the 1980s and 1990s a large portion of firms contracted dollar-debt to finance their production plans, and because hedging instruments to cover against exchange rate risk have been largely unavailable.

In this chapter, we explored the impact of REER uncertainty on output by estimating a supply function in which the output-price simultaneity was tackled using two alternative sets of instruments. We identified an average non-negligible negative effect of REER uncertainty on output changes, when considering the pooled sample of 28 manufacturing sectors for the 3 countries, after controlling for other determinants of output supply. This finding was robust to our choice of instruments, and relatively homogeneous across countries.

The average effect masks, however, a number of specificities. We found evidence of non-linearities in the uncertainty-output relationship. There is a threshold above which uncertainty affects output negatively, but below which the effect may even be positive. Furthermore, we found that differences in sectoral characteristics explain differences in the sensitivity of output to REER uncertainty. Output in those sectors that are more export oriented seem to be less affected by REER uncertainty. However, those sectors that trade more intensively with Mercosur countries seem to be more affected by REER. This finding is likely to be explained by the fact that exposure to uncertainty is larger in these sectors, and not necessarily because they are more sensitive to uncertainty. In addition, we found that higher labour productivity decreases the negative impact of REER uncertainty on output.

Last but not least, we found that output is not only responsive to the first two moments of the distribution of the REER, but also to higher ones, such as skewness and kurtosis. Given that the series of REER changes are non-normal, then a measure of its uncertainty should not only look at mean and variance, but also at higher moments.

Two policy implications emerge from this analysis. Firstly, given the finding of threshold effects, suggesting that it is high REER uncertainty that exerts a negative effect on output changes, it seems that the strategy of adopting fixed exchange rate regimes, or some sort of hard pegs to the dollar in an attempt to reduce uncertainty may be counterproductive. This is because experience has shown that these regimes tend to come to an end collapsing, and generate extremely high uncertainty. Instead, it is possible that the REER uncertainty associated with a freely floating nominal exchange rate regime may be within the benign range. In addition, if a portion of the effects of REER uncertainty on output are explained by the high degree of dollarization of the economies under analysis, then more flexible exchange rate arrangements may induce firms to internalise the risk of borrowing in foreign currency, and contribute to a reversal of dollarization, which may in turn reduce the vulnerability of output growth to REER uncertainty.

Secondly, if REER uncertainty affects manufacturing sectors' output growth negatively, and if those sectors trading predominantly with other Mercosur countries are particularly affected, because of their substantially higher volatility records, then policies that contribute to the diversification of export markets are likely to be beneficial. One example is to promote negotiations of free trade agreements with other trading blocs or countries. Another, is to strengthen the international networks that each country has already established in the form of their foreign service offices. Given that in the context of trade in differentiated manufactures, the connections between sellers and buyers are made through search processes that are costly, and that these costs tend to increase, the further away the potential buyer is from the seller, the role that foreign service offices have in partnering with the private sector to contribute to the diversification of export markets may be substantial.

Happily, some of the policies implemented since 2003, by the countries under analysis, have been in line with the recommendations that emerge from this study. Since 2003, the three countries have moved —although to different extents of intervention — to relatively freely floating exchange rate regimes.[46] In addition to this, there have been several policy initiatives for the diversification of export destinations. Examples of these are the increase in free trade agreements (or negotiations to that end) that the bloc has implemented with other countries or regions, and the increasing role played by the Secretariats of Foreign Affairs in these countries in promoting exports of goods and services.[47]

A few caveats are in order, which point to directions of future research. First, our measure of uncertainty is restrictive, as it imposes a backward-looking expectation formation mechanism. Although we argue that it is sensible to assume backward-looking expectations for the period under analysis, ideally one would like to construct a measure of uncertainty that does not impose a particular structure on expectation formation, and compare the results. Data for an 'assumption-free' measure of real exchange rate uncertainty would require, for example, the availability of data on forecasts for nominal exchange rates and relevant prices, with which to calculate the variance of a forecast error on the basis of a true mechanism — whichever it is — for forecasting, instead of an assumed one. These data are hard to find, and were not available for the three countries over the period of analysis. Second, in this chapter we cannot identify whether the average negative effect of uncertainty is related to risk-aversion, or to some other factors, such as agents contracting dollar-debt and facing bankruptcy costs. We have no measure of risk-aversion, or data on balance-sheet currency mismatches. We try to control for the latter with the trade orientation of the sector, but this is clearly an imperfect indicator. Finally, the instruments used to deal with the output-price simultaneity problem are in some cases weak, which means that results should be interpreted cautiously.

