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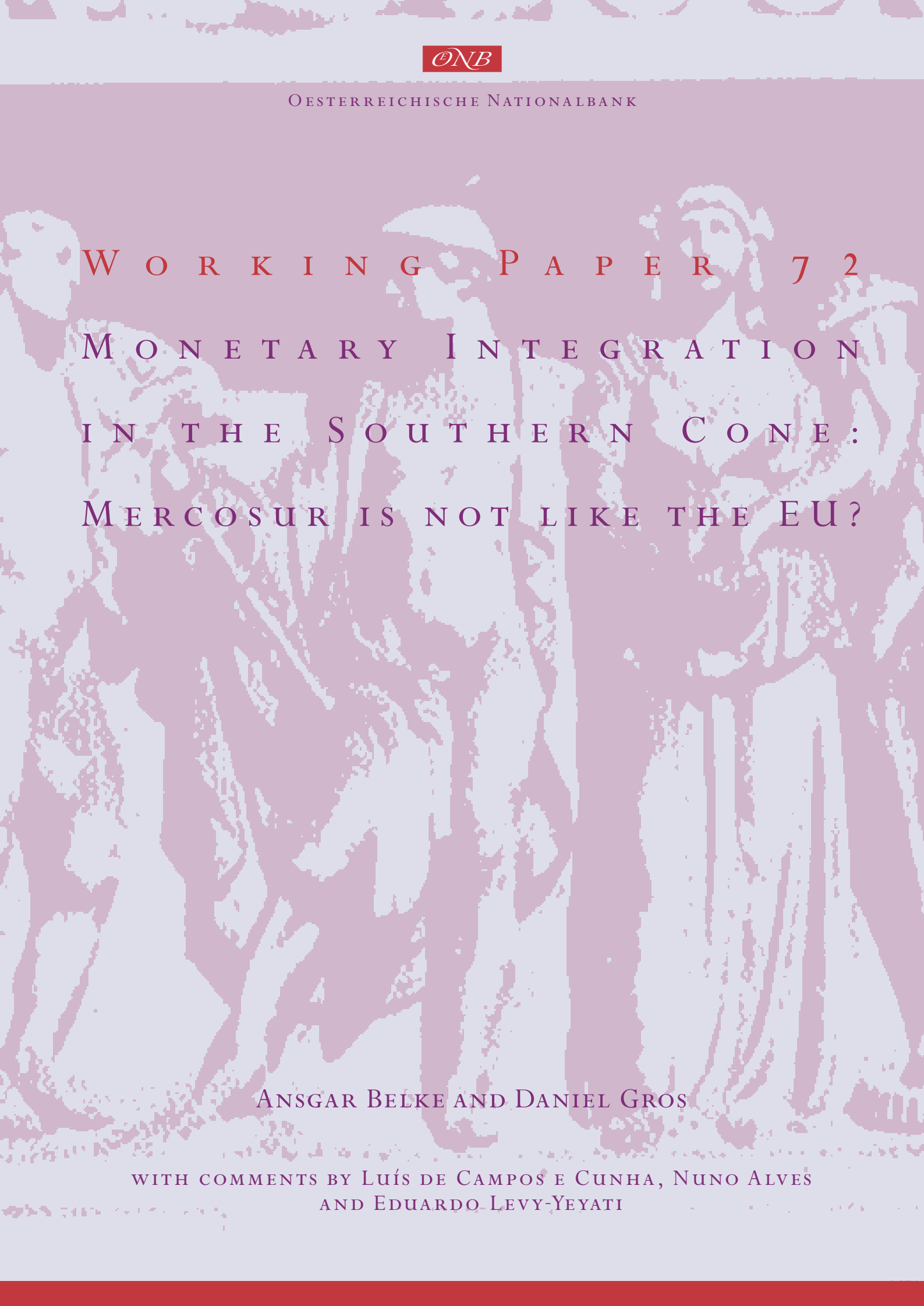

WORKING PAPER 72

MONETARY INTEGRATION IN THE SOUTHERN CONE: MERCOSUR IS NOT LIKE THE EU?

ANSGAR BELKE AND DANIEL GROS

WITH COMMENTS BY LUÍS DE CAMPOS E CUNHA, NUNO ALVES AND EDUARDO LEVY-YEYATI

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Editorial

On April 15 - 16, 2002 a conference on “Monetary Union: Theory, EMU Experience, and Prospects for Latin America” was held at the University of Vienna. It was jointly organized by Eduard Hochreiter (OeNB), Klaus Schmidt-Hebbel (Banco Central de Chile) and Georg Winckler (Universität Wien). Academic economists and central bank researchers presented and discussed current research on the optimal design of a monetary union in the light of economic theory and EMU experience and assessed the prospects of monetary union in Latin America. A number of papers presented at this conference are being made available to a broader audience in the Working Paper series of the Oesterreichische Nationalbank and in the Central Bank of Chile Working Paper series. This volume contains the ninth of these papers. The first ones were issued as OeNB Working Paper No. 64 to 71. In addition to the paper by Ansgar Belke and Daniel Gros the Working Paper also contains the contributions of the designated discussants Luís de Campos e Cunha, Nuno Alves and Eduardo Levy-Yeyati.

August 19, 2002

Monetary Integration in the Southern Cone: Mercosur Is Not Like the EU?*

by
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and Prospects for Latin America"
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ABSTRACT

Evaluating the costs and benefits of exchange rate stability requires a somewhat different approach for Mercosur than for the EU. EU member countries are highly integrated in terms of trade in goods and services. By contrast, trade integration within Mercosur is much more limited, intra-area exchange rates are thus less important than the exchange rate vis-à-vis the dollar and the euro. This contribution analyses the impact of both aspects of financial volatility (exchange rate and interest rate volatility) on investment and labour markets in the Southern Cone, finding that both exchange rate variability (mainly against the dollar and the euro) and (domestic) interest rate volatility have a significant dampening impact on employment and investment, as predicted by our theoretical model.

JEL classification: E42, F36, F42

Keywords: currency union, exchange rate and interest rate variability, job creation, Mercosur, option value effects

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1. Introduction

After the forced exit from its currency board arrangements Argentina has joined its neighbors in the Southern Cone in terms of its exchange rate arrangement. Is this a reason to stop discussing the issue of monetary integration in this area of Latin America?[1] We would argue no. The costs and benefits of fluctuating exchange rates in southern Latin America deserve another look. Europe seemed to have landed in a similar situation when in 1992/3/5 speculative attacks forced all the major currencies participating in the European Monetary System to loosen their exchange rate commitment (FRF, PTE) or abandon the system completely (ITL, GBP). However, monetary union did still start on schedule because despite intense market pressure policy makers consistently stuck to the policy choices required by the project of European monetary integration. It is thus entirely possible that monetary integration will one day again become a real option for the Mercosur area as well.

Our approach was inspired by the European experience. Previous research by the authors has shown that exchange rate variability can have a significant impact on the economy, and in particular on labor markets. The results are especially strong for intra-European exchange rate variability. This is not surprising in view of the importance of intra-European trade (both in absolute terms, e.g., as a percent of GDP, and relative to trade with the rest of the world). Should one expect to find similar results for Mercosur countries? It is difficult to give an immediate answer because there is one key difference between Europe and the Southern Cone: trade among the Mercosur countries used to be much less important than the trade of these countries with the rest of the world (mostly the EU and the US).

We document the difference in the degree of trade integration within the EU and within the Southern Cone in section 2 as this might be an important background for the subsequent empirical analysis.[2] The core of the paper starts in chapter 3 where we investigate the impact of two aspects of financial volatility - namely exchange rate and interest rate volatility -on investment and labor markets in the Southern Cone. We present first a theoretical model which shows why exchange rate volatility should affect investment decisions negatively, then comment on some first empirical results (chapter 4) and then provide some robustness tests (chap-

[1] Before the outbreak of the Argentina crisis, some authors like, e.g., Eichengreen (1998) and Giambiagi (1999) even discussed the sense or nonsense of a common currency for the Mercosur member countries. Corresponding declarations of intention were made at that time by policy circles, i.e. the president of Argentina, Fernando de la Rúa, and by the president of Brazil, Fernando Henrique Cardoso. An instructive source in this respect is Levy Yeyati and Sturzenegger (2000).

[2] See Belke and Gros (2002a) for a thorough analysis of the correlation between these two aspects of financial market volatility.

ter 5). Chapter 6 concludes and discusses the implications of the results for the debate on the design of intra-Mercosur monetary relations.

2. Comparative picture of the degree of trade integration within the EU and within the Southern Cone

We provide first a comparative picture of the degree of trade integration within the EU and within the Southern Cone. We leave out Paraguay from our analysis, because no data were available from GTAP. Hence, in the following we define Argentina, Brazil and sometimes, if data are available, Uruguay as 'the Mercosur'.[3] This paper focuses on Argentina and Brazil, because both countries together represent 95 % of the 215 million total population of the Mercosur and produce 97 percent of this region's GDP. Moreover, the 'peripheral' countries Paraguay and Uruguay are closely tied to Argentina and Brazil via the trade channel, have very small internal markets and limited access to international capital markets. Hence, they cannot be analyzed according to the same criteria like Argentina and Brazil. Chile, not in Mercosur, serves as a comparator. EU means EU-15 throughout the paper.

Table 1: Trade integration within the Southern Cone

	Exports as % of GDP		Intra-regional/ Extra-regional
	Total	Intra-regional	
Argentina	8.9	2.7	0.44
Brazil	7.6	0.9	0.13
Chile	26.5	2.8	0.11
Spain	26.6	16.4	1.61

Sources: Center for Global Trade Analysis (2001), own calculations for 1999

Table 1 shows the importance of trade for Southern Cone countries and compares it with one EU member country, Spain (whose figures are not far from the EU average). This table shows clearly that the two Mercosur countries are outliers because of the low importance of trade (less than 10 % of GDP for both). The data also show that Mercosur does not really qualify as a trade bloc given that for Brazil trade with Argentina amounts less than one sevenths of its exports outside the region. However, for Argentina intra-regional trade is more important. It is

[3] For consistency reasons, we use the package GTAP Version 5 Data Base, Center for Global Trade Analysis (2001) from Purdue University, USA, for any calculations concerning, e.g., trade weights throughout the whole paper.

interesting to note that a neighboring country, like Chile, which is not in Mercosur, is as integrated with this block as Argentina.

Table 2 shows the importance of importers of Mercosur goods and services. We disaggregate with respect to the destination of exported goods and services by differentiating between individual Mercosur countries and the two trade blocs EU-15 and NAFTA. For example, exports from Argentina to Brazil had a share of 2.4 percent of Argentina's GDP. Two main features emerge. First, a closer inspection of the shares of the extra-Mercosur trade blocs in Table 2 corroborates the general picture developed by Levy Yeyati and Sturzenegger (2000), pp. 72 ff., that Mercosur is in principle not designed as a trading bloc relatively close to the rest of the world. Instead, the strategy consisted of a general unilateral opening to third countries and a policy of preferential access to neighbors. There is again a clear difference to the working of the EU project which tends to make intra-regional trade cheaper and to increase extra-regional barriers. Second, both for Argentina and Brazil the EU is the more important trade partner than the NAFTA. This relation is even more pronounced for Argentina (see also IMF, Directions of trade, various issues and Alesina and Barro 2001, p. 384).

Mercosur countries are rather closed economies. Was that different in the past? Figure 1 suggests that this has always been the case. It is interesting to note that during the 1960s Spain had about the same degree of openness than Argentina and Brazil. However, this changed over time, and in particular since Spain joined the EU. Nevertheless, EU membership is not the only reason for the difference. Even within the Southern Cone there are large differences. Chile, as a somewhat smaller economy than Argentina should be somewhat more open. This was already the case during the 1960s, but the difference between Chile and its neighbors has actually increased considerably over the last decade. One could thus argue that Argentina and Brazil have become over the last decades exceptions, islands in a globalizing world.

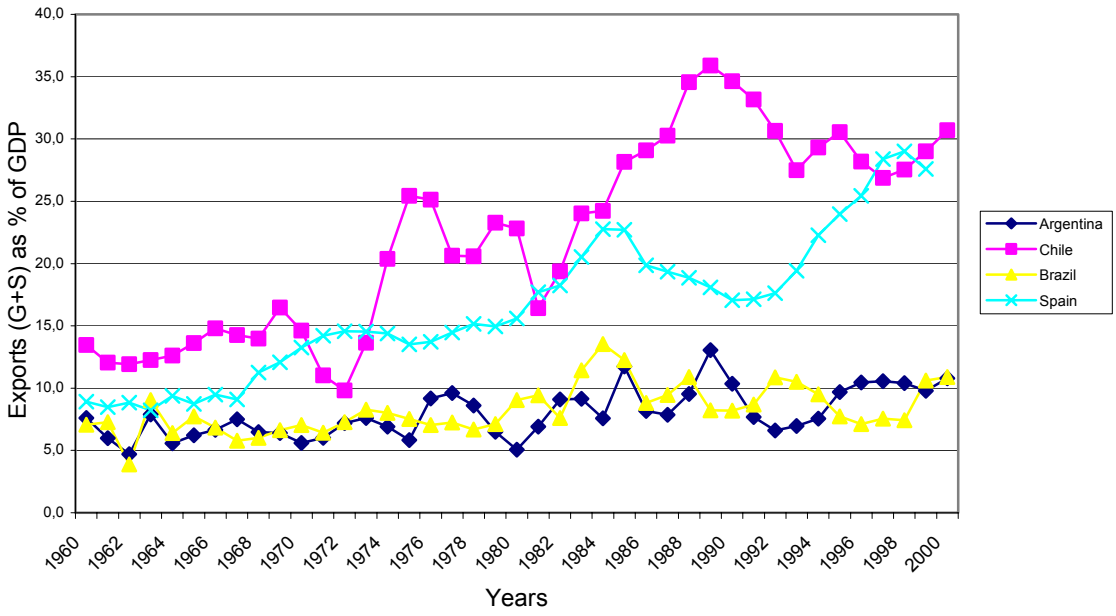
Table 2: Exports of the Mercosur Trade Bloc (1997)

Percent of gross domestic product

	Intra-Mercosur trade bloc					Extra-Mercosur trade bloc				
	Argentina	Brazil	Paraguay	Uruguay	Total	EU	NAFTA	Rest of the world	Total	Total exports
Argentina	0.0	2.4	0.0	0.2	2.7	1.6	0.9	3.7	6.2	8.9
Brazil	0.8	0.0	0.0	0.1	0.9	2.0	1.6	3.1	6.6	7.6
Paraguay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uruguay	1.9	5.2	0.0	0.0	7.1	5.9	3.1	6.5	15.5	22.5
Mercosur trade bloc	**0.6**	**0.8**	**0.0**	**0.1**	**1.5**	**1.9**	**1.4**	**3.3**	**6.7**	**8.2**

Sources: Center for Global Trade Analysis (2001); own calculations.

Figure 1: Mercosur economies: missing globalization



Source: Own calculations based on Directions of Trade (IMF).

Overall the data on trade flows indicate that (despite the increase which has taken place over the last years) the volume of trade among the Southern Cone countries is still of a different order of importance than that of intra-EU trade. This basic pattern is totally consistent with the findings by Levy Yeyati and Sturzenegger (2000), pp. 68 ff., who state that the degree of interdependence between Mercosur countries, as measured by trade flows, is much lower than it was for EMU members even at the time of the "Werner Report" when monetary union was proposed for the first time in Europe. The dramatic increase in regional trade between the largest partners, Argentina and Brazil (around 400 % between 1991 and 1997) albeit starting from a low level is mainly due to the fact that the member countries increased their total trade volumes significantly. In this sense, Mercosur did not foster trade reorientation but did only accompany the general opening process experienced in Latin America in the last decade.

Given the relatively low importance of trade for Mercosur countries, we would argue that for this group the analysis of the costs and benefits of regional exchange rate arrangements must be seen not only in terms of the impact stable exchange rates might have on trade, but more in terms of the *overall macroeconomic stability* that might result. In the following, we investigate therefore the correlation between two aspects of financial market volatility, namely exchange rate and interest rate volatility, and the real sector. If Latin America is different in the sense that there is little intra-regional trade, the link to the dollar should be more important than the intra-regional fixes.

3. Modeling the impact of exchange rate volatility on labor markets

In the following, we first introduce a consistent model and develop testable hypotheses in order to investigate possible consequences of exchange rate and interest rate volatility in Mercosur countries. The resulting hypotheses are then tested empirically. At first, however, we would like to elaborate on our motivation behind these efforts.

3.1 Motivation

The exchange rates between the G-3 and those between Mercosur and G-3 currencies (and less so via cross-rates also the intra-Mercosur exchange rates) are closely watched exchange rates in Latin America. Their gyrations, which are at times difficult to understand on purely economic grounds, are often perceived to be politically costly. The relevance of exchange rate variability as a proxy for risk for the Brazilian economic activity has already been emphasized, e.g., by Paredes (1989) and Coes (1981). Intuitively, for instance a dollar-peg would not do justice to Argentina's and Brazil's structure of foreign trade and might hamper their international competitiveness. The main reason is that this peg does not shelter these Mercosur economies from exchange rate variability vis-à-vis the euro or the yen (Krugman and Obstfeld 2000, pp. 525 ff.). Reinhart and Reinhart (2001) claim that G-3 exchange rate and interest rate volatility would seem *a priori* to have a negative effect on economic growth in the developing world. Higher interest rate volatility may delay investment whereas higher G-3 exchange rate volatility may hamper emerging market trade.[4]

However, their basic empirical results based on simple sample splits and on fundamental regressions testing for the relevance of specific G-3 factors let them conclude that enforcing target zones in the G-3 currencies merely means choosing a point along the tradeoff between lower exchange rate volatility and higher interest volatility. Their results are ambiguous with respect to the welfare effects of suppressing volatility. Only when they refer their sample split tests to the joint behavior of the relevant volatilities, they are able to deliver empirical evidence in favor of at least net positive growth impacts of reducing G-3 exchange rate volatility in emerging market economies, even if interest (and, by this, also consumption) volatility has increased at the same time. Seen on the whole, the case for limiting G-3 exchange rate volatility is not given from the point of view of emerging countries according to the results by Reinhart and Reinhart (2001). However, it has to be noted that their results are driven by their specific assumptions underlying the transmission mechanism of financial market volatility on

[4] See Calvo and Reinhart (2000a), pp. 15 ff., and Reinhart and Reinhart (2001), p. 10.

the real sector. Moreover, the results also suggest that direct benefits to emerging market economies should have their origin only in suppressed volatility of their *own* trade-weighted currencies. According to Rose (1999), a country should prefer adopting a common currency to target zones in this case.

It has even been argued in the wake of the large devaluation of the Brazilian real while Argentina was still caught in its currency board arrangements that movements of the dollar-euro rate comparable to those of the mark-dollar rate since 1971 would break the Mercosur apart (Financial Times 2001, Levy Yeyati and Sturzenegger 2000). This was an argument about the appropriate level (of the effective rate for the Argentinean peso), rather than volatility, which is our main issue.

The starting assumption of most economists is likely to be that exchange rate variability cannot have a significant impact on labor markets (whether in OECD economies or in emerging markets) given that the link between exchange rate variability and the volume of trade is known to be weak. However, there are two reasons why exchange rate volatility should have a strong negative impact on emerging markets' economies and, hence, may constitute the basis for the fear of large exchange rate swings (Calvo and Reinhart 2000a). First, the pattern of trade invoicing is different in emerging markets as compared to that in industrial countries. Following McKinnon (1999), primary commodities are primarily dollar invoiced. Since the Mercosur countries' exports have a high primary commodity content (see Belke and Gros 2002a, Table 3), exchange rate volatility should have a significant impact on foreign trade of these countries. This is especially valid for Argentina with its primary product share of 48.2 percent of total domestic value added induced by exports. However, even the lower respective values for Brazil (25.8%), and Uruguay (28.5%) are extremely large as compared with the EU trade bloc (5.5%). Second, the capital markets in emerging markets are of an incomplete nature. If futures markets are either illiquid or even nonexistent, tools for hedging the exchange rate risk are simply not available in these countries. As a complement, emerging markets are on average more intolerant to large exchange rate fluctuations because the pass-through from exchange rate swings to inflation is much higher in emerging markets (Calvo and Reinhart 2000a, pp. 18 f.).

Why would an increase in exchange rate volatility lead quickly to a lower volume (flow) of trade? The theoretical models that are used in this context start typically from the idea that in order to export one needs to sustain a sunk cost. This implies for all types of production, and perhaps even more for primary goods, which require large sunk capital investments. In view

of the relatively low trade linkages between Mercosur countries and the importance of primary commodities which are typically priced in dollars it might as well be argued that intra-Mercosur exchange rate variability should be of less concern than G-3 exchange rate volatility for the Mercosur countries.[5] However, as we emphasize throughout this paper, the impact of exchange rate volatility might still be large even in the light of a relatively low degree of trade openness because the volatilities themselves were high at times for Mercosur countries.

Another approach is that excess volatility of G-3 exchange rates is perceived to be costly for those emerging markets which link their currencies to the dollar because large swings in dollar's exchange rate on the foreign exchange market change their competitiveness (Reinhart and Reinhart 2001, p. 21, Calvo and Reinhart 2000). This is called the spending channel. According to this view, many developing countries are in 'fear of floating' directly or indirectly (with respect to G-3 volatility) and, hence, link their currencies to the dollar or the euro via a hard peg or a managed float. Examples were Argentina for a "fixed exchange rate regime" (March 1991 – December 2001) and both Brazil ('plano real' July 1994 – December 1998) and Uruguay (throughout) for regimes of "managed floating" (Calvo and Reinhart (2000), Tables 5 and 7).

Are we legitimized then to transfer the European transmission channel to the Mercosur? During the past decade, Latin American governments implemented economic reforms that affected almost every sector. Nonetheless, in most countries labor markets remain highly regulated. As of the late 90's, only a handful of Latin American nations had reformed their labor markets in any significant way, while most continued to rely on labor legislation enacted several decades earlier.[6] This legislation has favored employment protection while taxing employers heavily. Most analysts argue that the social protection provided through labor market regulation limits the market's ability to adjust wages and unemployment. Moreover, social protection is seen as the principal cause of large pockets of "precarious" employment, that is,

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[5] An additional argument would be that intra-regional capital flows within the Mercosur are much lower than flows with countries outside Mercosur. Hence, only exchange rate variability with external currencies should generate quantitatively important speculative capital flows. From this perspective, the main benefits of EMU in the European context (disappearing speculative inflows in the wake of capital market liberalization) do not apply for Mercosur, although capital flow volatility is much higher in the Mercosur than in the EU. See Levy Yeyati and Sturzenegger (2000), pp. 77 f.

[6] In Argentina, discussions about labor market reforms have been the central focus of the public economic policy debate in the last few years. Labor legislation has been modified as a condition of support by the IMF. However, even the two major changes in labor market legislation 1991 and 1995 introduced flexibility only at the margin. See extensively Hopenhayn (2001), pp. 3 ff. For first modest steps taken by Brazil in August 1998 to relax obstacles to part-time employment, to reduce costs of hiring and firing, e.g. costs of temporary layoffs, and fostering flexible modes of overtime compensation see Eichengreen (1998), pp. 31 ff. On economic reforms and labor markets in Latin American countries in general see Edwards, Cox Edwards (2000).

employment that does not receive any of the benefits and protection awarded by current legislation.[7] Many of the rules governing labor markets in Latin America raise labor costs, create barriers to entry and exit, and, hence, introduce rigidities in the employment structure. As in continental Europe, these rigidities include the exceedingly restrictive regulations on hiring and firing practices, as well as burdensome social insurance schemes. Most importantly, they prevent countries from reacting rapidly to new challenges from increased foreign competition. In contrast, e.g., to the Carribean, Labor Codes are much more encompassing in the scope of matters regulated and favor indefinite, full-time labor contracts through detailed regulation of probationary periods, benefits, and severance payments in case of separation. Employment stability protection like mandated severance payments and other regulations penalizing employment termination in Latin America is *even stricter* than in the majority of the OECD countries (Heckman and Pagés 2000, Márquez and Pagés 1998).

After controlling for differences in education and firm size, job security increases job duration in Latin America. Finally, union density is falling in Latin America (although still double as high as in the U.S., i.e. above 25 % of the non-agricultural labor force in Argentina and Brazil). The collective bargaining coverage rate (e.g., Argentina 72 % of formal sector workers) is lower than in Europe (between 80 and 90 percent in most countries) but higher than in East Asian countries. The reason is that, with the exception of Uruguay with its highly centralized bargaining system, pervasive state interventions traditionally lower incentives of workers to organize themselves in unions. State intervention tended to centralize collective bargaining in Argentina and Brazil as opposed to Peru and Chile where it decentralized collective bargaining. Hence, Argentina and Brazil systems can be considered as corporatist and highly interventionist systems whereas Uruguay can be regarded as rather unregulated (Márquez and Pagés 1998).

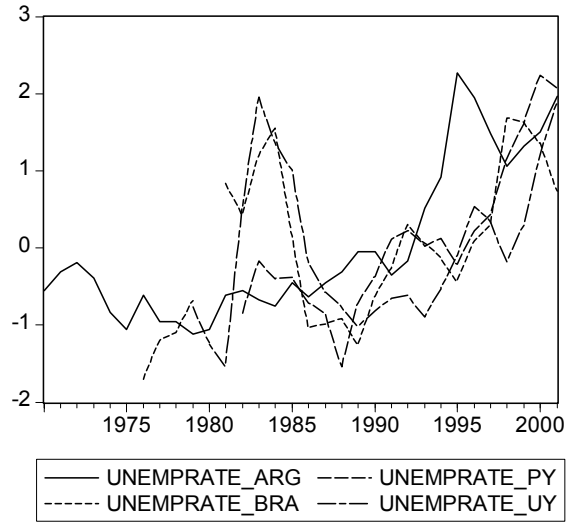
Given the importance of this debate, remarkable little empirical research is available on the relationship between labor market regulations and labor market performance in Latin America. The main purpose of recent empirical studies like Edwards and Cox Edwards (2000), Edwards and Lustig (1997), Heckman and Pagés (2000), and Márquez and Pagés (1998) is to help fill this gap. However, the main message from all these studies is that the bulk of impact of job security legislation in Latin America is *on employment* and not on unemployment (Heckman and Pagés 2000). This basic insight is important for our empirical investigation which should thus primarily focus on employment rather than on unemployment rates. As

[7] However, others believe that dismantling existing labor regulations will worsen social conditions and increase

shown by Lazear (1990), this result is not unusual because a reduction in employment is mirrored by a decline of participation rates if workers' participation decisions are determined by job security policies.

Although we spent much efforts in order to use the best available labor market data (for the exact sources see annex A5) we are well aware of the fact that our analysis might be hampered by the existence of a large amount of inofficial employment in the Mercosur countries. This so-called informal sector is even more important in Brazil than in Argentina. Due to these facts, registered unemployment figures might be only a poor proxy for actual figures. Most significant in Latin America in the past was the rise of open urban unemployment which reached double-digits in most countries in the nineties (and for Uruguay already in the eighties), a time in which reasonably reliable statistics have become available. The relevant unemployment figures are presented in Figure 2.

Figure 2: Unemployment rates in Mercosur countries (1970-2001)



Note: Data are normalized for comparability reasons. For data sources see annex A5.

As already noted previously, unemployment and underemployment are measured differently and thus comparisons across countries are strictly speaking not warranted. Still, the fact that unemployment rates, however measured, climbed significantly in country after country is indicative of a consistent regional trend. What this trend suggests is that increases in informal employment did not function as an effective counter-cyclical mechanism against the contraction of the so-called modern sector. Instead, both informality and open unemployment grew together in most countries. As a result, masses of people found themselves without access

poverty and income inequality.

even to the meager earnings drawn in the past from odd-jobbing, street vending, and other informal activities.

However, the existence of an in-official sector should not matter too much for regressions if one uses changes of employment. Moreover, data on employment refers of course only on official employment, i.e. those officially declared and thus subject to social security contributions, income tax, and all official labor market regulations. This implies that we not take into account the potentially very large grey or underground economy for data availability reasons. The focus on the official labor market is, however, entirely appropriate. In the grey economy the cost of firing are presumably much lower because official employment regulations do not apply. This implies that our model of firing costs applies mainly to official employment and we would expect volatility to be mainly a deterrent to official employment. Data on (official) employment is usually much more accurate than data on unemployment, because the definition of who is looking for work, but unable to find it, changes often. Moreover, the geographical coverage of the unemployment statistics changes over time as well, at times the national unemployment data reflect mainly data from one or two major provinces. Employment data, by contrast is usually nation-wide because it encompasses all people on the social security registers.

Hence, seen on the whole, we feel legitimized to transfer the transmission channel which was originally established for the EU to the Mercosur when modeling the impacts of exchange rate volatility on labor markets. By this, we follow the general perception that labor markets are very rigid in the Mercosur countries and, above all, labor markets in Argentina are even more scleroticized than its European counterparts (Galiani and Nickell 1998, Levy Yeyati and Sturzenegger 2000, pp. 74 ff.)

3.2 The model

The goal of this section is to develop a simple model apart from the Reinhart and Reinhart (2001) spending channel to illustrate a mechanism that explains a negative relationship between exchange rate uncertainty and job creation.[8] This model has originally been based on the idea that uncertainty of future earnings raises the 'option value of waiting' with decisions which concern *investment projects* in general (see Dixit 1989, Belke and Gros 2001). In this framework, we now model the labor market more explicitly.

[8] For a similar model that analyzes the effect of exchange rate uncertainty on investment, see Belke and Gros (2001).

When firms open a job, they have to incur sunk costs (hiring and capital costs). Moreover, wage payments are typically also sunk since firing restrictions and employment contracts prevent the firms from firing the workers too rapidly. If the exchange rate is uncertain, firms fear an unfavorable appreciation of the (domestic) currency in which case they incur heavy losses. With high uncertainty, firms may prefer to delay job creation, and this is even so if they are risk-neutral. Moreover, the better the bargaining position of workers is, the higher is the option value of waiting and the stronger is the impact of uncertainty on employment. Since generous unemployment compensation systems, union power and firing restrictions generally improve the bargaining position of workers (chapter 3.1), we would expect that the link between exchange rate uncertainty and employment should be rather strong in scleroticized Mercosur member countries.

The second goal is (chapters 4 and 5) to provide some casual empirical evidence on the negative relation between exchange rate and interest rate uncertainty and labor markets in the Mercosur. We consider the influence of two measures of return variability, namely exchange rate and interest rate variability potentially of the Mercosur member countries[9] on two key labor market indicators, changes in unemployment rates and employment growth, and changes in investment.[10] Our results confirm the theoretical presumption that there is a negative impact of exchange rate and interest rate variability on (un-) employment and investment in countries like Argentina and Brazil whose labor markets are generally perceived to be rather rigid.

The literature provides other mechanisms through which uncertainty may have an adverse impact on employment. First, in unionized labor markets in which contract wages are set in advance, uncertainty in labor demand (coming from uncertainty in productivity or in the exchange rate) may cause rational unions to set a higher wage than would otherwise be the case. Uncertainty results in a ´risk premium` in the wage, and thus in higher unemployment (Andersen and Sorensen 1988 and Sorensen 1992). Another channel by which uncertainty might affect employment is via its impact on investment. Our theoretical arguments are equally valid for firms who decide about an investment project, and, by the same reasoning, high un-

[9] For an analysis of the costs of intra-European variability for European labor markets which was suppressed by EMU see Belke and Gros (2001).

[10] These are the two politically most important variables of the indicators linked to popular explanations of the impact of financial volatility on the real sector (Dixit (1989), Aizenman and Marion 1996, Ramey and Ramey 1995).

certainty might induce firms to postpone investment projects (see Belke and Gros 2001).[11] Unemployment can be expected to rise if investment falls because investment is an important component of demand. Moreover, technological complementarities between labor and capital imply that a capital slowdown entails a fall in employment (see e.g. Rowthorn 1999).

In the following, we present a simple model of job creation and exchange rate uncertainty to illustrate the basic idea underlying the 'option value of waiting' à la Dixit (1989). The model which heavily relies on Belke and Kaas (2002) does not pretend to be close to reality. It is designed to convey the basic idea in a simple way. Moreover, our intention is to present a model that allows us to ask whether even a *temporary*, *short-run* increase in uncertainty can have a strong impact on employment, and how this impact depends on labor market parameters.

Consider a set-up in which there are three periods and a single firm active in an export-oriented industry decides about job creation. During the first two periods (called zero and one) the firm can open a job, hire a worker and produce output that is sold in a foreign market during the following periods. If the job is created during period zero, the worker is hired for two periods (zero and one) to produce output to be sold in periods one and two. If the job is created in period one, the worker is hired only for period one and output is sold in period two.

To create a job, the firm pays a start-up cost c which reflects the cost of hiring, training and the provision of job-specific capital. After a job is created, a worker is hired and is paid a wage w above the worker's fallback (or reservation) wage $\underline{w}$ during every period the worker is employed. The fallback wage measures (besides disutility of work) all opportunity income that the worker has to give up by accepting the job. In particular, it includes unemployment benefits, but it might also be positively related to a collective wage set by a trade union or to a minimum wage, both of which should raise the worker's fallback position. In general, we would argue that the fallback wage should be higher in countries that are characterized by generous unemployment benefit systems, by strong trade unions or by minimum wage legislation.

In every period in which the worker is employed, he produces output to be sold in the following period in a foreign market at domestic price p which has a certain component p^* (the foreign price) plus a stochastic component e (the exchange rate). We assume that the foreign

[11] Aizenman and Marion (1999) provide further empirical evidence on a negative relation between various volatility measures and private investment. They argue that increasing volatility has a negative impact on investment if investors are disappointment-averse. Moreover, in the presence of credit constraints, realized investment is on average lower when investment demand is more volatile, since credit constraints bind more

price is fixed ('pricing to market' or dollar invoiced exports), and that the exchange rate follows a random walk. In period one, the exchange rate e_1 is uniformly distributed between $-\sigma_1$ and $+\sigma_1$. The exchange rate in period two, e_2, is uniformly distributed between $e_1-\sigma_2$ and $e_1+\sigma_2$. An increase in σ_i means an increase in uncertainty, or an increase in the mean preserving spread in period i=1,2 (σ_i is proportional to the standard deviation of e_i). Uncertainty can be temporary (e.g. if $\sigma_1>0$ and $\sigma_2=0$) or persistent (if also $\sigma_2>0$). As will become apparent soon, however, the variability of the exchange rate during the second period has no influence on the result.[12]

The wage rate w for the job is determined by the (generalized) Nash bargaining solution that maximizes a weighted product of the worker's and the firm's expected net return from the job. We assume that both the firm and the worker are risk-neutral. This assumption implies that risk-sharing issues are of no importance for our analysis. Thus we may assume realistically (but without loss of generality) that the worker and the firm bargain about a fixed wage rate w (which is independent of realizations of the exchange rate) when the worker is hired, so that the firm bears all the exchange rate risk. A wage contract which shifts some exchange rate risk to the worker would leave the (unconditional) expected net returns unaffected, and has therefore no effect on the job creation decision. Of course, if the firm was risk-averse, the assumption that the firm bears all exchange rate risk would make a postponement of job creation in the presence of uncertainty even more likely.

Consider first the wage bargaining problem for a job created in *period zero* in which case the worker is hired for two periods. After the job is created (and the job creation cost is sunk), the (unconditional) expected net return of this job is equal to $E_0(S_0) = 2p^*-2\underline{w} = 2\pi$ where $\pi=p^*-\underline{w}$ denotes the expected return of a filled job per period (we abstract from discounting). Denoting the bargaining power of the worker by $0<\beta<1$, the firm's net return from the job created in period zero is[13]

$$(1) \qquad E_0(\Pi_0) = (1-\beta)E_0(S_0) - c = 2(1-\beta)\pi - c \,.$$

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average lower when investment demand is more volatile, since credit constraints bind more often. Real impacts of volatility are also confirmed by Ramey and Ramey (1995).

[12] An interesting aspect of this crude model is that it does not contain an often used assumption, namely that the uncertainty is resolved at the end of the first period. In reality uncertainty is usually not resolved, but persists. In a model with an infinite horizon this could imply that the same decision represents itself every period in the same way. A monetary union constitutes an exception to the rule that uncertainty just continues in the sense that the start of it should definitely eliminate uncertainties about the economic environment. In this sense, the start of a monetary union might boost employment.

[13] Formally, the wage bargain leads to a wage rate maximizing the Nash product $(2w-2\underline{w})^{\beta}(2p^*-2w)^{1-\beta}$ whose solution is $w=(1-\beta)\underline{w}+\beta p^*$, and hence the expected net return for the firm is $2p^*-2w-c=(1-\beta)(2p^*-2\underline{w})-c$.

In order to make the problem non-trivial, the expected return from job creation in period zero must be positive, i.e. we assume that $2(1-\beta)\pi-c > 0$.

Implicit in our model is the assumption that the firm and the worker sign a binding employment contract for two periods (zero and one). Hence they cannot sign a contract that allows for the possibility of job termination in the first period whenever the exchange rate turns out to be unfavorable. In period one (after realization of the exchange rate) the conditional expected surplus from job continuation is $E_1(S_1)=\pi+e_1$ which may be negative if the exchange rate falls in period one below $-\pi<0$. In such circumstances, both the worker and the firm would benefit from termination. If a contract allowing for termination in period one could be signed, the unconditional expected surplus in period zero would be larger (consequently both the worker and the firm would prefer to sign such a contract).[14] However, having in mind the interpretation of a rather short period length (a month, to be compatible with our empirical analysis), the assumption of a binding contract for two periods seems to be more appropriate. Of course, once a binding contract for two periods is signed, the worker always prefers continuation (since the contract wage exceeds the fallback wage), and the firm would incur losses if the exchange rate turns out to be unfavorable. Later on in this chapter we consider an alternative set-up which allows for the possibility of job destruction. It turns out that in this case uncertainty does not delay job creation, but job destruction becomes more likely if uncertainty increases. Hence, the negative relationship between exchange rate variability and employment is robust to this variation.

If the firm waits until *period one* it keeps the option of whether or not to open a job. It will create a job only if the exchange rate realised during period one (and so expected for period two) is above a certain threshold level, or barrier, denoted by b. Given that an employment relationship in period one yields a return only during period two, this barrier to make the creation of the job just worthwhile is given by the condition that the (conditional) expected net return to the firm is zero:

$$(2) \qquad (1-\beta)(p^* + b - \underline{w}) - c = 0 \text{ or } b = c/(1-\beta) + \underline{w} - p^* = c/(1-\beta) - \pi \,.$$

Whenever $e_1 \geq b$, the firm creates a job in period one, and the conditional expected net return to the firm is $E_1(\Pi_1) = (1-\beta)(\pi+e_1)-c \geq 0$. Whenever $e_1 < b$, the firm does not create a job in period one, and its return is zero. Hence, whenever both events occur with positive probabili-

[14] Of course, such a flexible contract implies that some exchange rate risk is shared between the worker and the firm. However, the reason why they both benefit is not the risk-sharing aspect, but the fact that the flexible contract excludes continuation of unprofitable work relationships.

ties (i.e. whenever $\sigma_1 > b > -\sigma_1$)[15], the unconditional expected return of waiting in period zero is given by:

$$(3) \qquad E_0(\Pi_1) = [(\sigma_1 + b)/(2\sigma_1)]0 + [(\sigma_1 - b)/(2\sigma_1)][(1-\beta)(\pi + (\sigma_1+b)/2) - c] ,$$

where the first element is the probability that it will not be worthwhile to open a job (in this case the return is zero). The second term represents the product of the probability that it will be worthwhile to open the job (because the exchange rate is above the barrier) and the average expected value of the net return to the firm under this outcome. Given condition (2) this can be rewritten as:

$$(4) \qquad E_0(\Pi_1) = (1-\beta)\,(\sigma_1-b)^2 / (4\sigma_1) .$$

This is the key result since it implies that an increase in uncertainty *increases* the value of the waiting strategy, since equation (4) is an increasing function of σ_1.[16] As σ_1 increases it becomes more likely that it is worthwhile to wait until more information is available about the expected return during period two. At that point the firm can avoid the losses that arise if the exchange rate is unfavorable by not opening a job. This option not to open the job becomes *more valuable* with *more uncertainty*. The intuitive explanation is that waiting implies that the firm foregoes the expected return during period one, but it keeps the option not to open the job which is valuable if the exchange rate turns out to be unfavorable. The higher the variance the higher the potential losses the firm can avoid and the higher the potential for a very favorable realization of the exchange rate, with consequently very high profits.