[46] In Argentina, the Central Bank significantly intervenes in the foreign exchange market, but it does not make public announcements or commits to a particular future value.

[47] Of a total of twenty agreements aiming at liberalizing trade, subscribed by Mercosur member countries with other regions, seven have been subscribed before 2003, while thirteen have been subscribed since then (source: Mercosur Secretatat).

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A Data

Series of growth rates of the relative price and growth rates of output are calculated on the basis of data obtained from the PADI dataset, complied by ECLAC. The indicator of relative prices results from the variation of the quotient between the deflator of value added and a general production price index. The former is sector, country and year specific while the latter is country, year specific. Hence, the growth rate of relative prices varies along time and across sector and country. Figure 9 shows the distribution of the series of growth of output (top) and relative prices (bottom) over the whole dataset (left) and excluding atypical observations (right). There are a number of atypical observations that exhibit extremely large values for these variables.

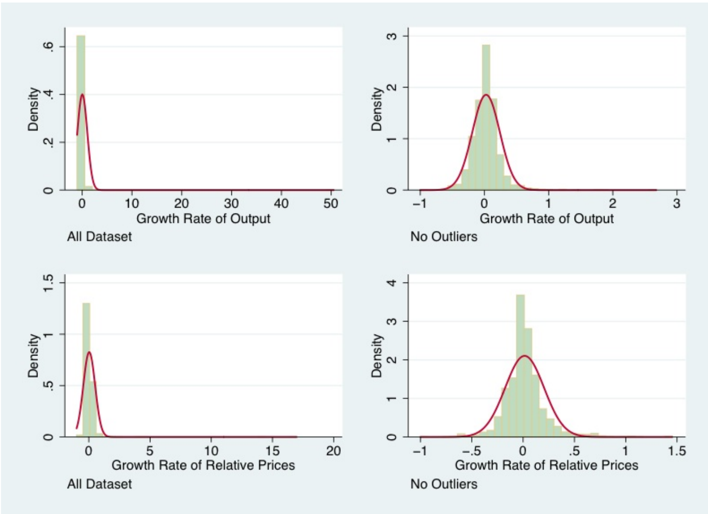

Figure 9: Distribution of the Price and Output Changes with and without Outliers

Table 9 reports summary statistics for the two series. The mean relative price growth is positive as well as output growth. The series are right-skewed, suggesting that large price increases are more common than large price decreases, and their kurtosis departs substantially from normality. The fat tails indicate the frequency of extreme outcomes, even when outliers have been excluded.

Variable	Mean	Std Dev	Max	Min	Skewness	Kurtosis
Growth of Rel Prices	0.0318	0.4854	16.970	-1.0000	25.156	804.427
Growth of Rel Prices (No Out.)	0.0203	0.2392	4.578	-1.0000	5.8238	91.907
Growth of Output	0.0724	0.9812	47.383	-1.0000	41.936	2016.576
Growth of Output (No Out.)	0.0486	0.3356	1.9853	-1.0000	2.387	12.372

Table 9: Summary Statistics for Price and Output Changes with and without Outliers

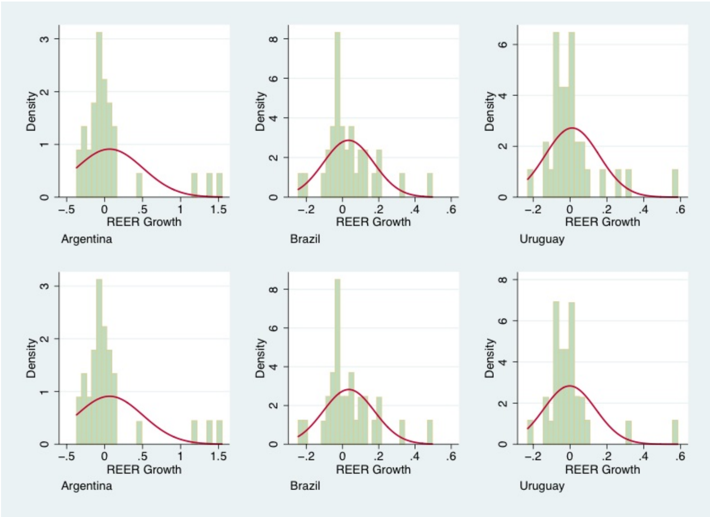

Figure 10: Distribution of the Growth Rate of the REER

Country	Mean	Std. Dev	Min	Max	Skewness	Kurtosis
Argentina	0.007	0.150	-0.343	2.205	8.894	114.0
Brazil	0.002	0.038	-0.113	0.247	1.964	13.83
Uruguay	0.001	0.068	-0.241	0.874	9.217	117.1