It is now clear from (1) and (4) that a firm prefers to wait if and only if

$$(5) \qquad (1-\beta)(\sigma_1-b)^2 / (4\sigma_1) > 2(1-\beta)\pi - c .$$

As the left hand side is increasing in σ_1, the firm delays job creation if exchange rate uncertainty is large enough. The critical value at which (5) is satisfied with equality can be solved as [17]

$$(6) \qquad \sigma_1^{*} = 3\pi - c/(1-\beta) + 2\sqrt{\pi(2\pi - c/(1-\beta))} .$$

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[15] We do not a priori restrict the sign of the barrier b. Hence one of these conditions is automatically satisfied, whereas the other is satisfied only if uncertainty is large enough.

[16] Formally this results from the fact that equation (4) is only valid whenever σ_1 exceeds b (otherwise the exchange rate could never exceed the barrier and the firm never creates a job in period 1) and whenever $-\sigma_1$ is lower than b (otherwise the exchange rate could never fall below the barrier and the firm always creates a job in period one).

Whenever $\sigma_1>\sigma_1^*$, firms decide to postpone job creation in period zero. Since σ_1^* is increasing in π (and thereby decreasing in the fallback wage $\underline{w}$), decreasing in the cost of job creation c and decreasing in the worker's bargaining power β, we conclude that a strong position of workers in the wage bargain (reflected in a high fallback wage or in the bargaining power parameter) and higher costs of hiring raise the option value of waiting and make a postponement of job creation more likely. Thus, the adverse impact of exchange rate uncertainty on job creation and employment should be stronger if the labor market is characterized by generous unemployment benefit systems, powerful trade unions, minimum wage restrictions or large hiring costs. That such features of the labor market are detrimental to employment is of course not surprising. The adverse impact of these features on employment has been confirmed empirically in various studies, and there are many other theoretical mechanisms explaining it (see e.g. Nickell 1997 and Layard, Nickell and Jackman 1991). What our simple model shows is that these features also reinforce the negative employment effects of exchange rate uncertainty.

Another important implication of the model is that *only the current*, short term uncertainty σ_1 has an impact on the decision to wait. Future uncertainty, represented here by σ_2, does not enter in the decision under risk neutrality. If one takes a fixed period, e.g. one quarter or one year, the likelihood that job creation will be postponed to the end of that period depends only on the uncertainty during that period and not on future uncertainty. This implies that *even short spikes* in uncertainty as, e.g., grasped by a contemporaneous uncertainty proxy in empirical investigations of the real option effect detected above, can have a *strong impact* on employment.

In the following, we consider the scenario of a labor market in which the firm and the worker can sign *a contract only for one period* and keep the option to terminate the work relationship whenever it becomes unprofitable. In period 1, the conditionally expected surplus of job continuation is $\pi+e_1$ which is positive whenever $e_1>-\pi$. Hence, whenever uncertainty is large enough ($\sigma_1>\pi$), there is job destruction in period 1 with probability $(\sigma_1-\pi)/(2\sigma_1)$. The (unconditional) expected net return to the firm from a job created in period zero (and with the option of destruction in period one) is therefore

$$(7) \qquad E_0(\Pi_0) = [(1-\beta)\pi - c] + [(\sigma_1 - \pi)/2\sigma_1]0 + [(\sigma_1 + \pi)/2\sigma_1](1-\beta)[\pi + (\sigma_1 - \pi)/2)] \,,$$

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[17] The other (smaller) solution to this equation is less than |b| and is therefore not feasible.

where the first term is the expected return from the job in period one, whereas the second and third term represent the expected surplus from the job in period two (after destruction or after continuation in period one) under the assumption $\sigma_1>\pi$. If $\sigma_1<\pi$, the job would never be destroyed, and the expected net return is, as before, $2(1-\beta)\pi - c$. Hence, after rearranging (7), the expected net return from a job created in period zero can be written

$$E_0(\Pi_0) = \begin{cases} 2(1-\beta)\pi - c \ , \ \text{if} \ \ \sigma_1 < \pi \ , \\ (1-\beta)\left(\pi + (\sigma_1+\pi)^2/(4\sigma_1)\right) - c \ , \ \ \text{if} \ \ \sigma_1 \geq \pi \ . \end{cases}$$

On the other hand, if the firm waits until period one, the (unconditional) expected net return is, as before,

$$E_0(\Pi_1) = \begin{cases} \max(0,(1-\beta)\pi - c) \ , \ \text{if} \ \ \sigma_1 < |\pi - c/(1-\beta)| \ , \\ (1-\beta)(\sigma_1 + \pi - c/(1-\beta))^2/(4\sigma_1) \ , \ \ \text{if} \ \ \sigma_1 \geq |\pi - c/(1-\beta)| \end{cases}.$$

It is now easy to see that the firm never delays job creation. First, if $\sigma_1 \leq |\pi - c/(1-\beta)|<\pi$, the firm never destroys a job in period one, and so we have $E_0(\Pi_0)>E_0(\Pi_1)$. Second, if $\sigma_1 \geq \pi$, the condition $E_0(\Pi_0)>E_0(\Pi_1)$ means that

$$4\sigma_1(\pi - c/(1-\beta)) + (\sigma_1+\pi)^2 > (\sigma_1+\pi-c/(1-\beta))^2$$

which turns out to be equivalent to $(2(1-\beta)\pi-c)(c/(1-\beta)+2\sigma_1)>0$ and which is satisfied because of our assumption $2(1-\beta)\pi-c>0$. Hence, the firm does not delay job creation also in this case. Finally, if $|\pi-c/(1-\beta)| < \sigma_1 < \pi$, the condition $E_0(\Pi_0)>E_0(\Pi_1)$ means that

$$4\sigma_1(2(1-\beta)\pi-c) - (1-\beta)(\sigma_1+\pi-c/(1-\beta))^2 > 0 \ .$$

But since this inequality is satisfied at the boundaries $\sigma_1=\pi$ and $\sigma_1=|\pi-c/(1-\beta)|$ and since the left hand side is a concave function of σ_1, the inequality is also satisfied in the interval $|\pi-c/(1-\beta)| < \sigma_1 < \pi$. Hence, firms always prefer to create a job in period zero, and so exchange rate uncertainty has no impact on job creation.

However, since there is job destruction with probability $(\sigma_1-\pi)/(2\sigma_1)$ (whenever $\sigma_1>\pi$), the probability of job *destruction* is *increasing in uncertainty*. Hence, there is also a negative impact of exchange rate uncertainty on employment in this case. Moreover, this effect is more pronounced if the worker's fallback wage is higher (if π is smaller). Therefore, the basic conclusions of our basic model remain valid.

Our crude model has abstracted from risk aversion. However, we would argue that the basic conclusion that even a temporary increase in uncertainty can make a postponement of job

creation optimal does not change is robust because a prolonged period of high uncertainty means that expected returns beyond the next period would be discounted more heavily. Moreover, the additional impact of risk aversion on job creation should be stronger under the realistic assumption that firms bear all the exchange rate risk.

In sum, we retain two conclusions from the model. First, even a *temporary* 'spike' in exchange rate variability can induce firms to wait with their creation of jobs (of course and for exactly this reason, the level of the exchange rate at the same time loses explanatory power). Second, the relationship between exchange rate variability and (un-) employment should be particularly strong if the labor market is characterized by rigidities that improve the bargaining position of workers. A stronger fallback position of workers raises the contract wage, lowers the net returns to firms and induces firms to delay job creation in the face of uncertainty.

Our argument rests on the assumption that workers cannot be fired immediately if the exchange rate turns out to be unfavorable. Hence, sunk wage payments are associated with the decision to hire a worker. These sunk costs and, consequently, the impact of uncertainty on job creation become more important if there are high firing costs. However, as we argued above, even if there are no firing costs and if workers can be laid off at any point in time, exchange rate uncertainty should have a direct impact on job destruction. A more elaborate labor market model of job creation and job destruction (e.g., following the model of Pissarides 2000, Chapter 3) might further clarify these issues, but we would expect that uncertainty has a negative effect on both job creation and destruction flows. In the empirical analysis, we therefore prefer to employ aggregate labor market indicators rather than more disaggregate job flow data.[18]

Interest rate volatility should have a similar effect as exchange rate volatility in the context of our model. A weaker domestic exchange rate increases the profits of an exporter (or the profits on domestic sales for producers competing with imports). Lower interest rates have the same effect, for all types of producers (as all production involves some investment). Uncertainty about future interest rates will be particularly important for longer term investments in the Mercosur countries in which long-term financing was simply not available during decades, thus forcing producers to rely on rolling over short term credits over long time periods.

[18] Klein, Schuh and Triest (2000) investigate the impact of exchange rate movements on job flows in the US. They find a response of job destruction to dollar appreciation, whereas job creation does not respond significantly to depreciations. This result reflects the asymmetric responses of job creation and destruction to aggregate shocks that have been detected in other studies. It does not contradict our conclusions, however, since job creation might just respond to *exchange rate volatility* rather than to actual appreciations or depreciations.

After having modeled the impact of return uncertainty on employment and investment decisions, we now ask whether exchange rate and interest rate volatility (including a G-3 indicator variable like the volatility of the nominal and real euro-dollar exchange rate) have any ability to explain the residuals of fundamental investment and (un-) employment regressions for Mercosur economies. Up to now, the amount of literature which examines the link between exchange rate variability and the real sector in emerging markets is rather thin. Hence, we feel legitimized to present and comment some first results.

4. Empirical analysis

Having established that the Mercosur is not like the EU in several respects which are relevant for the issue of monetary integration, we now proceed to the second practical issue: How should one measure exchange rate and interest rate variability? Let us first define our measures of exchange rate and interest rate variability relevant for Mercosur countries. We used a very simple measure: for each year of our total sample from 1970 to 2001 we calculated a standard deviation of the basis of twelve monthly observations of the first difference of the respective exchange rate and interest rate measure. To take the closer ties to the EU than to the U.S. as a special pattern of Mercosur foreign trade relationships into account (see chapter 2), we also include the volatilities of the euro exchange rates of the Argentinean peso, of the Brazilian real, and of the Uruguayan peso. However, extra calculations show that the correlation between dollar and euro volatilities of the respective home currencies amount to close to 99 percent for Argentina and Brazil, as could have been expected. Finally, we include nominal and real euro-dollar exchange rate volatility in order to test whether there are real impacts of G-3 exchange rate volatilities in Mercosur countries (as projected by Reinhart and Reinhart 2001).

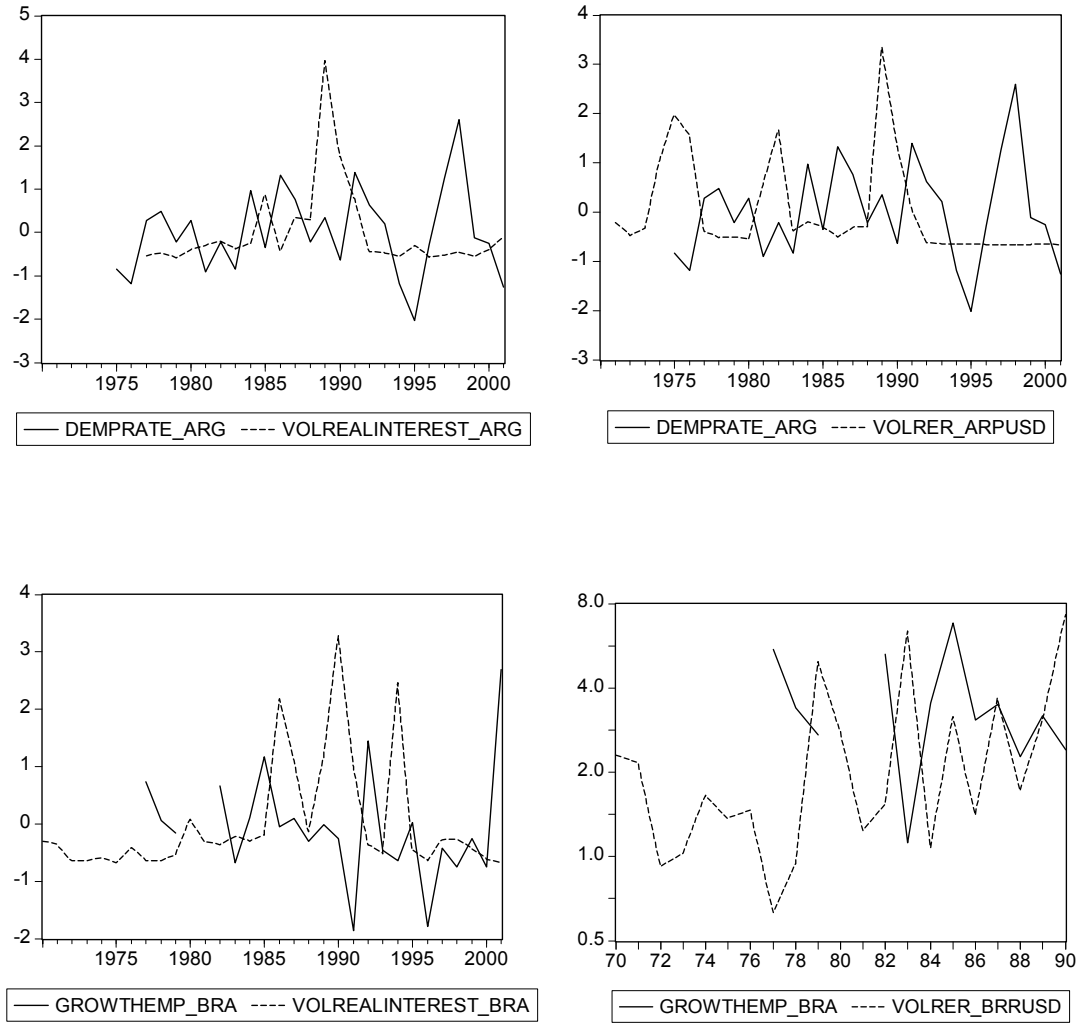
At this stage, it is useful to illustrate the exact definitions of the exchange rate and interest volatility variables taking the example of Argentina. Here, we consider the volatility of the nominal and real exchange rate vis-à-vis the US-dollar VOLNER_ARPUSD and VOLRER_ARPUSD, of the nominal and real exchange rate vis-à-vis the euro VOLNER_ARPEUR and VOLRER_ARPEUR, of the nominal and real dollar-exchange rate of the euro VOLNER_USDEUR and VOLRER_USDEUR, of the real effective rate VOLREER_ARG, and of the nominal and real effective intra-Mercosur exchange rate VOLNEERINTRAMERC_ARG and VOLREERINTRAMERC_ARG. The volatility of the nominal short-term interest rate is

called INTEREST_ARG, the one of real interest rate volatility REALINTEREST_ARG.[19] For more details concerning the construction of our volatility measures see the annexes A1 to A3.

In this section we present and comment the results of first tests of the importance of our array of measures of exchange rate variability and our two measures of interest rate volatility (nominal and real interest rate variability VOLINTEREST and VOLREALINTEREST) on two measures of labor market performance (changes in the unemployment rate DUNEMPRATE, employment growth EMPGROWTH) and one measure for investment (change in real gross fixed capital formation GROWTHREALINVEST) in the Mercosur countries. To start with a summary: exchange rate variability and interest rate variability enter most of the equations with the expected sign and are in most of the cases statistically significant. The empirical problem tackled in this chapter is visualized in Figure 3 below, based on the example of the respective real dollar exchange rate and real interest rate variability as determinants employment in Argentina and in Brazil. The hypothesis tested is that there is a significant impact of the variable represented by the dotted line on the variable plotted by the uninterrupted line.

[19] We used money market rates as a proxy for the short-term interest rate in the cases of Brazil and the euro zone. For the U.S., we focus on the treasury bill rate. However, for Argentina, Uruguay and Paraguay, we preferred the deposit rate because this enables us to use a by far larger data set (starting in march 1977 instead of March 1979 in the case of Argentina, in November 1992 instead of July 1999 in the case of Paraguay, and in July 1976 instead of December 1991 in the case of Uruguay).

Figure 3: Exchange rate and interest volatility as determinants of employment in Mercosur?



Note: Data are normalized for illustration purposes. For data sources see annex A5.

4.1 Methodology

Before commenting the individual results we need to explain our methodology. In cases of doubt we always preferred *taking differences* since the disadvantages of differencing when it is not needed appear to us much less severe than those of failing to difference when it is appropriate. In the first case the worst outcome would be that the disturbances are moving average, but the estimators would still be consistent, whereas in the second case the usual properties of the OLS test statistics would be invalidated. All macroeconomic time series and the exchange rate data we use are listed in detail in the annex A5.

As a first step we present the results of some simple tests. We explain the first difference of the unemployment rate and employment growth by their own past and lags of our measures of exchange rate variability and interest rate variability. The results which are summarized below

in the Tables 3a and 3b are thus based on standard causality tests on the annual data used throughout this paper. The Tables 3a and 3b just summarize the regression results from bivariate VARs on annual data (1970-2001, sometimes shorter periods had to be used subject to data availability).[20] The hypothesis tested is, as usual, that exchange rate variability and interest variability do not have an influence on the real economy variables investigated here.[21] All the results presented here are implicitly based on a comparison of two regression equations, exemplified here with respect to the impact of exchange rate variability on unemployment. The notations are chosen for consistency reasons (for a similar procedure see Belke and Gros 2001 and 2002):

$$(8) \qquad DUE_t = \alpha_0 + \sum_{i=1}^{N} \alpha_i \cdot DUE_{t-i} + u_t, \text{ and}$$

$$(9) \qquad DUE_t = \alpha_0 + \sum_{i=1}^{N} \alpha_i \cdot DUE_{t-i} + \sum_{i=0}^{N} \beta_i \cdot EXV_{t-i} + u_t,$$

where DUE_t stands for change in the unemployment rate (between period t and t-1), EXV_{t-i} specifies the level of exchange rate variability (between period t-i and period t-i-1), u_t represents the usual i.i.d. error term and N is the maximum number of considered lags (here: 2 lags). Exchange rate variability (measured by one of the indicators as explained above) can then be said to "cause" unemployment if at least one ß, i.e. one of the coefficients on the past and contemporaneous level of exchange rate variability, is significantly different from zero. In other words, these tests measure the impact of exchange rate variability on changes in national unemployment rates once the autonomous movements in unemployment have been taken into account by including lagged unemployment rates among the explanatory variables. Thus, a significant effect (of whatever sign) implies that one can reject the hypothesis that (the change in) exchange rate variability does not influence unemployment at the usual confidence levels. In order to be allowed to use the standard t-distribution for the purpose of model selection one has to use changes at least in the unemployment rate as the level of this variable is clearly non-stationary. Substituting the unemployment rate by the change in employment or

[20] The individual regression results are as the ADF-test results for the variables used available on request.

[21] We thus use VARs in first differences of the respective real variables. Since we classify all real variables as integrated of order one we feel justified to deviate from the usual specification of an Augmented Dickey-Fuller test (including a drift term) only by neglecting the (insignificant) lagged endogenous level variable. The significance of the coefficient estimates of the lags of the changes in the real variables and of the indicator of exchange

in investment in the above setting describes our proceedings in the case of employment and investment instead of unemployment. The same is valid if we insert measures of interest rate volatility instead of exchange rate volatility.

The Tables 3a and 3b show the results for Argentina and Brazil, using the eleven different volatility measures and the three real economy variables. In view of the analysis in Belke and Gros (2002a), we prefer to emphasize the results gained for the *limited samples* case.[22] The results based on full samples estimates for Argentina, Brazil and Uruguay can be found in the Annex A4. For each of the real sector variables mentioned we first used as explanatory variables only their own past and lags of the exchange rate and interest rate variability measures. Hence, each table contains 33 (= 11 times 3) entries by construction. The results reported in the first row of Table 3a, for example, imply that exchange rate variability, as measured by the standard deviation of the nominal exchange rate of the peso against the US-dollar, has a significant impact on labor markets and investment in Argentina.

As exchange rate variability could be either caused by, or stand for some other macroeconomic variables we also performed a series of robustness tests by adding

- the (first difference of the) level of the respective definition of the exchange rate, and
- the (first difference of the) real short term interest rate.

Only the coefficient estimate, its significance level and the lag order of exchange rate variability are displayed in the summary tables. The numbers in parentheses correspond to the lag order of exchange rate variability. If the impact effect is for example estimated to be lagged two years, this might indicate inflexibilities in the respective national labor market. According to our model, the expected sign of exchange rate and interest rate variability is positive for (the changes in) the unemployment rate and negative for (the changes in) employment and investment.

The specification of the underlying equations is based on the usual diagnostics combined with the Schwarz Bayesian Information Criterion (SCH). The latter is chosen as our primary model selection criterion since it asymptotically leads to the correct model choice (if the true model is among the models under investigation, Lütkepohl 1991). The regression which reveals the lowest SCH value and at the same time fulfills the usual diagnostic residual criteria is cho-

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rate variability can then be judged on the basis of the usual standard normal respectively the asymptotic values of the student-t-distribution. See Belke and Gros (2001, 2002) and Haldrup (1990), pp. 31 f.

[22] By this, we operationalize Argentina's transition from different attempts to fix or to control the exchange rate (Alfonsín and Menem) to the convertibility plan. In the case of Brazil, we introduced a sample split for the year 1994 (real plan). For Paraguay, reliable data were only available from 1990 on, i.e., after the transition to flexible exchange rates. For Uruguay, no sample split seems to be indicated according to our above considerations.

sen.[23] As already stated above, the sample has been chosen to be 1970 to 2001. However, in the case of Argentina it is limited in order to exclude its currency board period. The inclusion of the latter would have introduced structural breaks in the relationships because the correlation between exchange rate volatility as a variable that does not move and a real sector variable is nil per se. This procedure is exactly the same for each country. We never intervene to exercise a discretionary judgment. As usual, we add country specific dummies from time to time in order to account for possible breaks in the VAR relations. These dummies are added only if they improve the SCH statistics (higher informational contents even if a penalty for the extra dummy is taken into account) and do not lead to a rejection of the normality assumption of the residuals (Jarque and Bera 1987). At the same time they should contribute to fulfill the criteria on the residuals, especially those on normality. However, none of our results is due to the implementation of these dummies. Most of the dummies were also economically meaningful (relating to episodes emphasized by Díaz-Bonilla and Schamis 2001) and mostly disappeared when policy variables were introduced in the robustness tests below.

4.2 Summary of results

The results have to be read off the Tables 3a and 3b below as follows. In these tables, point estimates for the impact of exchange rate volatility and interest rate volatility are displayed together with their significance levels. For Argentina (Table 3a), the point estimate obtained from the first specification implies that a decrease of one percentage point in the variability (standard deviation) of the nominal bilateral exchange rate of the peso vis-a-vis the US-dollar is associated during the same year with a decrease in the unemployment rate of 0.06 percentage points. This is economically not significant, but it is not surprising that the effect during the same year is small. A jump in exchange rate variability from the average (9%) to zero, e.g. through the currency board, would yield in the same year already a more perceptible 0.5%. We will comment only briefly on the impact coefficients because the longer run effects depend of course on the dynamic behavior of the variables (Belke and Gros 2001 and 2002). Only the results of the best, basic specification are displayed.

[23] However, one important precondition for their application is the same number of observations for the alternative specifications. See Banerjee et al. (1993), p. 286, Mills (1990), p. 139, and Schwarz (1978).

Table 3a: Regression results for Argentina (until 1990)

	DUNEMPRATE_ARG	DEMPRATE_ARG	GROWTH REALINVEST_ARG
VOLNER_ARPUSD	0.06*** (0)	-0.02** (-1)	-0.44* (0)
VOLRER_ARPUSD	0.07*** (0)	-0.03*** (-1)	-0.51* (0)
VOLNER_ARPEUR	0.04** (0)	-0.02** (-1)	-0.65** (0)
VOLRER_ARPEUR	0.05* (0)	-0.03** (-1)	-0.78** (0)
VOLNER_USDEUR	1.38*** (0)	-0.52*** (-1)	-11.33** (0)
VOLRER_USDEUR	1.41*** (0)	-0.53*** (-1)	-10.57* (0)
VOLREER_ARG	0.05* (0)	-0.03** (-1)	-0.80** (0)
VOLNEERINTRAMERC_ARG	0.06*** (0)	-0.02** (-1)	-0.44* (0)
VOLREERINTRAMERC_ARG	0.07*** (0)	-0.03*** (-1)	-0.48* (0)
VOLINTEREST_ARG	0.01*** (0)	-0.003* (-1)	-0.11*** (0)
VOLREALINTEREST_ARG	0.01*** (0)	-0.003* (-1)	-0.10*** (0)

Note: Point estimates for the impact of exchange rate volatility are displayed together with their significance levels (***: 1 %; **: 5 %; *: 10 %). Numbers in brackets refer to the lags of the implemented volatility variable.

The first upper right hand entry in Table 3a comes from a standard causality type regression whose results are reproduced in detail below in Table 4 in order to give a concrete example. This entry refers to the impact of the variability of the nominal bilateral exchange rate vis-à-vis the US-dollar on Argentina's labor markets. The dependent variable in this case is represented by the change in the unemployment rate (DUNEMPRATE_ARG). The depicted specification of the regression equation leads to the 'best' result in terms of the (lowest realization of the) Schwarz criterion, samples being the same throughout. The dummies for the years 1974 and 1975 approximate the stimulative fiscal and monetary policies with which the government under Isabel Peron tried to rekindle economic growth (Díaz-Bonilla and Schamis (2001), pp. 76 f.).

Table 3b: Regression results for Brazil (until 1993)

	DUNEMPRATE_BRA	GROWTHEMP_BRA	GROWTH REALINVEST_BRA
VOLNER_BRRUSD	0.11* (-1)	-0.50*** (-1)	-2.03*** (-1)
VOLRER_BRRUSD	0.28*** (0)	-0.92*** (-1)	-4.46*** (0)
VOLNER_BRREUR	0.12** (-1)	-0.65*** (-2)	-2.19** (-1)
VOLRER_BRREUR	0.26* (0)	-0.82* (-1)	-5.59*** (-0)
VOLNER_USDEUR	/	-1.78** (-2)	/
VOLRER_USDEUR	/	-1.93** (-2)	/
VOLREER_BRA	0.28* (0) 0.39* (-2)	-1.37*** (-1)	-7.13*** (0) -4.50* (-2)
VOLNEERINTRAMERC_BRA	0.04* (-1)	-0.13*** (-2)	-0.72*** (-1)
VOLREERINTRAMERC_BRA	0.05** (-1)	-0.12* (-2)	-0.87*** (-1)
VOLINTEREST_BRA	/	-0.03** (-1)	-0.16** (-1)
VOLREALINTEREST_BRA	/	-0.03** (-1)	-0.13** (-1)

Note: Point estimates for the impact of exchange rate volatility are displayed together with their significance levels (***: 1 %; **: 5 %; *: 10 %). Numbers in brackets refer to the lags of the implemented volatility variable. / means 'not significant'.

Let us now interpret the results summarized in the Tables 3a and 3b above, starting with Argentina, then commenting the results for Brazil and finally concluding with some general remarks. For Argentina we focus on the results up to 1990, i.e. the inauguration of the currency board regime. It is apparent that one could no longer expect exchange rate variability to have any influence on macroeconomic variables after the installation of the currency board.[24] Tables 3a and 3b above show that all the different volatility variables (whether they are based on exchange rates or interest rates) have a significant influence on labor markets and investment and that in all the cases the sign is the expected one (negative for employment and investment and positive for unemployment. Table A4 in the annex shows the results for the full sample, including the currency board period, 1991 to 2001. It is also interesting to note that the effect

[24] For Argentina significant estimates only result if the nineties are excluded from the sample (see annex). Even experimenting with a dummy for the currency board period did not help in this respect. In addition, it turned out that the implementation of a dummy for 1990 would have had a strong inadequate impact on the results.

of both exchange rate and interest rate volatility are contemporaneous for unemployment and investment, but lagged one period in all cases for employment. This might be due to the fact that in times of increased uncertainty individuals might try to enter the labor market as an insurance (to be able earn an additional wage or at least to collect unemployment benefits in case other members of the household are fired). Firms can also stop first investing in machinery (investment) and the workforce (no new hiring) immediately. However, they might take some time to see how things work out before they actually start hiring (provided the labor market does not allow them quick firing as well).

Table 4: Example regression for Argentina: unemployment rate on the variability of the nominal bilateral exchange rate vis-à-vis the US-dollar

Dependent Variable: DUNEMPRATE_ARG
Method: Least Squares
Sample(adjusted): 1973 1990
Included observations: 18 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.214707	0.254948	-0.842163	0.4162
DUNEMPRATE_ARG(-1)	-0.565809	0.174110	-3.249719	0.0070
DUNEMPRATE_ARG(-2)	-0.251537	0.151962	-1.655258	0.1238
D74	-3.328228	0.821639	-4.050718	0.0016
D75	-3.953302	0.974150	-4.058207	0.0016
VOLNER_ARPUSD	**0.060749**	0.016028	3.790162	0.0026

R-squared	0.743486	Mean dependent var	0.038889
Adjusted R-squared	0.636606	S.D. dependent var	1.259850
S.E. of regression	0.759465	Akaike info criterion	2.548798
Sum squared resid	6.921453	Schwarz criterion	2.845588
Log likelihood	-16.93918	F-statistic	6.956224
Durbin-Watson stat	1.708864	Prob(F-statistic)	0.002880

Note: D74 and D75 are 'Peron'-Dummies defined in the text.

Concerning individual volatility measures it is apparent that real and nominal measures have usually the same point estimates and significance levels. This is not surprising in view of the fact that in the very short run (monthly data for the volatility measures) changes in nominal and real exchange rates are highly correlated (but not exactly the same, as documented in Belke and Gros 2002a). It is also not surprising that the dollar/euro exchange rate variability has a larger point estimate than that of the volatility of the national exchange rate against the dollar because the former is much less variable than the latter.

For Brazil we obtain a similar pattern as for Argentina: the results are much stronger when we limit the sample to the period before the real plan, i.e. up to 1993.[25] For this sample period we find again that all the significant coefficients have the expected sign, and seem to act with a lag of one or two years. The latter can serve as a first hint in favor of exogeneity of the volatility variables with respect to the real sector variables (Belke and Gros 2001). As a striking fact, the lag structure is exactly the same for the unemployment rate and growth of real investment. We would give the same interpretation as above: the unemployment rate and investment can react more quickly because in times of increased uncertainty it is easier to stop immediately new hiring and investment projects. The main difference with respect to Argentina is that the dollar/euro exchange rate does not seem to be as important and interest rate volatility is not always significant. The former might be due to the difference in the geographical distribution of exports (Belke and Gros 2002a). Moreover, this exactly mirrors the empirical evidence delivered by Reinhart and Reinhart (2001) that only the volatility of the own currency should matter (see chapter 3.1). The latter might be caused by the widespread use of indexation clauses in Brazil prior to the real plan period. The point estimates are generally higher for Brazil. This might be caused by the fact that the volatilities for Argentina are higher than those for Brazil (see Belke and Gros 2002a, chapter 3). The latter implies firms have adapted to this environment, implying that impact of observed changes in exchange rate variability might be lower.

Let us now turn to some more general issues. There is practically no difference between the results using the volatility of the national currency against the US dollar or against the euro. This was to be expected as the average volatility of the dollar/euro rate VOLRER_USDEUR is at 2.37 % (sample 1978 to 1990) so much lower than, for example, the average volatility of the Argentinean currency (or rather currencies) in real terms against either of these two major currencies, e.g., against the euro VOLRER_ARPEUR which amounts to 9.63% (sample 1979 to 1990). For the reasons already alluded to in Belke and Gros (2002a), interest and exchange rate volatility are highly correlated (in the case of Argentina in particular). Hence, it is not surprising that the two yield not too different results, at least with respect to the sign and the significance levels.

The results are generally weaker for unemployment than for employment. This suggests that movements in and out of the labor force dominate over flows into and out of unemployment in the adjustment of the labor market. This is a quite typical finding for Latin America (see

[25] The results for Brazil (full sample) and for Uruguay (full sample) are displayed in the annex (Tab. A2 and

chapter 3.1). The significance of entry into and exit from the labor force is clearly supported by our model developed in chapter 3.2. Let us now finally turn to some robustness tests of the empirical results gained so far.

5. Robustness tests

5.1 Missing variables?

The purpose of the following is to report the results of some tests for the robustness of the relationships found so far. We try to take into account the two most plausible ways in which our measures of exchange rate and interest rate variability could stand for some other variable. For each hypothesis we then implement the same procedure based on the SCH criterion explained above.

The two hypotheses we consider are:

i) Exchange rate variability is just a sign of a misalignment (i.e. a wrong level of the exchange rate).

ii) Interest rate variability just reflects the financial stress defined as high real (short-term) interest rates.

ad i) A first possible reason for the significant correlation of exchange rate variability with (un-) employment and investment might be that this volatility just stands for misalignments of the real exchange rate. The sign of the correlation, negative for employment (positive for unemployment) makes it a priori unlikely that exchange rate variability just stands for a misaligned exchange rate because Mercosur currencies were usually variable when they were very weak. But this argument needs to be addressed because it represents a possible explanation for the results we obtain if devaluations are contractionary as claimed for some.

ad ii) Interest rate variability could also just be the result of a tight monetary policy. The hypothesis is that this policy leads to employment losses in the short-term, and that this is exclusively assigned to interest rate variability in Tables 3a and 3b. However, this problem of identification can be reduced by explicitly adding a variable that indicates the degree of tightness to the equation. We use the *(real) interest rate* as a first indicator. This control variable actually improves the performance of the equation overall.[26]

A3).

[26] Space and time constraints did not allow us to pursue other combinations, e.g., 1) both intra- and extra-Mercosur exchange rate variability on the one hand and interest rate changes on the other hand, 2) or interest rate variability on the one hand and exchange rate changes on the other hand.

In order to take these hypotheses into account, we added the first difference (the level is not stationary) of the exchange rate in the regressions displayed in the Tables 5a and 5b, if the implemented volatility measure is one for exchange rate variability. In contrast, if an interest rate volatility measure enters the regression equation, the change in the respective interest rate (again, the level is non-stationary) is inserted as a control variable. Hence, in order to check for robustness, we augment the regression equations which are underlying the results depicted in Tables 3a and 3b (we use the same sample period to conceive comparability) with an additional regressor which in each case is the variable for which the respective volatility measure is calculated. For example, in row one of Table 3a we add the change in the nominal dollar exchange rate of the Argentinean peso and get the first row of Table 5a. By this, we secure overall consistency of our procedure.

Table 5a: Robustness regression results for Argentina (until 1990)

	DUNEMPRATE_ARG	DEMPRATE_ARG	GROWTH REALINVEST_ARG
VOLNER_ARPUSD	0.11*** (0) -0.006** (-1)	-0.02*** (-1) 0.006*** (-2)	-0.46* (0) /
VOLRER_ARPUSD	0.06*** (0) 0.01** (-2)	-0.02** (-1) -0.007* (-2)	-0.50* (0) /
VOLNER_ARPEUR	0.04** (0) /	-0.02* (-1) 0.004* (-2)	-0.61* (-1) /
VOLRER_ARPEUR	0.05* (0) 0.02* (-2)	-0.02* (-1) -0.007* (-2)	-0.70** (0) -0.21** (-1)
VOLNER_USDEUR	1.38*** (0) -0.01* (0)	-0.70** (-1) /	-13.80* (0) /
VOLRER_USDEUR	1.45*** (0) 0.01* (0)	-0.66** (-1) /	-13.15* (-1) /
VOLREER_ARG	0.04* (0) 0.03** (-2)	-0.03* (-1) /	-0.75** (0) -0.20** (-1)
VOLNEERINTRAMERC_ARG	/ -0.01*** (-2)	/ 0.04** (-2)	/ /
VOLREERINTRAMERC_ARG	0.06***(0) 0.02*** (-2)	-0.03** (-1) -0.007* (-2)	/ /
VOLINTEREST_ARG	0.01** (0) /	/ /	-0.10*** (0) -0.06** (-1)
VOLREALINTEREST_ARG	0.01** (0) /	/ /	-0.10*** (0) -0.06*** (-1)

Note: The first numbers displayed are the point estimates for the impact of exchange rate volatility. The second numbers refer to the respective robustness variable. The respective significance levels are attached to the point estimates (***: 1 %; **: 5 %; *: 10 %; -: not significant). Numbers in brackets in each case refer to the lags of the implemented volatility variable. Regression equations include the respective robustness variable. / means 'not significant'.

In contrast to the Tables 3a and 3b, point estimates are now displayed for the impact of exchange rate volatility *and for the additional robustness variable* together with their significance levels. Interpreting Tables 5a and 5b, one has to keep in mind that an increasing nominal (real) exchange rate index means a nominal (real) devaluation (appreciation) of the home currency (see annex). The results suggest that the above mentioned hypotheses that variability just stands for a wrong level do not hold a lot of explanatory power as the addition of the change in the exchange rate does in only few cases like sometimes for intra-Mercosur exchange rate volatility change the magnitude or significance level of the coefficient of exchange rate variability. The argument that a high degree of variability stands for the 'wrong' level does not really make sense if one looks at the dollar/euro rate. We have tabulated the results, but they are more difficult to interpret since it is not clear a priori whether a strong dollar is good or bad for Mercosur exports (since the shares of the US and the EU are not that different).