Table 10: Summary Statistics for the Growth Rate of the REER

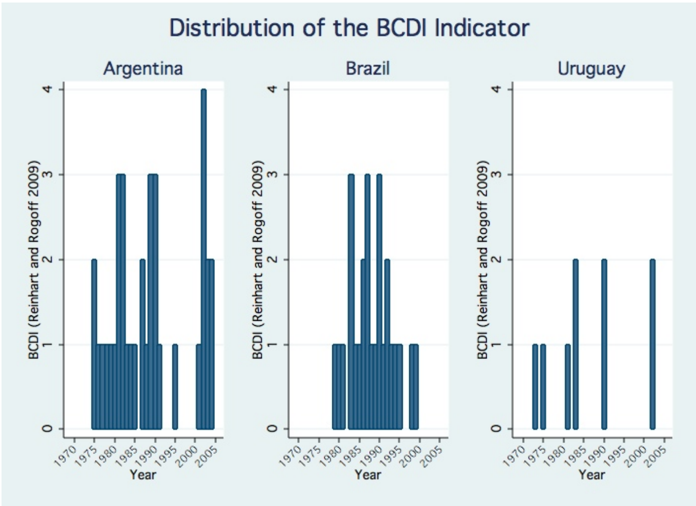

Figure 11: Distribution of the BCDI Index

Distribution over time and by country of the BCDI Crises Index.

Table 11: Ratios of Means of Volat-GARCH across Periods

Argentina	**1970**	**1980**	**1990**
1980	0.950		
1990	1.447**	1.524***	
2000	1.479**	1.558**	1.021
Brazil	**1970**	**1980**	**1990**
1980	0.461***		
1990	0.467***	1.014	
2000	0.271***	0.589***	0.581***
Uruguay	**1970**	**1980**	**1990**
1980	0.992		
1990	1.644***	1.658***	
2000	1.457**	1.470***	0.885

Notes: '***' indicates differences are significant at 1%, '**' significant differences at 5% and '*' significant diff. at 10%

B Robustness Checks

Table 12: International Comparison of Instability of Selected Economic Indicators

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**C.V.**	**Obs.**
Real GDP Growth						
Argentina	2.494	5.421	-10.894	10.579	3.62	40
Brazil	4.133	3.951	-4.234	13.948	0.995	40
Uruguay	2.542	4.816	-11.032	11.82	2.699	40
Australia	3.261	1.717	-0.888	6.735	0.552	40
Canada	2.933	2.155	-2.859	6.964	0.654	40
New Zealand	2.703	2.548	-3.284	8.471	1.002	40
United Kingdom	2.211	2.197	-4.92	7.196	0.843	40
CPI Inflation						
Argentina	2.458	6.068	-0.012	30.793	2.218	39
Brazil	4.032	7.498	0.032	29.477	1.559	29
Uruguay	0.443	0.315	0.044	1.125	0.565	39
Australia	0.06	0.041	0.003	0.151	0.622	39
Canada	0.046	0.034	0.002	0.125	0.669	39
New Zealand	0.07	0.056	0.003	0.171	0.723	39
United Kingdom	0.066	0.055	-0.006	0.242	0.768	39
Depreciation of the NER						
Argentina	4.63	20.741	-0.063	130.109	4.054	39
Brazil	0.401	0.656	-0.242	2.694	1.219	27
Uruguay	0.412	0.463	-0.18	1.923	0.902	39
Australia	0.023	0.113	-0.214	0.362	2.835	39
Canada	0.016	0.087	-0.13	0.208	2.868	39
New Zealand	0.028	0.105	-0.184	0.304	2.444	39
United Kingdom	0.026	0.098	-0.117	0.339	3.385	39

Notes: Annual data obtained from IMF IFS database expressed in percentage changes

Table 13: Replication of Table 2 with Heteroscedasticity and Autocorrelation Consistent Standard Errors