Table 5b: Robustness regression results for Brazil (until 1993)

	DUNEMPRATE_BRA	GROWTHEMP_BRA	GROWTH REALINVEST_BRA
VOLNER_BRRUSD	0.16*** (-1) -0.006** (-1)	-0.66*** (-1) 0.01* (-2)	-1.89** (-1) /
VOLRER_BRRUSD	0.24** (0) -0.02* (-1)	-0.67*** (-1) -0.10** (-2)	-4.73*** (0) -0.53*** (0)
VOLNER_BRREUR	0.17** (-1) -0.009** (-1)	-0.64*** (-2) /	-2.71** (-1) /
VOLRER_BRREUR	0.65** (0) -0.06* (-1)	-0.88* (-1) /	-5.86*** (0) -0.43** (0)
VOLNER_USDEUR	/ /	-1.78* (-2) -	/ /
VOLRER_USDEUR	/ 0.05*** (-2)	-1.93** (-2) -	/ /
VOLREER_BRA	/ 0.04*** (-2)	-1.44*** (-1) /	-4.60** (-2) -0.70*** (-1)
VOLNEERINTRAMERC_BRA	0.04* (-1) /	-0.14*** (-2) -	-0.63*** (-1) +0.07** (-2)
VOLREERINTRAMERC_BRA	0.05** (-1) /	-0.12* (-2) /	-0.87*** (-1) /
VOLINTEREST_BRA	/ /	-0.03** (-1) -0.009** (-1)	-0.14** (-1) -0.05** (-1)
VOLREALINTEREST_BRA	/ /	-0.03** (-1) -0.01** (-1)	-0.13** (-1) -0.06** (-1)

Note: The first numbers displayed are the point estimates for the impact of exchange rate volatility. The second numbers refer to the respective robustness variable. The respective significance levels are attached to the point estimates (***: 1 %; **: 5 %; *: 10 %; -: not significant). Numbers in brackets in each case refer to the lags of the implemented volatility variable. Regression equations include the respective robustness variable. / means 'not significant'.

As expected, adding the real short term interest rate to the equation does in some cases change the results in the sense that the coefficient on interest rate variability does not remain significant. Nevertheless, for Argentina, we still find that in the four equations regarding unemployment and investment interest rate variability remains significant and enters with the expected sign. For Brazil there are, however, more entries in the employment and investment columns.

Our main focus is on the importance of volatility; we are thus not particularly interested in the size of the additional variables introduced to test for robustness. However, it is interesting to observe that for Mercosur countries a devaluation has a in most cases positive impact on the economy. The only exceptions are the two results gained for the impact of the real exchange rate of the Brazilian real against the dollar and against the euro on the change in the Brazilian unemployment rate. The point estimates of the parameters are usually somewhat smaller for the robustness variable (the first moment) than for the second moment.

In chapter 2, we have shown that both for Argentina and Brazil the EU is the more important trade partner than the NAFTA. This relation is even more pronounced for Argentina. However, we do not find that exchange rate variability vis-à-vis the euro is more important than that vis-à-vis the dollar, as the point estimates are in most cases virtually undistinguishable.

5.2 Exogeneity of volatility variables?

Reverse causation and missing third variables are possible objections against the simple test results presented so far. Whenever exchange rate variability influences real variables with a lag, reverse causation appears less plausible. But even in cases of a contemporaneous relationship reverse causation appears not to be a problem as suggested by additional pairwise Granger causality tests which are applied to exchange rate and interest rate variability and the real sector variables used in this contribution. Hence, the Tables A4 and A5 in the annex each display the results from (11 volatility variables times 3 real sector variables =) 33 pairwise Granger causality tests.

For the data for Argentina and Brazil we are not forced to reject the hypothesis that the real sector variables do not Granger cause our volatility measures in 63 out of 66 cases. However, based on our estimates displayed in Tables 3a, 3b, 5a and 5b we do in the overwhelming majority of cases reject the hypothesis that our volatility measures do not “cause” the three real sector variables. Therefore it appears that “causality” runs from volatility to the real sector.

However, there are even some additional arguments which speak in favor of our exogeneity hypothesis for the volatility variables. We are skeptical in general about the possibility that

exchange rate and interest rate variability at our high frequency was caused by slow moving variables such as labor market rigidities or unemployment and investment. A further argument validating our methodology and our results comes from the work of Canzoneri, Vallés and Viñals (1996) and others who show for a different sample of countries that exchange rates reacted mainly to financial shocks rather than real fundamentals. Rose (1995) and Flood and Rose (1995) also emphasize that exchange rate volatility is largely noise. It does not make much sense to treat a noise series as endogenous.

5.3 Multicollinearity of volatility and robustness variables?

Are there problems of multicollinearity, e.g., for interest rate volatility? The Tables 5a and 5b suggest some collinearity between the volatility variable and the change in the exchange rate or interest rate variable, since the coefficient of the latter is sometimes not significant. Therefore, one might argue that the issue of reverse causation from real variables to exchange rate variability appears to be less of a problem than the possibility that exchange rate volatility might itself be affected by the additional regressors considered in the larger VARs introduced in this section. To check for robustness we applied pairwise Granger-causality tests to exchange rate volatility and the additional explanatory variables. On the whole, these tests (Tables A6 and A7 in the annex) confirm that our regression results are not spurious.

Finally, we would like to stress again that one should be very cautious with any far-reaching conclusions in view of the weak quality of the labor market data for the Mercosur countries.

6. Summary and outlook

The data from the past investigated by us suggest that exchange rate variability (whether extra- or intra-Mercosur) and interest rate variability have had a statistically significant negative impact on employment, and investment for a number of countries like Argentina, Brazil and Uruguay. We have argued that this result is due to the fact that all employment and investment decisions have some degree of irreversibility. Our model of the 'option value of waiting' also suggests that temporary short-run increases in variability could have a stronger impact than permanent ones on decisions that involve sunk costs, such as hiring, firing or investing. Our results here confirm earlier results for European countries, which went in the same direction. The fact that similar results were obtained for other countries as well, renders the limited

number of observations, which would otherwise constitute a reason to be cautious, less important.[27]

We have investigated on both intra- and extra-Mercosur exchange rate variability because the geographical distribution of trade is of the countries in question is less concentrated than for European countries. We are aware of the general finding in the empirical literature that the impact of exchange rate variability on trade is small. However, we do not want, nor need, to take a stance on whether the economic impact of exchange rate variability on trade is strong or not. We simply argue that exchange rate variability has a stronger impact on investment and employment than on current production and exports, because the latter can be adjusted with the existing labor through variations in utilization rates. Irreversibility of set-up costs is thus not an important consideration for production that can be sold within weeks or days, whereas it is crucial for long-run decisions, such as decisions to invest or to hire additional workers.

In general, our results are rather strong in that we find in almost all cases, and despite extensive robustness tests, that exchange rate and interest rate variability has a significant impact on investment and employment. Moreover, one would have expected that economies with relatively closer ties to the U.S. like Brazil would show a stronger impact of dollar exchange rate variability, a result confirmed by the data. The estimated impact coefficients for Argentina were in most of the cases smaller than for Brazil. However, we argued that the 'nature' of exchange rate variability is different from pre-EMU Europe and at times much larger. This implies that firms have adapted to the environment, implying that the impact of observed changes in exchange rate variability might be lower. But we also acknowledge that some aspects of the results remain unsatisfactory. The prior that intra-Mercosur exchange rate volatility has a higher impact on Argentina's real sector (exports to the Mercosur trade bloc amount to 2.7 percent of it's GDP) than for the Brazilian one (only 0.9 % of GDP go to Mercosur countries) is only partially corroborated by the estimations. This is a general feature also of our earlier work in the sense that for Europe we also did not find a systematic correlation between openness and the strength of the impact of exchange rate volatility on trade. This is the main reason why we do not invoke more the general finding of the literature on the impact of exchange rate variability on international trade, which is that for LDCs this channel is much more important.

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[27] However, it might anyway be argued that Calvo and Reinhart (2000) and Reinhart and Reinhart (2001) more or less make use of the old and common argument against reducing exchange rate variability that volatility must have a valve somewhere else. In other words, could the gains from suppressing exchange rate variability that are suggested by our results be lost if the volatility reappear elsewhere, for example in higher interest rate variabil-

What are the implications of the results for the debate on exchange rate policy in Mercosur and on the design of intra-Mercosur monetary relations? By accepting our main result one could jump to the policy conclusion that fixing exchange rates either within the Mercosur or against G-3 currencies should bring about significant benefits. Our estimates are not precise enough to decide which option would yield larger benefits. Whether there are benefits depends essentially on whether the gains from suppressing exchange rate variability are lost if the volatility reappears elsewhere, for example in a higher dollar variability or higher interest rate variability. Recent research (Rose 1995) shows that official action can reduce exchange rate variability even holding constant the variability of fundamentals such as interest rates and money.

We would argue that fixing the exchange rate might be beneficial if the underlying policies are compatible with this choice. This is a big if as the experience of Argentina shows if fiscal policy is out of control then fixing the exchange rate might just suppress the appearance of the true problem temporarily. In the case of Argentina one might even argue that the currency board worked too well for too long, thus allowing a considerable dis-equilibrium to accumulate under the surface. The explosion that followed in the end then might have such high costs that it can easily offset the benefits of a stable exchange rate that were accumulated in the preceding 10 years. Our analysis is more appropriate for countries and time periods during which there are no violent regime shifts. Our results should become relevant again when Mercosur countries will have shifted to a 'normal' regime, which has two aspects: first, that movements of the exchange rate do not take extreme values because of doubts that the country will go bankrupt or sink into anarchy, and, secondly, that any fixing of exchange rates is supported by other policy choices. To enforce this, any renewed attempt to fix exchange rates (either within the region or by using an external anchor) would have to be accompanied by tight fiscal policy rules.

In sum, we maintain that the high degree of exchange rate variability observed from time to time in Mercosur has tangible economic costs, but that fixing exchange rates was too often considered a free lunch by irresponsible politicians.

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ity? We would argue that recent research *on OECD economies* is suggestive in this respect. See Belke and Gros (2002a).

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Annex

1. Construction of exchange rate and interest rate variability series

What kind of exchange rate did we take as the basis for our calculations? To measure volatility of the Mercosur currencies themselves, we used both the nominal and real bilateral US-dollar rates and the real effective exchange rates of the Mercosur currencies. Following the hypothesis by Reinhart and Reinhart (2001) that it is G-3 volatility which matters for the real sector of emerging markets (especially those with a peg to a G-3 currency), we use the nominal and real bilateral exchange rate of the US-dollar vis-à-vis the euro area (reconstituted for the past) and the effective rates of the dollar and the euro. In order to have percentage changes we either used directly the first difference of the raw numbers for the exchange rates when they are indices, with a base around 100. In the case of the remaining rates we used the first difference of the natural logarithm. The historical series of the external effective exchange rate of Euroland was taken directly from the official sources, which calculate the average of bilateral exchange rates of the 11 present euro countries, with weights given by the non-euro trading partners. In order to convey an exact picture of our proceedings, the algorithm for the construction of the variability variables (VOL …) is described in the annex as well.

We use *monthly* exchange rates to calculate volatility instead of daily (or other higher frequency) volatility because the required data were easier to obtain on a consistent basis for the entire sample period. Another reason to prefer this measure over more short-term alternatives (e.g., daily variability) was that we are convinced that while the latter might be important for financial actors it is less relevant for decisions whether *to employ or to invest*, which have a longer time horizon. The drawback of this decision was that we had to use annual data in order to have a meaningful measure of variability. We thus had only about 31 observations for each country, but this turned out to be sufficient.

In principle one could have used option prices to extract implicit forward looking volatilities, but option prices are generally available only for the US dollar and sometimes against the DM (the euro), and even then only for limited periods. Hence, it would not have been possible to construct a measure of euro volatility on a consistent basis using option prices. We used *actual* exchange rate changes instead of only unanticipated ones. But at the monthly horizon the anticipated change is usually close to zero. That's why actual and unanticipated changes should give the same results. An advantage of using monthly data is that price indices are available on a monthly basis so that one could use real exchange rates. We have preferred to

start with nominal rates in this first test since over a short-term horizon nominal and real exchange rates are usually highly correlated.

Concerning our measure of interest rate volatility we apply an analogous procedure. In most cases (Argentina, and in Belke and Gros 2002a, also for Paraguay and Uruguay) we refer to the deposit rate. In the case of Brazil, we use the money market rate; for the euro zone we choose the German money market rate until December 1994 and from January on the 3-month rate. Finally, the U.S. interest rate is approximated by the treasury bill rate. Real interest rates are deflated with the respective consumer price index (see annex). When calculating the relevant volatilities for the euro-dollar relationship, we used the interest rate *differential* instead of the interest rate levels in this case, because it is not ex ante obvious whether, e.g. the U.S. interest rate is exogenous to the euro interest rate (as it might be presumed for the U.S. interest rate with respect to, e.g., Argentina).

It seems important to note that the model for a negative relationship between G-3 exchange rate and interest (or monetary aggregate) volatility developed by Reinhart and Reinhart (2001), pp. 5 ff. is not exactly based on our measure of volatility. However, their measure is closely linked to our than to the first moment of exchange rate and interest rate changes which are also often used in this context. The same is valid with respect to Calvo und Reinhart (2000), pp. 5 ff. who use annual averages of the absolute value of the monthly change in the logarithm of the real exchange rate and of the percentage point change in the real treasury bill rate.

2. Plot of selected volatility variables

In the following, some examples of our volatility measures are displayed graphically.

Figure A1: Volatilities of real effective exchange rates

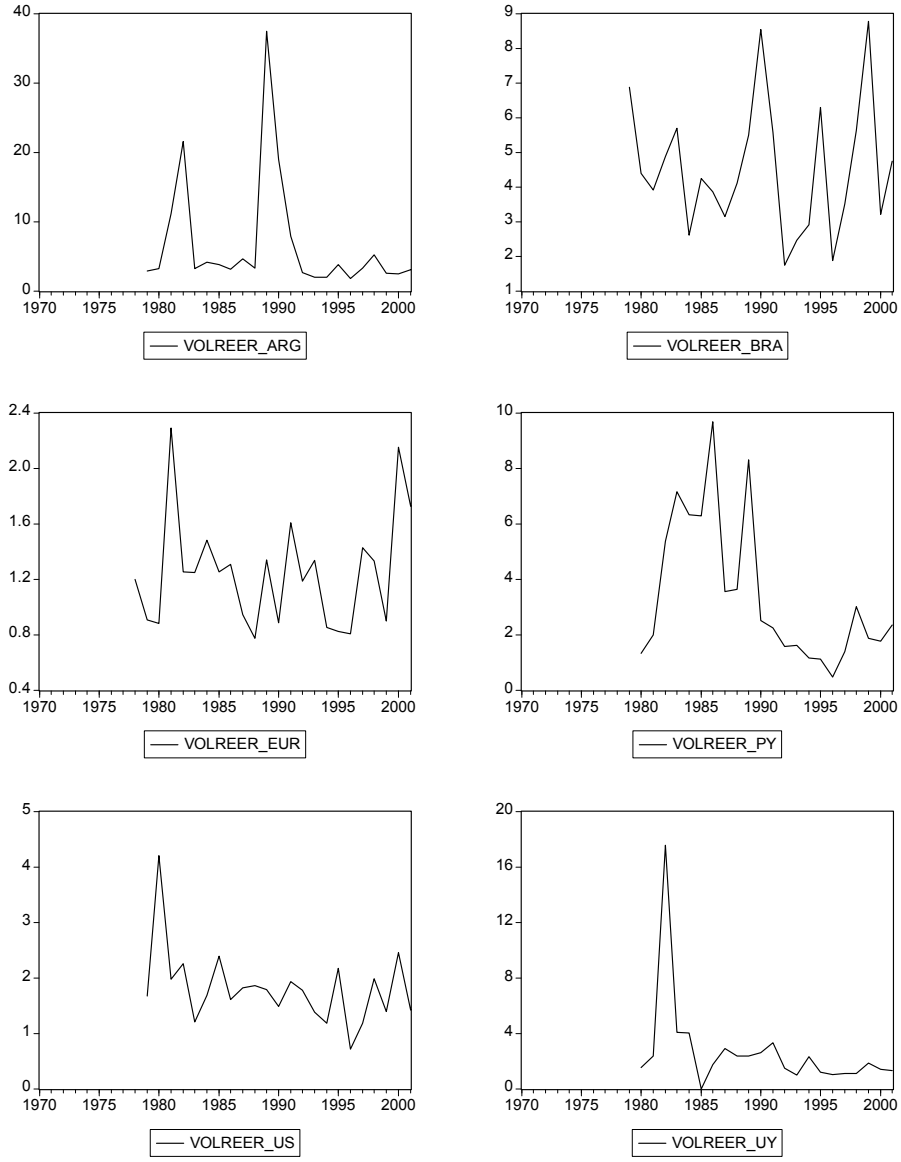


Figure A2: Volatilities of intra-Mercosur real effective exchange rates

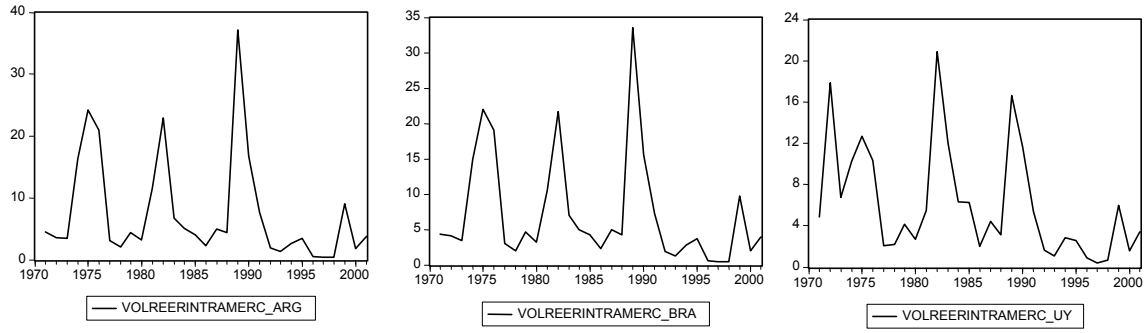
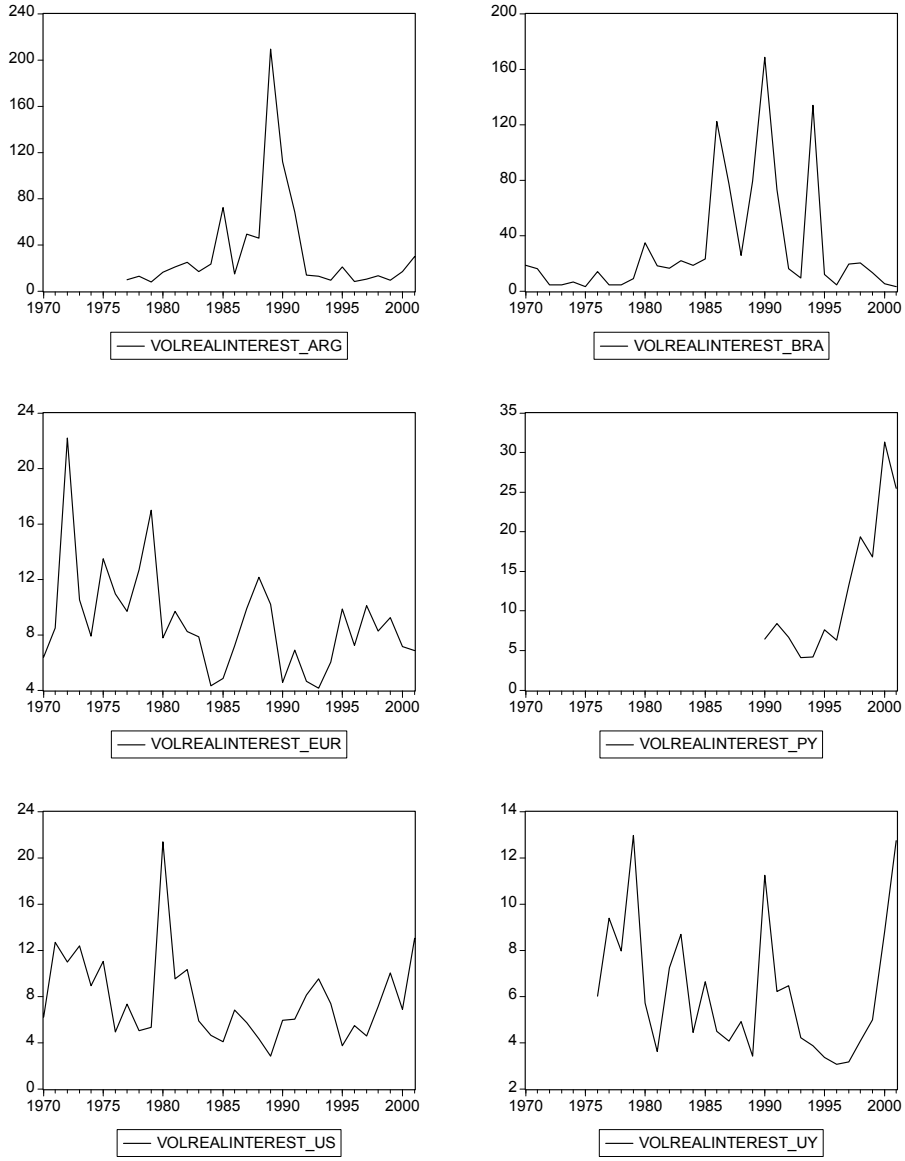


Figure A3: Volatilities of real short-term interest rates



3. Program to calculate Mercosur exchange rate and interest variability series

```
SMPL 1970.1 2001.12

FOR %EX  NER_ARPBRR  NER_ARPEUR   NER_ARPPYG   NER_ARPUSD  NER_ARPUYP
NER_BRREUR NER_BRRPYG NER_BRRUSD NER_BRRUYP NER_PYGEUR
    NER_PYGUSD   NER_PYGUYP   NER_USDEUR  NER_UYPEUR NER_UYPUSD
RER_ARPBRR RER_ARPEUR RER_ARPPYG RER_ARPUSD    RER_ARPUYP RER_BRREUR
RER_BRRPYG RER_BRRUSD RER_BRRUYP   RER_PYGEUR   RER_PYGUSD
    RER_PYGUYP   RER_USDEUR   RER_UYPEUR   RER_UYPUSD REER_ARG REER_BRA
REER_EUR REER_PY REER_US REER_UY INTEREST_ARG INTEREST_BRA INTEREST_EUR
INTEREST_PY   INTEREST_US   INTEREST_UY REALINTEREST_ARG
REALINTEREST_BRA REALINTEREST_EUR REALINTEREST_PY REALINTEREST_US
REALINTEREST_UY



 GENR VOL%EX = NA

 FOR !1=0 to 372 STEP 12

 SMPL 1970.1+!1 1970.12+!1

 GENR VOL%EX=SQR(@VAR(D(log(%EX))*100))

 NEXT



NEXT


FOR %INTEREST  DIFINTEREST_EURUS DIFREALINTEREST_EURUS

 GENR VOL%INTEREST = NA

 FOR !1=0 to 372 STEP 12

 SMPL 1970.1+!1 1970.12+!1

 GENR VOL%INTEREST=SQR(@VAR(D(%INTEREST)/%INTEREST(-1)))

 NEXT



NEXT
```

4. Regression and Granger causality tests results

Table A1: Regression results for Argentina (full sample)

	DUNEMPRATE_ARG	DEMPRATE_ARG	GROWTHREALINVEST_ARG
VOLNER_ARPUSD	/	/	-0.64*** (0) +1.14*** (-1)
VOLRER_ARPUSD	/	-0.03* (-1) +0.03** (-2)	-0.72*** (0) +1.35*** (-1)
VOLNER_ARPEUR	/	/	-0.72*** (0) 1.22*** (-1)
VOLRER_ARPEUR	/	/	-0.86** (0) 1.49*** (-1)
VOLNER_USDEUR	1.12*** (0) 1.02*** (-2)	-0.26* (-1)	-8.97*** (0)
VOLRER_USDEUR	1.10*** (0) 1.00** (-2)	-0.27* (-1)	-8.46** (0)
VOLREER_ARG	/	+0.04* (-2)	-0.80*** (0)
VOLNEERINTRAMERC_ARG	/	-0.02* (-1) +0.03*** (-2)	-0.45** (0)
VOLREERINTRAMERC_ARG	/	+0.04*** (-2)	-0.53** (0)
VOLINTEREST_ARG	/	/	-0.18*** (0) +0.30*** (-1)
VOLREALINTEREST_ARG	/	/	-0.18*** (0) +0.29*** (-1)

Note: Point estimates for the impact of exchange rate volatility are displayed together with their significance levels (***: 1 %; **: 5 %; *: 10 %). Numbers in brackets refer to the lags of the implemented volatility variable.

Table A2: Regression results for Brazil (full sample)

	DUNEMPRATE_ BRA	GROWTHEMP _BRA	GROWTH REALINVEST_BRA
VOLNER_BRRUSD	/	-0.16* (-1)	-0.65* (-2)
VOLRER_BRRUSD	/	-0.46* (-1)	-2.46*** (0)
VOLNER_BRREUR	0.10** (-1)	-0.30*** (-2)	-0.78* (-2)
VOLRER_BRREUR	/	/	/
VOLNER_USDEUR	/	-2.30** (-2)	/
VOLRER_USDEUR	/	-2.36** (-2)	/
VOLREER_BRA	0.20** (-1)	-0.54** (-1)	-3.09** (0)
VOLNEERINTRAMERC_BRA	0.04* (-1)	-0.08* (-2)	-0.61*** (-1)
VOLREERINTRAMERC_BRA	0.05** (-1)	/	-0.76*** (-1)
VOLINTEREST_BRA	/	-0.03** (-2)	-0.11** (-1)
VOLREALINTEREST_BRA	/	-0.03** (-2)	-0.10* (-1)

Note: Point estimates for the impact of exchange rate volatility are displayed together with their significance levels (***: 1 %; **: 5 %; *: 10 %). Numbers in brackets refer to the lags of the implemented volatility variable.

Table A3: Regression results for Uruguay (full sample)

	DUNEMPRATE_UY	GROWTHEMP_UY	GROWTH REALINVEST_UY
VOLNER_UYPUSD	0.28*** (0)	-2.26** (-2)	-1.53** (0) -1.16** (-1)
VOLRER_UYPUSD	0.27*** (0)	/	-1.46*** (0)
VOLNER_UYPEUR	0.30*** (0)		-2.58*** (-1)
VOLRER_UYPEUR	0.30*** (0)		-2.69*** (-1)
VOLNER_USDEUR	/	/	-7.17* (0)
VOLRER_USDEUR	/	/	-6.47* (0)
VOLREER_UY	0.33*** (0)	/	-2.52*** (-1)
VOLNEERINTRAMERC_UY	0.11* (0)	-0.10** (-1)	-0.68** (0)
VOLREERINTRAMERC_UY	0.18*** (0)	-0.15** (-1)	-0.96** (0)
VOLINTEREST_UY	0.15** (0)	/	-2.81** (0)
VOLREALINTEREST_UY	0.18* (0)	-0.19* (0)	/

Note: Point estimates for the impact of exchange rate volatility are displayed together with their significance levels (***: 1 %; **: 5 %; *: 10 %). Numbers in brackets refer to the lags of the implemented volatility variable.

Table A4: Pairwise Granger causality tests for exogeneity, Argentina (until 1990)

Sample: 1970 1990			
Lags: 2			
Null Hypothesis:	*Obs*	*F-Statistic*	*Probability*
DUNEMPRATE_ARG does not Granger Cause VOLNER_ARPUSD	18	0.12724	0.88160
DEMPRATE_ARG does not Granger Cause VOLNER_ARPUSD	14	0.11310	0.89431
GROWTHREALINVEST_ARG does not Granger Cause VOLNER_ARPUSD	18	1.41721	0.27747
DUNEMPRATE_ARG does not Granger Cause VOLRER_ARPUSD	18	0.12798	0.88096
DEMPRATE_ARG does not Granger Cause VOLRER_ARPUSD	14	0.77229	0.49030
GROWTHREALINVEST_ARG does not Granger Cause VOLRER_ARPUSD	18	1.87850	0.19202
DUNEMPRATE_ARG does not Granger Cause VOLNER_ARPEUR	10	0.41030	0.68392
DEMPRATE_ARG does not Granger Cause VOLNER_ARPEUR	10	0.15039	0.86412
GROWTHREALINVEST_ARG does not Granger Cause VOLNER_ARPEUR	10	2.97760	0.14073
DUNEMPRATE_ARG does not Granger Cause VOLRER_ARPEUR	10	0.56661	0.60007
DEMPRATE_ARG does not Granger Cause VOLRER_ARPEUR	10	0.87667	0.47166
GROWTHREALINVEST_ARG does not Granger Cause VOLRER_ARPEUR	10	1.66061	0.27987
DUNEMPRATE_ARG does not Granger Cause VOLNER_USDEUR	11	0.13773	0.87401
DEMPRATE_ARG does not Granger Cause VOLNER_USDEUR	11	0.23971	0.79405
GROWTHREALINVEST_ARG does not Granger Cause VOLNER_USDEUR	11	3.46332	0.10000
DUNEMPRATE_ARG does not Granger Cause VOLRER_USDEUR	11	0.01988	0.98038
DEMPRATE_ARG does not Granger Cause VOLRER_USDEUR	11	0.07952	0.92452
GROWTHREALINVEST_ARG does not Granger Cause VOLRER_USDEUR	11	2.43737	0.16796
DUNEMPRATE_ARG does not Granger Cause VOLREER_ARG	10	0.69747	0.54055
DEMPRATE_ARG does not Granger Cause VOLREER_ARG	10	0.93030	0.45344
GROWTHREALINVEST_ARG does not Granger Cause VOLREER_ARG	10	1.87016	0.24752
DUNEMPRATE_ARG does not Granger Cause VOLNEERINTRAMERC_ARG	18	0.03811	0.96272
DEMPRATE_ARG does not Granger Cause VOLNEERINTRAMERC_ARG	14	0.35379	0.71137
GROWTHREALINVEST_ARG does not Granger Cause VOLNEERINTRAMERC_ARG	18	1.19252	0.33457
DUNEMPRATE_ARG does not Granger Cause VOLREERINTRAMERC_ARG	18	0.10576	0.90041
DEMPRATE_ARG does not Granger Cause VOLREERINTRAMERC_ARG	14	0.77773	0.48803
GROWTHREALINVEST_ARG does not Granger Cause VOLREERINTRAMERC_ARG	18	1.64289	0.23114
DUNEMPRATE_ARG does not Granger Cause VOLINTEREST_EUR	18	2.60862	0.11156
DEMPRATE_ARG does not Granger Cause VOLINTEREST_EUR	14	4.35821	0.04747
GROWTHREALINVEST_ARG does not Granger Cause VOLINTEREST_EUR	18	0.46633	0.63740
DUNEMPRATE_ARG does not Granger Cause VOLREALINTEREST_ARG	12	0.10970	0.89762
DEMPRATE_ARG does not Granger Cause VOLREALINTEREST_ARG	12	0.17749	0.84102
GROWTHREALINVEST_ARG does not Granger Cause VOLREALINTEREST_ARG	12	4.20507	0.06317

Table A5: Pairwise Granger causality tests for exogeneity, Brazil (until 1993)

Sample: 1970 1993			
Lags: 2			
Null Hypothesis:	*Obs*	*F-Statistic*	*Probability*
DUNEMPRATE_BRA does not Granger Cause VOLNER_BRRUSD	11	0.57322	0.59181
GROWTHEMP_BRA does not Granger Cause VOLNER_BRRUSD	11	0.15391	0.86063
GROWTHREALINVEST_BRA does not Granger Cause VOLNER_BRRUSD	20	0.34319	0.71493
DUNEMPRATE_BRA does not Granger Cause VOLRER_BRRUSD	11	0.02013	0.98014
GROWTHEMP_BRA does not Granger Cause VOLRER_BRRUSD	11	0.42746	0.67057
GROWTHREALINVEST_BRA does not Granger Cause VOLRER_BRRUSD	20	0.31563	0.73406
DUNEMPRATE_BRA does not Granger Cause VOLNER_BRREUR	10	0.06160	0.94096
GROWTHEMP_BRA does not Granger Cause VOLNER_BRREUR	10	0.34632	0.72301
GROWTHREALINVEST_BRA does not Granger Cause VOLNER_BRREUR	13	0.76528	0.49646
DUNEMPRATE_BRA does not Granger Cause VOLRER_BRREUR	10	0.14623	0.86753
GROWTHEMP_BRA does not Granger Cause VOLRER_BRREUR	10	0.33368	0.73109
GROWTHREALINVEST_BRA does not Granger Cause VOLRER_BRREUR	13	0.05090	0.95068
DUNEMPRATE_BRA does not Granger Cause VOLNER_USDEUR	10	1.94686	0.23698
GROWTHEMP_BRA does not Granger Cause VOLNER_USDEUR	10	3.15206	0.13012
GROWTHREALINVEST_BRA does not Granger Cause VOLNER_USDEUR	14	1.50949	0.27207
DUNEMPRATE_BRA does not Granger Cause VOLRER_USDEUR	10	1.41545	0.32576
GROWTHEMP_BRA does not Granger Cause VOLRER_USDEUR	10	2.59733	0.16846
GROWTHREALINVEST_BRA does not Granger Cause VOLRER_USDEUR	14	1.42910	0.28907
DUNEMPRATE_BRA does not Granger Cause VOLREER_BRA	10	0.27249	0.77210
GROWTHEMP_BRA does not Granger Cause VOLREER_BRA	10	1.51958	0.30507
GROWTHREALINVEST_BRA does not Granger Cause VOLREER_BRA	13	0.65453	0.54543
DUNEMPRATE_BRA does not Granger Cause VOLNEERINTRAMERC_ARG	11	0.00899	0.99106
GROWTHEMP_BRA does not Granger Cause VOLNEERINTRAMERC_ARG	11	0.03552	0.96531
GROWTHREALINVEST_BRA does not Granger Cause VOLNEERINTRAMERC_ARG	20	1.38112	0.28148
DUNEMPRATE_BRA does not Granger Cause VOLREERINTRAMERC_BRA	11	0.06423	0.93842
GROWTHEMP_BRA does not Granger Cause VOLREERINTRAMERC_BRA	11	0.14094	0.87134
GROWTHREALINVEST_BRA does not Granger Cause VOLREERINTRAMERC_BRA	20	1.61251	0.23210
DUNEMPRATE_BRA does not Granger Cause VOLINTEREST_BRA	11	1.79351	0.24513
GROWTHEMP_BRA does not Granger Cause VOLINTEREST_BRA	11	0.05188	0.94986
GROWTHREALINVEST_BRA does not Granger Cause VOLINTEREST_BRA	20	0.74368	0.49210
DUNEMPRATE_BRA does not Granger Cause VOLREALINTEREST_BRA	11	1.95062	0.22253
GROWTHEMP_BRA does not Granger Cause VOLREALINTEREST_BRA	11	0.08504	0.91956
GROWTHREALINVEST_BRA does not Granger Cause VOLREALINTEREST_BRA	20	0.49117	0.62141

Table A6: Pairwise Granger causality tests for collinearity, Argentina (until 1990)

Sample: 1970 1990			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Probability
DNER_USDEUR does not Granger Cause VOLNER_ARPUSD	10	1.64941	0.28176
VOLNER_ARPUSD does not Granger Cause DNER_USDEUR		1.97201	0.23366
DRER_ARPUSD does not Granger Cause VOLRER_ARPUSD	17	0.25393	0.77981
VOLRER_ARPUSD does not Granger Cause DRER_ARPUSD		0.64730	0.54080
DNER_ARPEUR does not Granger Cause VOLNER_ARPEUR	10	0.27593	0.76971
VOLNER_ARPEUR does not Granger Cause DNER_ARPEUR		0.64037	0.56546
DRER_ARPEUR does not Granger Cause VOLRER_ARPEUR	10	0.19087	0.83199
VOLRER_ARPEUR does not Granger Cause DRER_ARPEUR		1.04636	0.41725
DNER_USDEUR does not Granger Cause VOLNER_USDEUR	10	0.17078	0.84772
VOLNER_USDEUR does not Granger Cause DNER_USDEUR		2.76643	0.15526
DRER_USDEUR does not Granger Cause VOLRER_USDEUR	10	0.30133	0.75238
VOLRER_USDEUR does not Granger Cause DRER_USDEUR		2.33932	0.19182
DREER_ARG does not Granger Cause VOLREER_ARG	10	0.06961	0.93364
VOLREER_ARG does not Granger Cause DREER_ARG		5.32913	0.05762
DNEERINTRAMERC_ARG does not Granger Cause VOLNEERINTRAMERC_ARG	17	5.08888	0.02509
VOLNEERINTRAMERC_ARG does not Granger Cause DNEERINTRAMERC_ARG		3.16092	0.07894
DREERINTRAMERC_ARG does not Granger Cause VOLREERINTRAMERC_ARG	17	0.08418	0.91980
VOLREERINTRAMERC_ARG does not Granger Cause DREERINTRAMERC_ARG		0.46574	0.63855
DINTEREST_ARG does not Granger Cause VOLINTEREST_ARG	11	1.46720	0.30287
VOLINTEREST_ARG does not Granger Cause DINTEREST_ARG		2.11429	0.20184
DREALINTEREST_ARG does not Granger Cause VOLREALINTEREST_ARG	11	1.36871	0.32382
VOLREALINTEREST_ARG does not Granger Cause DREALINTEREST_ARG		1.94391	0.22343

Table A7: Pairwise Granger causality tests for collinearity, Brazil (until 1993)

Sample: 1970 1993			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Probability
DNER_BRRUSD does not Granger Cause VOLNER_BRRUSD	21	4.00341	0.03893
VOLNER_BRRUSD does not Granger Cause DNER_BRRUSD		0.47820	0.62848
DRER_BRRUSD does not Granger Cause VOLRER_BRRUSD	21	1.43466	0.26725
VOLRER_BRRUSD does not Granger Cause DRER_BRRUSD		0.84662	0.44720
DNER_BRREUR does not Granger Cause VOLNER_BRREUR	13	3.65378	0.07460
VOLNER_BRREUR does not Granger Cause DNER_BRREUR		1.63188	0.25446
DRER_BRREUR does not Granger Cause VOLRER_BRREUR	13	3.69713	0.07293
VOLRER_BRREUR does not Granger Cause DRER_BRREUR		0.18704	0.83294
DNER_USDEUR does not Granger Cause VOLNER_USDEUR	13	0.23825	0.79340
VOLNER_USDEUR does not Granger Cause DNER_USDEUR		1.12704	0.37049
DRER_USDEUR does not Granger Cause VOLRER_USDEUR	13	0.25428	0.78151
VOLRER_USDEUR does not Granger Cause DRER_USDEUR		1.19173	0.35236
DREER_BRA does not Granger Cause VOLREER_BRA	13	8.26253	0.01132
VOLREER_BRA does not Granger Cause DREER_BRA		0.44627	0.65502
DNEERINTRAMERC_BRA does not Granger Cause VOLNEERINTRAMERC_BRA	20	0.59728	0.56288
VOLNEERINTRAMERC_BRA does not Granger Cause DNEERINTRAMERC_BRA		2.54312	0.11193
DREERINTRAMERC_BRA does not Granger Cause VOLREERINTRAMERC_BRA	20	0.05226	0.94925
VOLREERINTRAMERC_BRA does not Granger Cause DREERINTRAMERC_BRA		0.47821	0.62902
DINTEREST_BRA does not Granger Cause VOLINTEREST_BRA	21	1.75644	0.20436
VOLINTEREST_BRA does not Granger Cause DINTEREST_BRA		1.04519	0.37444
DREALINTEREST_BRA does not Granger Cause VOLREALINTEREST_BRA	21	1.76103	0.20359
VOLREALINTEREST_BRA does not Granger Cause DREALINTEREST_BRA		0.82133	0.45756

5. Data

CPI_ARG: Consumer Price Index Argentina (1995=100), Source: Instituto Nacional de Estadística y Censos, (http://www.indec.mecon.gov.ar).