Dep. Var.:	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Growth Ind Output	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Growth of Rel Prices	0.11	(0.07)	0.08	(0.06)	0.12*	(0.07)	0.12*	(0.07)	0.09	(0.06)	0.12*	(0.07)	0.10	(0.07)
REER Growth	0.91***	(0.03)	0.90***	(0.03)	0.91***	(0.03)	0.90***	(0.03)	0.89***	(0.03)	0.90***	(0.03)	0.90***	(0.03)
REER Uncert GARCH	-23.43	(21.26)					-9.91	(22.36)			-12.26	(22.54)		
BCDI	-0.04***	(0.01)	-0.04***	(0.01)	-0.05***	(0.01)	-0.05***	(0.01)	-0.04***	(0.01)	-0.05***	(0.01)	-0.04***	(0.01)
Dummy Floating	-0.02	(0.02)	-0.02	(0.02)	-0.01	(0.02)	-0.01	(0.02)	-0.01	(0.02)	-0.01	(0.02)	-0.02	(0.02)
Dummy Interm	-0.01	(0.02)	-0.01	(0.02)	-0.01	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)	-0.02	(0.02)
REER Uncert RollVar			-27.96***	(10.56)					-21.59*	(11.04)			-20.77*	(11.15)
Variance REER					-0.22	(0.17)								
REER Skewness							0.03***	(0.01)	0.03**	(0.01)	0.03**	(0.01)	0.02**	(0.01)
REER Kurtosis							-0.02**	(0.01)	-0.01**	(0.01)	-0.01**	(0.01)	-0.01**	(0.01)
REER Misalignment											0.01	(0.01)	0.00	(0.01)
Observations	2563		2563		2563		2563		2563		2563		2563	
Time Dummies	✓		✓		✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓		✓		✓	
Hansen Overid Test	1.944		0.617		2.380		2.345		0.907		2.498		1.129	
K&P Statistic	25.258		25.821		24.991		25.146		25.716		24.957		25.403	
C Statistic	7.190		2.909		11.247		10.635		8.126		11.079		8.693	

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Hansen Overid and the C tests are distributed χ^2_1, the K&P statistic is distributed χ^2_2.

Table 14: Replication of Table 5 with HAC standard errors

Dep. Var.:	(1)		(2)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	0.26*	(0.14)	0.29**	(0.14)
REER Growth	0.87***	(0.03)	0.86***	(0.03)
REER Uncert RollVar	65.13***	(21.66)		
Sq REER Uncert Roll Var	-26589.69***	(6219.99)		
REER Skewness	0.03**	(0.01)	0.03***	(0.01)
REER Kurtosis	-0.02**	(0.01)	-0.02**	(0.01)
BCDI	-0.04***	(0.01)	-0.05***	(0.01)
REER Misalignment	0.01	(0.01)	0.01	(0.01)
Dummy Floating	-0.02	(0.02)	-0.03	(0.02)
Dummy Interm	-0.03	(0.02)	-0.03	(0.02)
lv1290			50.12***	(17.38)
hv1290			-23.13**	(10.25)
Observations	2563		2563	
Time Dummies	✓		✓	
Sector-Country FE	✓		✓	
Hansen Overid Test	1.320		2.255	
K&P Statistic	6.243		5.242	
C Statistic	8.502		8.895	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Replication of Table 6 with HAC standard errors

Dep. Var.:	(1)		(2)		(3)		(4)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	0.19	(0.13)	0.27*	(0.15)	0.26*	(0.15)	0.13	(0.17)
REER Growth	0.88***	(0.03)	0.87***	(0.03)	0.87***	(0.03)	0.89***	(0.04)
REER Uncert RollVar	-33.86***	(10.71)	-31.94***	(11.11)	-33.05***	(11.44)	23.40	(21.43)
REER Skewness	0.03**	(0.01)	0.03**	(0.01)	0.03**	(0.01)	0.01	(0.01)
REER Kurtosis	-0.01**	(0.01)	-0.01**	(0.01)	-0.01*	(0.01)	-0.00	(0.01)
BCDI	-0.04***	(0.01)	-0.05***	(0.01)	-0.05***	(0.01)	-0.03**	(0.01)
REER Misalignment	0.00	(0.01)	0.01	(0.01)	0.01	(0.01)	0.01	(0.01)
Dummy Floating	-0.01	(0.02)	-0.00	(0.02)	-0.00	(0.02)	-0.01	(0.03)
Dummy Interm	-0.01	(0.02)	0.00	(0.02)	0.00	(0.02)	-0.02	(0.03)
Uncert*Lagged Exp/Out	16.13***	(4.37)						
L.Exp/Out	0.00	(0.00)						
Uncert*5-y Ave Exp/Out			7.63**	(3.85)				
5-y Ave Exp/Out			-0.01***	(0.01)				
Uncert*10-y Ave Exp/Out					7.75**	(3.92)		
10-y Ave Exp/Out					-0.01***	(0.00)		
Uncert*Q1 Exp/Out							-68.15***	(24.03)
Uncert*Q2 Exp/Out							-42.13*	(23.35)
Uncert*Q3 Exp/Out							-45.81	(28.24)
Q1 Exp/Out							0.04	(0.03)
Q2 Exp/Out							0.02	(0.03)
Q3 Exp/Out							0.03	(0.02)
Observations	2563		2563		2563		1992	
Time Dummies	✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓	
Hansen Overid Test	0.727		1.279		1.126		1.041	
K&P Statistic	6.527		5.717		6.006		9.451	
C Statistic	6.385		8.263		8.081		1.676	

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Hansen Overid and the C tests are distributed χ^2_1, the K&P statistic is distributed χ^2_2.

Table 16: Replication of Table 7 with HAC standard errors

Dep. Var.:	(1)		(2)		(3)		(4)		(5)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	-0.01	(0.12)	0.12	(0.14)	0.37	(0.28)	0.10	(0.14)	-0.03	(0.18)
REER Growth	0.98***	(0.03)	0.93***	(0.04)	0.93***	(0.05)	0.94***	(0.04)	0.95***	(0.04)
REER Uncert RollVar	-33.85**	(15.96)	-50.50***	(12.96)	-6.61	(16.63)	41.82	(25.86)	-40.14**	(17.00)
REER Skewness	0.02**	(0.01)	0.01	(0.01)	-0.00	(0.01)	0.02	(0.01)	0.01	(0.01)
REER Kurtosis	-0.00	(0.01)	-0.01	(0.01)	0.00	(0.01)	-0.01	(0.01)	-0.01	(0.01)
BCDI	-0.06***	(0.01)	-0.05***	(0.01)	-0.08***	(0.02)	-0.05***	(0.01)	-0.03**	(0.01)
REER Misalignment	0.01	(0.01)	0.00	(0.01)	-0.00	(0.01)	0.00	(0.01)	-0.01	(0.01)
Dummy Floating	0.00	(0.03)	-0.00	(0.02)	0.04	(0.03)	-0.01	(0.02)	-0.00	(0.03)
Dummy Interm	-0.01	(0.03)	0.00	(0.02)	0.06*	(0.04)	-0.00	(0.02)	-0.02	(0.02)
Uncert*L.Prod	150.87***	(49.88)								
Labour Productivity	0.01***	(0.00)								
Uncert*L.Prod			3.92**	(1.89)						
Average L.Prod			0.00	(0.00)						
Uncert*1st Qtile.LP					-54.53*	(30.05)				
Uncert*2nd Qtile.LP					-42.17*	(25.07)				
Uncert*3rd Qtile.LP					26.29	(23.24)				
Qtiles LP					-0.01	(0.01)				
Uncert*Dist Frontier							-94.87***	(32.06)		
Dist to Frontier							-0.18***	(0.05)		
Uncert*1st Qtile. Dist									27.46	(19.70)
Uncert*2nd Qtile. Dist									25.31	(17.88)
Uncert*3rd Qtile. Dist									15.81	(16.84)
Qtiles Dist Frontier									0.00	(0.01)
Observations	2235		2514		1931		2570		2048	
Time Dummies	✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓	
Hansen Overid Test	0.244		0.303		3.277		0.035		1.359	
K&P Statistic	6.468		7.340		4.765		7.034		8.874	
C Statistic	4.581		3.530		3.776		4.163		0.123	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: Replication of Table 8 using HAC standard errors