CPI_BRA: Consumer Price Index Brazil (1995=100), Source: IFS (IMF) series CPI (22364...ZF...) + IMF – Statistical Yearbook and various Monthly Reports.

CPI_PY: Consumer Price Index Paraguay (1995=100), Source: IFS (IMF) series CPI (22364...ZF...) + IMF – Statistical Yearbook and various Monthly Reports and Banco Central del Paraguay (from September 1999 on).

CPI_UY: Consumer Price Index Uruguay (1995=100), Source: IFS (IMF) series CPI + IMF – Statistical Yearbook and various Monthly Reports.

CPI_EUR: Consumer Price Index (1995=100), Source: until December 1994 Bundesbank, from January 1995 on ECB.

CPI_US: Consumer Price Index (1995=100), Source: IFS (IMF) series CPI (11164...ZF...) + IMF – Statistical Yearbook and various Monthly Reports.

DNER_USDEUR: = D(LOG(NER_USDEUR))*100; growth rate of the nominal dollar exchange rate of the euro; the remaining exchange rate growth rates are constructed analogously.

EMP_BRA: Employment general level Brazil (in thousands): Persons aged 10 years and over. Excl. rural population of Rondônia, Acre, Amazonas, Roraima, Pará and Amapá. Sep. of each year. Prior to 1979: excl. rural areas of Northern Region, Mato Grosso, Goiás and Tocantins. 1992 methodology revised; data not strictly comparable. Source: LABORSTA (http://laborsta.ilo.org/), IFS (IMF) and http://www4.bcb.gov.br/series-i/default.asp.

EMPRATE_ARG: Evolución de la las principales variables ocupacionales (en % of employed population to total population), Empleo, Tasa de Empleo en Aglomerados Urbanos, Source: Encuesta Permanente de Hogares, INDEC. http://www2.mecon.gov.ar/infoeco/.

EMP_URU: Employment general level (in thousands), urban areas, incl. professional army; excl. compulsory military service, persons aged 14 years and over. 1984 and 1986 first semester, ACLARACIÓN IMPORTANTE: Hasta el año 1997 la encuesta cubría a las localidades de 900 y más habitantes y a partie del año 1998 cubre de 5.000 o más habitantes. Source: IFS (IMF), LABORSTA (http://laborsta.ilo.org/), Instituto Nacional de Estadística **(**http://www.ine.gub.uy/**),** Principales Resultados Encuesta Continua de Hogares.

EMP_PY: Employment Paraguay (in thousands), Source: Banco Central del Paraguay, Real sector data, población ocupada (http://www.bcp.gov.py/gee/statistic/indice.htm), see http://www.ine.gub.uy/mercosur/english/cuadros/mc_3_1.htm for the data consoistency is massively hampered by different definitions of the sample, e.g., Metropolitan area of Asunción.(4) Urban area. (5) National total for urban and rural areas. Encuesta Permanente de Hogares.

INTEREST_ARG: Deposit Rate (in home currency), Source: IFS (IMF) series 21360L..ZF... .

INTEREST_BRA: Money Market Rate (in home currency), Source: IFS (IMF) series 22360B..ZF... .

INTEREST_PY: Deposit Rate (in home currency), Source: IFS (IMF) series.

INTEREST_UY: Deposit Rate (in home currency), Source: IFS (IMF) series.

INTEREST_EUR: until December 1994: German money market rate, Source: Bundesbank; from January 1995 on: 3-month rate, Source: ECB, Monthly Reports.

INTEREST_US: treasury bill rate, Source: Federal Reserve Bank.

INVEST_ARG: Gross Fixed Capital Formation Argentina (millions of Arg. peso), Source: IMF Statistical Yearbook, IFS (IMF).

INVEST_BRA: Gross Fixed Capital Formation Brazil (millions of real), Source: IMF Statistical Yearbook, IFS (IMF).

INVEST_PY: Gross Fixed Capital Formation Paraguay (billions of guarani), Source: IMF Statistical Yearbook, IFS (IMF).

INVEST_UY: Gross Fixed Capital Formation Uruguay (millions of Urug. peso), Source: IMF Statistical Yearbook, IFS (IMF).

NER_ARPUSD: IMF – Statistical Yearbook and various Monthly Reports.

NER_BRRUSD: IMF – Statistical Yearbook and various Monthly Reports.

NER_PYGUSD: IMF – Statistical Yearbook and various Monthly Reports.

NER_UYPUSD: Banco Central del Uruguay (until June 1973) and IMF – Statistical Yearbook and various Monthly Reports (from July 19973 on).

NER_USDEUR: Bilateral nominal US $/ECU exchange rate period av., Source: IMF – Statistical Yearbook and various Monthly Reports, IFS (IMF) series 111..EB.ZF... .

The remaining bilateral nominal exchange rate time series were created via cross-rates.

NEER_PY: Nominal effective exchange rate of the Paraguayan Guarani, Source: IFS (IMF) series.

NEER_UY: Source: IFS (IMF) series.

NEER_EUR: Nominal effective exchange rate euro zone, Source: IFS (IMF) series 163..NEUZF...

NEER_US: Nominal effective exchange rate of the US-dollar based on unit labor costs, Source, IFS (IMF) series 111..NEUZF... .

REALINTEREST_ARG: real short-term interest rate of Argentina; INTEREST_ARG deflated by the consumer price index.

REALINTEREST_BRA: real short-term interest rate of Argentina; INTEREST_BRA deflated by the consumer price index.

REALINTEREST_PY: real short-term interest rate of Argentina; INTEREST_PY deflated by the consumer price index.

REALINTEREST_UY: real short-term interest rate of Argentina; INTEREST_UY deflated by the consumer price index.

REALINTEREST_EUR: real short-term interest rate of Argentina; INTEREST_EUR deflated by the consumer price index.

REALINTEREST_US: real short-term interest rate of Argentina; INTEREST_US deflated by the consumer price index.

REER_PY: Real effective exchange rate based on relative CPI of the Paraguayan Guarani, Source: IMF – Statistical Yearbook and various Monthly Reports.

REER_UY: Real effective exchange rate based on relative CPI, Source: IMF – Statistical Yearbook and various Monthly Reports.

REER_US: Real effective exchange rate of the US-dollar based on unit labor costs, Source: IFS (IMF) series 111..REUZF... .

REER_EUR: Real effective exchange rate Euro area based on unit labor costs, Source: IFS (IMF), series 163..REUZF... .

REER_ARG: Annual data: Real effective exchange rate Argentina in terms of import prices, Source: Comisión Económica para América Latina y el Caribe http://www.eclac.org/publicaciones/DesarrolloEconomico. Monthly data: reer_arg = 4.739*RER_ARPJPY+22.058*RER_ARPUSD+35.402*RER_ARPEUR+35.004*RER_ARPBRR+2.797*RER_ARPUYP (weights from Center for Global Trade Analysis (2001): GTAP 5: exports + imports).

REER_BRA: Annual data: Real effective exchange rate Brazil in terms of import prices, Source: Comisión Económica para América Latina y el Caribe http://www.eclac.org//publicaciones/DesarrolloEconomico. Monthly data: reer_bra = 8.258*RER_BRRJPY+31.974*RER_BRRUSD+41.362*RER_BRREUR+16.431*(1/RER_ARPBRR)+1.974*RER_BRRUYP (weights from Center for Global Trade Analysis (2001): GTAP 5: exports + imports).

UNEMPRATE_ARG: Evolución de la las principales variables ocupacionales (en %), Desocupación (in percent), Sources: Encuesta Permanente de Hogares, INDEC. http://www2.mecon.gov.ar/infoeco/.

UNEMPRATE_BRA: Unemployment rate Brazil (in percent), TAXA DE DESEMPREGO ABERTO - ORIGINAL E DESSAZONALIZADA - TAXAS MEDIAS 30 dias; Source: http://www.ibge.gov.br on the page "Indicadores Conjunturais" [Conjuncture Indicators] under the heading "Trabalho e Rendimento" [Labor and Income]: "Ajuste sazonal - taxa de desemprego" [Seasonal adjustment - unemployment rate]. IBGE, Diretoria de pesquisas, departamento de emprego e rendimento, pesquisa mensal de emprego.

UNEMPRATE_PY: Unemployment rate Paraguay (in percent), Source: Banco Central del Paraguay, Real sector data, población ocupada (http://www.bcp.gov.py/gee/statistic/indice.htm).

UNEMPRATE_URU: Unemployment rate Uruguay (in percent), Source: Instituto Nacional de Estadistica INE, TASA DE DESEMPLEO ANUAL - Total País urbano y Por Departamento, http://www.ine.gub.uy/bancodedatos/ECH/ECH%20TOT%20Des%20A.xls.

VOLNEER_EUR: Exchange rate variability from NEER_EUR.

VOLNEER_US: Exchange rate variability from NEER_US.

VOLREER_EUR: Exchange rate variability from REER_EUR.

VOLREER_US: Exchange rate variability from REER_US.

VOL_USDEUR: Exchange rate variability from NERDOLLECU.

VOLREERINTRAMERC_ARG = 0.926*volrer_arpbrr + 0.074*volrer_arpuyp.

VOLREERINTRAMERC_BRA = 0.8927*volrer_arpbrr + 0.1073*volrer_brruyp.

VOLREERINTRAMERC_UY = 0.60*volrer_brruyp + 0.40*volrer_arpuyp.

VOLNEERINTRAMERC_BRA = 0.8927*volner_arpbrr + 0.1073*volner_brruyp.

VOLNEERINTRAMERC_ARG = 0.926*volner_arpbrr + 0.074*volner_arpuyp.

VOLNEERINTRAMERC_UY = 0.60*volner_brruyp + 0.40*volner_arpuyp.

(weights = exports plus imports weights from Center for Global Trade Analysis 2001 for consistency reasons)

The remaining volatility variables are constructed analogously.

Discussion

Luís Campos e Cunha and Nuno Alves

This paper by Belke and Gros (BG) shows that the exchange rate volatility has a significant impact on employment and investment in Mercosur countries, with a special emphasis on Argentina and Brazil. To build the argument, BG present in section 2 some statistics on the degree of trade integration in the Southern cone to conclude for its low level when compared with EMU members. In section 3 it is modelled the impact of exchange rate volatility on employment. To motivate the conclusion, the authors present a set of regressions (sections 4 and 5) supporting the existence of real effects of exchange rate volatility in the Mercosur countries.

Due to the large scope of the paper, it may be useful to split the discussion in the above-presented sections, i.e., the descriptive statistics on the region, the arguments in the literature, the theoretical model and the empirical evidence.

1. The descriptive statistics

The paper presents some interesting evidence on the trade relations of countries in the Mercosur, pointing to three conclusions.

First, these countries are relatively closed in terms of their trade flows. **Table 1** below shows the weight of (total) exports (X) and imports (M) as a percentage of GDP in the four countries of the Mercosur. The table clearly illustrates that the two "large countries" – accounting for around 97 per cent of the GNP of the common market – are relatively closed in terms of trade flows, while the two "small countries" present degrees of openness analogous to those observed in EU countries.

Table 1

1999	X/GDP	M/GDP
Argentina	9.8%	11.5%
Brazil	10.6%	11.7%
Paraguay	23.0%	36.7%
Uruguay	18.0%	19.3%

Source: IMF.

Second, the weight of intra Mercosur trade on each country's total trade is also distinct between countries. Although this weight has increased in the last decade in all countries, Brazil (and to a lesser extent Argentina) still shows a relatively low degree of trade integration with the other members of the common market. Of course, this has also to do with the mere relative size of each country. **Table 2** below updates Table 2 of the paper, including also data for imports (and Paraguay).

Table 2

Weights of intra Mercosur trade

	Total EXPORTS			Total IMPORTS		
	1991	1995	2000	1991	1995	2000
Argentina	16.5	32.3	31.8	21.0	22.8	28.4
Brazil	7.3	13.2	**14.0**	10.8	13.8	**14.0**
Paraguay	35.1	57.5	63.5	29.9	39.4	50.6
Uruguay	35.5	47.1	44.5	42.2	46.1	43.8

Note: The table presents the weights of intra-MERCOSUR exports (imports) in total exports (imports) of each country
Source: Centro de Economía International (CEI)

Thirdly, as a corollary, the situation does not call for the introduction of a single currency, as the authors argue, since the "degree of interdependence … is much lower than it was for EMU members at the time of the "Werner Report" when monetary union was proposed for the first time in Europe." (Page 5)

We do agree with Belke and Gros that the situation of the Mercosur today is very different from the one of 35 years ago in Europe. On the one hand, the level of trade integration was higher, and the level of financial and capital integration was certainly very different (and lower in this case).

On the other hand, and more importantly, we think the conclusion of the comparison in BG is unfair and misleading. We think that the Mercosur does not need a single currency, because in a sense it already has one –the Brazilian real- that carries similar weight as the euro, taking into consideration the obvious differences between the Mercosur and the

European Union (EU). In other words, the Mercosur should be compared with the Europe of today and not with the one of the Werner Report.

Let us now compare in **Table 3** the relative importance of Brazil vis-à-vis the Mercosur and the relative position of the 12 Euro area countries within the EU-15 countries. We will use some standard relative size indicators.

Table 3

Brazil (% Mercosur)
and
EU-12 (% European Union)

	Population	**Area**	**GNP**	**GNP p/cap**	**Trade openness**
Brazil	**78.9**	**71.8**	**70.8**	**89.8**	**11.2**
Euro area 12	**80.5**	**78.3**	**78.2**	**97.2**	**16.5**

Sources: WB, IMF, European Commission, Eurostat and ECB.
Note: (Exports + Imports of goods and services) / 2*GDP. Balance of payments data (excludes intra EU-12 trade).

The sticking similarity of the data reported in table 3 between Brazil and the euro area "country" raises other issues: the Banco Central do Brasil is not a supranational organization as the European Central Bank and there are obvious differences of credibility.

However, Brazil has been able to make important reforms in several areas which makes the *real* a realistic option for a future basis of a single currency for Mercosur. In the last 4 years Brazilian authorities introduced some discipline in its fiscal policy and the Central Bank has been very skilful in pursuing its monetary and exchange rate policy. It was the Brazilian authorities (not the IMF) that avoided contagion from Argentina. The consolidation of sustainable fiscal and monetary policies in Brazil will determine whether our daring prophecy will come true.

2. The arguments in the literature

The literature studying the effect of exchange rate uncertainty on trade flows (mainly focusing on developed countries) is usually ambiguous on the sign of the relation. In fact, higher exchange rate volatility has two counteracting effects: first, it increases the uncertainty of the profits of exporters (when they invoice in foreign currencies); second, it creates profit-making opportunities. The effect of volatility on trade thus depends on the degree of risk aversion and risk exposure of the agents (Lafrance and Tessier, 2000).

This ambiguity, added to the low degree of openness of the Mercosur as a whole, raises the idea that exchange rate movements could have a limited impact on this area. However, the paper argues (correctly) that there are some qualifications to such a conclusion.

In developing countries the level and variability of the exchange rate may be more important than in developed countries. This is due, on the one hand, to the fact that many developing countries link their currencies to the dollar (either through a peg or through substantial management of the float). In these cases, large currency movements translate directly in competitiveness changes (see Reinhart and Reinhart (2001)). On the other hand, as described in Calvo and Reinhart (2000), developing (and also developed…) countries have a fear of floating. A quotation from these authors summarises this idea (pgs 8-9):

> "…lack of credibility may lead to a situation where policy makers wind up stabilizing the exchange rate even at the expense of engaging in procyclical policies. However, there are numerous other reasons why exchange rate stability may be highly sought. In Emerging Markets (EM) devaluations (or large depreciations) tend to be associated with recessions (…). Defaults and general debt servicing difficulties mount if the exchange rate is allowed to slide significantly. The adjustments in the current account following these large exchange rate swings are far more acute and abrupt in EM. Credit market access is adversely affected by currency instability. Exchange rate volatility appears to be more damaging to trade in EMs; perhaps because trade is predominantly invoiced in US dollars and hedging opportunities are more limited. The passthrough of inflation from exchange rate swings to inflation is far higher in EMs than in developed economies. (…) All these factors may explain why, at least historically there has been a marked tendency in most of the countries in our sample to confine exchange rate movements to relatively narrow bands (…) "

Other arguments could also be put forward:

- Recent work by Frankel and Rose (2002) suggests that the move to a currency union (permanent and credible exchange stability) has a very large effect on trade flows and on income per capita. This raises the possibility that even though trade flows are low, the benefits from exchange rate stability might be significant in Mercosur.
- While the low overall trade flows of the Mercosur suggest that the impact of exchange rate volatility may not significantly affect the region, it may nonetheless be very relevant for the two small countries of the region. This heterogeneity is de-emphasised in the paper, which mostly analyses Argentina and Brazil.

Recognising the possibility that exchange rate volatility can have sizeable real effects in Mercosur, the paper focuses thereafter on the link between the volatility of exchange rates/ interest rates and real aggregates like investment and employment.

3. The theoretical model

Before presenting the theoretical model of the paper, it is useful to analyse the channels through which uncertainty (such as price or exchange rate uncertainty) can impact on investment. This is important since the paper does not give a balanced view of the real effects of uncertainty found in the literature. Instead, the authors decided to stress only the (intuitive) idea that increased uncertainty lowers investment and labour employment.

However, the literature shows that the effect of uncertainty on investment decisions is ambiguous (see Lafrance and Tessier (2000)). This is consistent with the ambiguous empirical results also reported in numerous papers (see, for example, Darby et al. (1998)). What are the arguments supporting this ambiguity?

1. If the marginal revenue product of capital is convex in price, a mean-preserving increase in uncertainty raises the expected payoff of marginal capital (by Jensen's inequality), increasing investment.
2. When investment is irreversible, the firm faces a higher user cost of capital than when investment is reversible. This user cost is higher the higher the uncertainty of the returns to capital. Since the firms anticipate that the irreversibility constraint may bind in the future, they invest less. This effect is magnified when uncertainty increases.
3. Abel and Eberly (1999) show, however, that in the irreversible investment model under uncertainty, there is a channel that tends to increase capital accumulation (and more the higher the degree of uncertainty). This channel is related to the fact that, at any time *t*, firms have a stock of previously accumulated capital. Under irreversibility, the firm is thus constrained by past investments (since it cannot sell capital in face, e.g., of an economic slowdown). This effect can lead to a higher capital stock under irreversibility (as compared to the case of reversible investments) and the more so the higher the level of uncertainty.
4. This latter view is generalised by Darby et al. (1998). They use a Dixit-Pindyck model of investment that determines a zone of inactivity within which the firm delays its investment decisions. They show that increasing exchange rate uncertainty can increase or decrease investment, depending on the conditions of the set-up. As reported by Lafrance and Tessier (2000), pg. 12,

> "…more exchange rate variability uncertainty can actually increase investment. (…) Greater exchange rate stability would encourage investment in industries with relatively lower productivity, high scrapping value and a low opportunity cost of waiting (e.g. service industries). However, greater exchange rate stability would tend to reduce investment in industries with low scrapping value (e.g. public utilities) or high entry costs (e.g. high-tech and R&D) or in industries with high scrapping values combined with high opportunity costs of waiting (e.g. financial services)."

The model presented in the paper is a simplified version of a model incorporating the "option value of waiting", i.e., the idea that it may be beneficial to wait and to delay investment decisions (see bullet 2. above). It is analogous to the model in Belke and Gros

(2001), with the difference that the focus is not on investment decisions but rather on labor hiring decisions.

The model has three periods:

- In period 0, the firm can open a job, and hire a worker for periods 0 and 1, who will then produce output (that is sold in the foreign market in periods 1 and 2 respectively);
- In period 1, the firm can open a job, and hire a worker for period 1, who will then produce output (that is sold in the foreign market in period 2);
- In period 2, there is no job creation.