Dep. Var.:	(1)		(2)		(3)		(4)		(5)	
Growth Ind Output	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Growth of Rel Prices	-0.14	(0.28)	0.10	(0.12)	0.05	(0.16)	0.05	(0.15)	0.03	(0.14)
REER Growth	0.94***	(0.06)	0.95***	(0.04)	0.64***	(0.05)	0.65***	(0.05)	0.66***	(0.05)
REER Uncert RollVar	-26.15*	(15.54)	-29.60**	(14.60)	27.36	(25.01)	151.59**	(59.29)	141.01**	(60.21)
REER Skewness	0.01	(0.02)	0.02	(0.01)	0.01	(0.02)	0.01	(0.01)	0.01	(0.01)
REER Kurtosis	0.00	(0.01)	-0.02**	(0.01)	0.03***	(0.01)	0.03***	(0.01)	0.03***	(0.01)
BCDI	-0.02*	(0.01)	-0.06***	(0.01)	-0.07***	(0.02)	-0.07***	(0.02)	-0.07***	(0.02)
REER Misalignment	0.00	(0.01)	-0.01	(0.01)	0.00	(0.01)	0.00	(0.01)	0.00	(0.01)
Dummy Floating	-0.04	(0.03)	-0.00	(0.03)	-0.07*	(0.04)	-0.07**	(0.04)	-0.07**	(0.03)
Dummy Interm	-0.05**	(0.02)	0.01	(0.02)	-0.05	(0.03)	-0.05	(0.03)	-0.05	(0.03)
Uncer*EII					-0.32*	(0.19)	-0.31*	(0.19)	-0.23	(0.17)
Merco EII					0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
v12DistToUS							-168.48**	(72.67)	-178.65**	(72.18)
distancetoUS							-0.27***	(0.09)	-0.28***	(0.09)
Uncert*L. Exp/Out									10.52*	(5.57)
L.Exp/Out									0.01	(0.01)
Observations	1006		1561		1530		1530		1530	
Time Dummies	✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓	
Hansen Overid Test	0.129		2.254		4.797		4.441		4.500	
K&P Statistic	6.636		3.504		0.445		0.434		0.439	
C Statistic	0.463		2.515		2.807		1.856		1.767	

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Hansen Overid and the C tests are distributed χ^2_1, the K&P statistic is distributed χ^2_2.

Table 18: Replication of Table 2 excluding Sector 311

Dep. Var.:	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
Growth Ind Output	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Growth of Rel Prices	0.26*	(0.14)	0.15	(0.12)	0.30**	(0.13)	0.29**	(0.14)	0.18	(0.13)	0.31**	(0.15)	0.20	(0.14)
REER Growth	0.88***	(0.03)	0.89***	(0.03)	0.89***	(0.04)	0.87***	(0.04)	0.88***	(0.03)	0.88***	(0.04)	0.88***	(0.03)
REER Uncert GARCH	-18.42	(18.55)					-2.67	(20.69)			-5.85	(20.14)		
BCDI	-0.05***	(0.01)	-0.04***	(0.01)	-0.05***	(0.01)	-0.06***	(0.01)	-0.05***	(0.01)	-0.06***	(0.01)	-0.05***	(0.01)
Dummy Floating	-0.01	(0.02)	-0.01	(0.02)	-0.00	(0.02)	0.00	(0.02)	-0.01	(0.02)	-0.00	(0.02)	-0.01	(0.02)
Dummy Interm	-0.00	(0.02)	-0.01	(0.02)	0.00	(0.02)	-0.00	(0.02)	-0.01	(0.02)	-0.01	(0.02)	-0.01	(0.02)
REER Uncert RollVar			-28.44***	(8.60)					-21.74**	(9.75)			-21.17**	(10.21)
Variance REER					-0.26	(0.19)								
REER Skewness							0.03***	(0.01)	0.03**	(0.01)	0.03**	(0.01)	0.03**	(0.01)
REER Kurtosis							-0.02**	(0.01)	-0.01**	(0.01)	-0.02**	(0.01)	-0.01*	(0.01)
REER Misalignment											0.01	(0.01)	0.01	(0.01)
Observations	2471		2471		2471		2471		2471		2471		2471	
Time Dummies	✓		✓		✓		✓		✓		✓		✓	
Sector-Country FE	✓		✓		✓		✓		✓		✓		✓	
Clustered SE	C&S		C&S		C&S		C&S		C&S		C&S		C&S	
Hansen Overid Test	1.173		0.367		1.354		2.345		0.501		1.444		0.615	
K&P Statistic	4.442		6.503		4.127		3.957		5.564		4.074		6.120	
C Statistic	5.463		3.019		5.650		6.255		3.672		6.632		4.081	

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Hansen Overid and the C tests are distributed χ^2_1, the K&P statistic is distributed χ^2_2.

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