To hire workers, the firms pay a start-up cost. The workers are paid a wage above their reservation level.

The uncertainty of the model comes from the price of the good in the foreign market, i.e., from the exchange rate.

The decisive element in the model lies in the firm's decision to hire labor in period 0. Note that this decision binds the firm to stay with the worker for periods 0 and 1. Here lies the irreversibility component in job creation. Since in period 0 the firms do not know the realization of the exchange rate in that period, there may be cases in which they find *ex-post* that it would have been preferable not to produce in period 0 (delaying any job creation to period 1). This possibility introduces an option value of waiting and thus delaying job creation. In the model, the higher the exchange rate uncertainty, the higher the value of waiting.

This set-up raises a number of questions.

First, the authors assume that the irreversibility of labour hiring (and of the costs of hiring, training and providing the job-specific capital) is comparable, for modelling purposes, to the irreversibility of investment. This is questionable, even for rigid labour markets as in the EU or in the Mercosur. Two issues should be highlighted in this context:

- The relation between regulations and performance in the labour market is complex and ambiguous (see, in particular, the conclusions of Blanchard and Portugal (2001) for the US and Portuguese cases);
- The model assumes complete enforceability of labour contracts, which may not be a good description of the functioning of the labour market, in particular in cases of severe economic instability.

Second, in the theoretical model all firms are exporters. Since the empirical tests that follow focus on countries that are relatively closed to the rest of the world, it would be interesting to discuss the impact of introducing a tradable/non-tradable dimension to the model. In this case an increase in exchange rate volatility could have a (negative) level effect on investment, but also a substitution effect (or portfolio shift) from the tradable to

the non–tradable sector. If the latter is more labour-intensive than the former, the impact of exchange rate volatility on job-creation could even be positive.

Third, the exchange rate is assumed to be a random walk. This is an important assumption of the model, since it allows the unconditional expected return of waiting in period zero (equation (3)) to depend only on the exchange rate observed in period 1 (which is also the expected exchange rate for period 2). Even though the assumption of a random walk process for the exchange rate seems justifiable under certain monetary policy regimes, it is important to stress this crucial assumption. Furthermore, it could also be interesting to discuss other cases in which the volatility of the exchange rate is endogenous and dependent on the exchange policy rule pursued by the central bank.

4. The empirical evidence

BG perform an extensive exercise regressing changes in investment/(un)employment on measures of exchange rate or interest rate volatility. These exercises raise a number of questions (some of which acknowledged by the authors), which we present in turn.

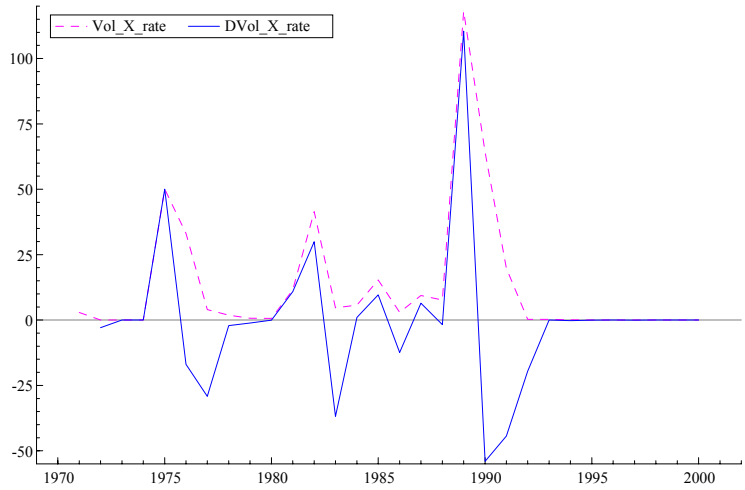
4.1. The order of integration of the variables

The basic regression implemented by the authors is the following:

$$\Delta I_t = \alpha_0 + \sum_{i=1}^{N} \alpha_i \Delta I_{t-i} + \sum_{i=0}^{N} \beta_i Xvol_{t-i} + u_t$$

where ΔI_t is the first difference of the real variable in question (employment, unemployment or investment) and $Xvol$ is the level of the interest or exchange rate volatility. These variables are assumed to be I(0), but no ADF tests are presented to assess this. In particular, the stationarity of the volatility measures is surely controversial, due to the exchange rate crisis experienced by the countries in study. Figure 1 shows the graph of the volatility (and first difference) of the nominal exchange rate volatility of the Argentinean peso vis-à-vis the dollar. While the standard ADF tests do not reject the stationarity of DVol_X_rate (and are robust across sub-samples), the case is much more borderline for Vol_X_rate (since the conclusion depends on the sample period). A discussion of this issue should be included in the paper.

Figure 1



4.2. The sample period

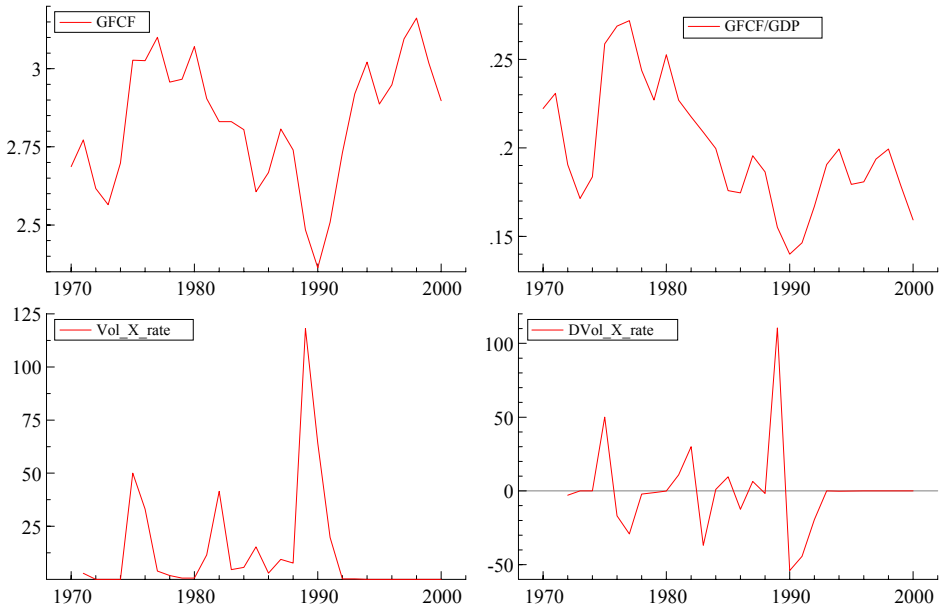
Due to data constraints, the regressions are run with quite few observations (from a minimum of 10 to a maximum of 18). With the inclusion of one regressor (sometimes lagged) and sporadic dummies, the degrees of freedom become scarce. This implies that the results may be very sensitive to outliers.

4.3. Replicating some of the results

Since the authors present an example regression for Argentina (see Table 4, pg. 28), we decided to replicate, as far as possible, the results of the authors in order to gain some insights on the reasons driving the results.

Since we were not able to find a long run series for unemployment[1] in Argentina, we regressed instead the change in real gross fixed capital formation (GFCF). All data were taken from the IFS of the IMF.

[1] The web site referred to by the authors had a long series for unemployment only for the period 1982-2001.



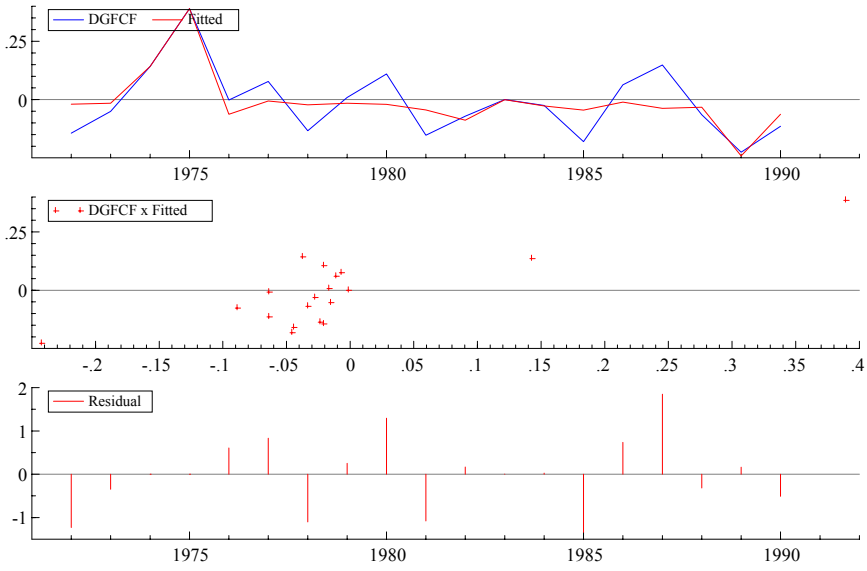
The results of the regression are presented below (as in the paper, we also included dummies for the years 1974 and 1975 though the authors do not present their underlying rationale). The sample period ends in 1990, since the Argentinean currency board was implemented in 1991.

The number of lags in the regression presented in Table 4 of the paper is not balanced between the dependent and the independent variables. The authors do not give reasons for this option (though it shouldn't affect the results much). We decided to test the optimal number of lags in the regression with the usual criteria (AIC, SB, HQ). All tests pointed to 0 as the optimal number of lags. However, the residuals had some autocorrelation so we present the results with one lag (this does not change any of the conclusions below).

```
EQ(17) Modelling DGFCF by OLS   (using Argentina.in7)
The present sample is:  1972 to 1990
```

Variable	Coefficient	Std.Error	t-value	t-prob	PartR^2
Constant	-0.019450	0.030841	-0.631	0.5392	0.0297
DGFCF_1	-0.027781	0.17134	-0.162	0.8737	0.0020
Vol_X_rate	**-0.0019376**	**0.00087626**	**-2.211**	**0.0455**	**0.2733**
D74	0.16061	0.10597	1.516	0.1536	0.1502
D75	0.51043	0.11315	4.511	0.0006	0.6102
Vol_X_rate_1	0.00063007	0.00091219	0.691	0.5019	0.0354

```
R^2 = 0.657153  F(5,13) = 4.9836 [0.0091]  \sigma = 0.1008  DW = 2.16
RSS = 0.1320880809 for 6 variables and 19 observations


AR 1- 2 F( 2, 11) =     2.1326 [0.1649]
ARCH 1  F( 1, 11) =    0.11723 [0.7385]
Normality Chi^2(2)=     0.6056 [0.7387]
Xi^2    F( 8,  4) =    0.36977 [0.8922]
RESET   F( 1, 12) =    0.29503 [0.5970]
```



Note that the volatility of the exchange rate enters with a negative and significant coefficient.

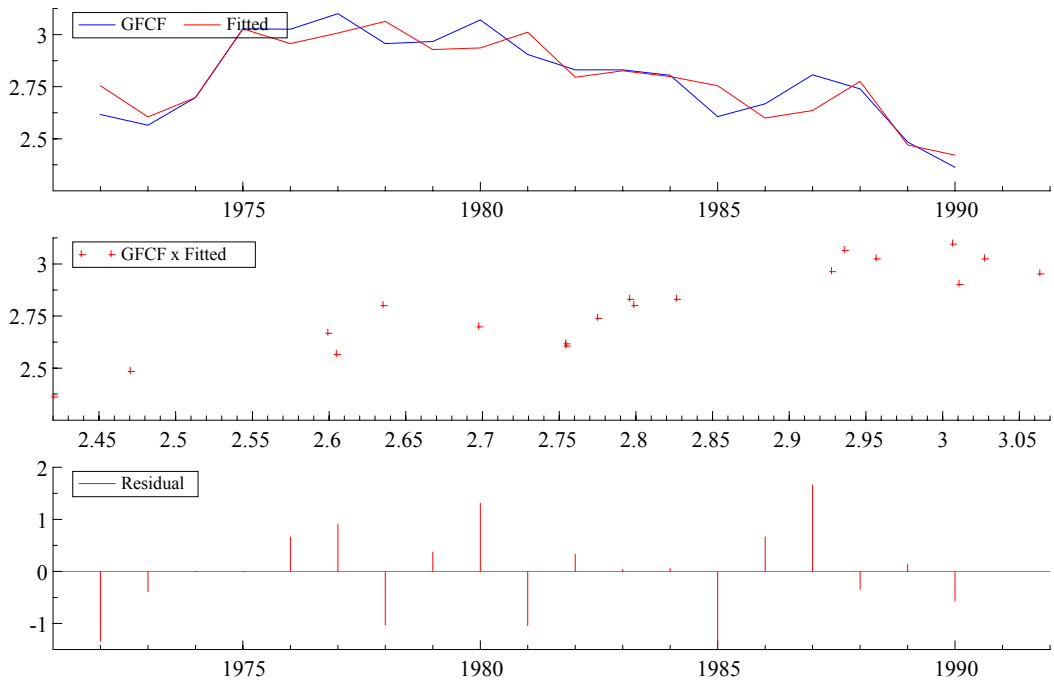
The same conclusion would apply if we considered the variable Vol_X_rate as I(1) and regressed the equation as an ADL instead:

EQ(18) Modelling GFCF by OLS (using Argentina.in7)
The present sample is: 1972 to 1990

Variable	Coefficient	Std.Error	t-value	t-prob	PartR^2
Constant	0.12234	0.45462	0.269	0.7921	0.0055
GFCF_1	0.94887	0.15721	6.036	0.0000	0.7370
Vol_X_rate	**-0.0021751**	**0.00090446**	**-2.405**	**0.0318**	**0.3079**
Vol_X_rate_1	0.00068437	0.00096540	0.709	0.4909	0.0372
D74	0.14206	0.11905	1.193	0.2541	0.0987
D75	0.45381	0.11471	3.956	0.0016	0.5462

R^2 = 0.822288 F(5,13) = 12.03 [0.0002] \sigma = 0.103221 DW = 2.15
RSS = 0.1385083576 for 6 variables and 19 observations

AR 1- 2 F(2, 11) = 2.5829 [0.1203]
ARCH 1 F(1, 11) = 0.20749 [0.6576]
Normality Chi^2(2)= 0.054284 [0.9732]
Xi^2 F(8, 4) = 0.18335 [0.9797]
RESET F(1, 12) = 0.17946 [0.6793]

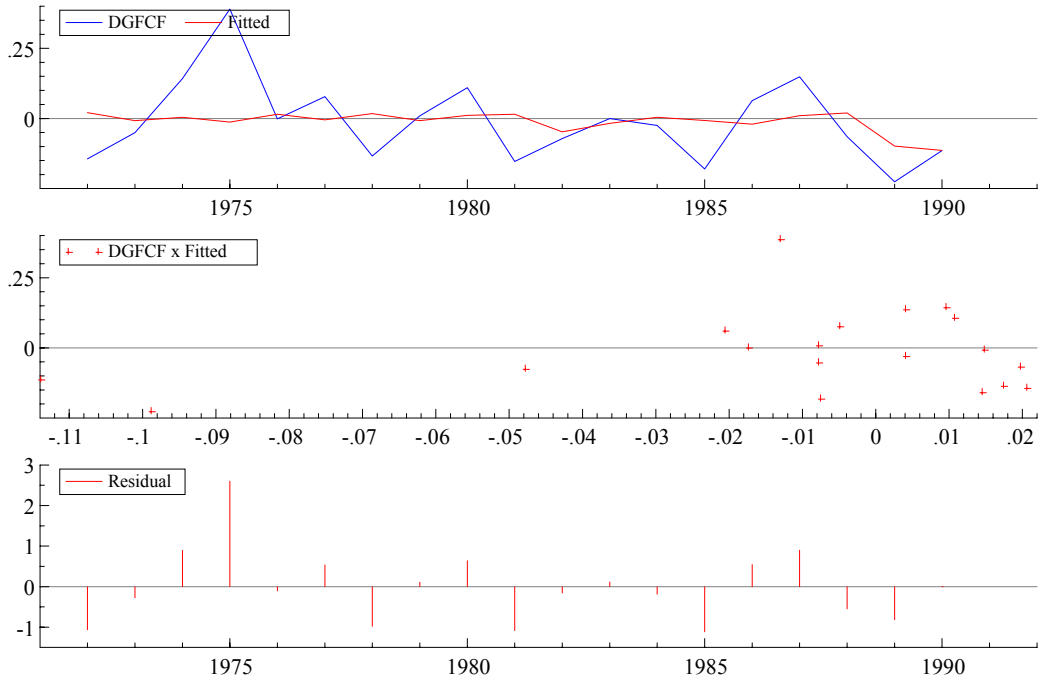


The conclusions are the same as in the I(0) case. In the following, we will thus assume, in line with the authors, that the volatility measure is stationary.

Below, we report some robustness exercises. The results suggest that two issues completely determine the results: a) the dummies for 1974 and 1975; b) the exchange rate crisis in 1989.

a) Re-running the first regressing without the dummies

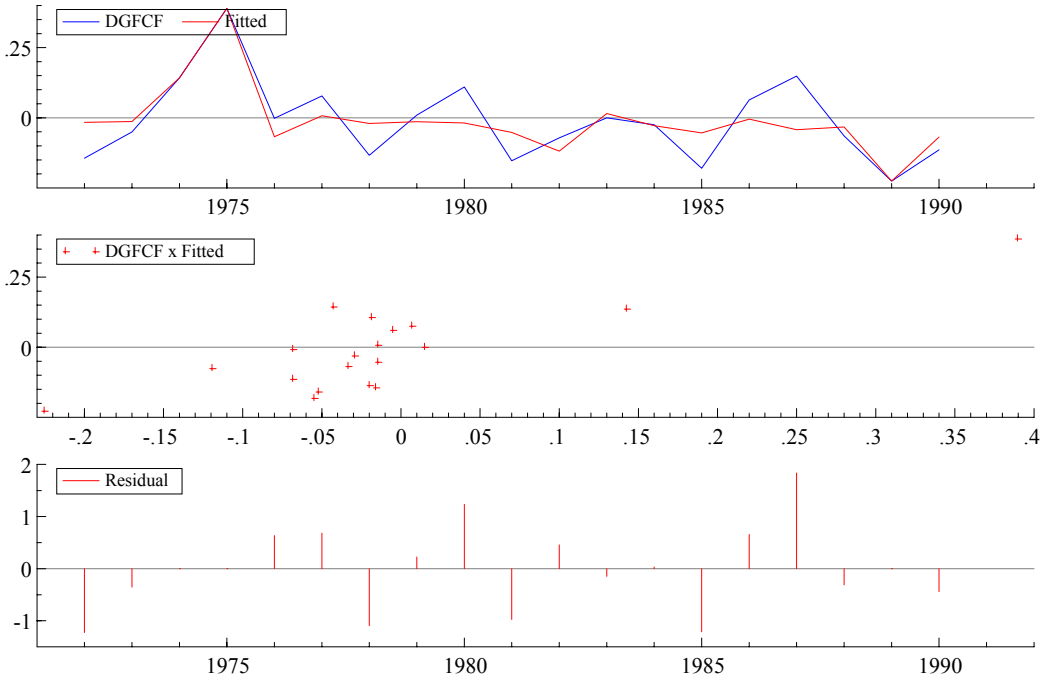
```
EQ(19) Modelling DGFCF by OLS  (using Argentina.in7)
The present sample is:  1972 to 1990

Variable      Coefficient    Std.Error  t-value  t-prob PartR^2
Constant         0.010532     0.044916    0.234  0.8178  0.0037
DGFCF_1           0.12741      0.25432    0.501  0.6237  0.0165
Vol_X_rate    -0.00083175    0.0012682   -0.656  0.5218  0.0279
Vol_X_rate_1  -0.00035774    0.0013637   -0.262  0.7966  0.0046

R^2 = 0.0655522  F(3,15) = 0.35075 [0.7892]  \sigma = 0.154922  DW = 1.80
RSS = 0.360013487 for 4 variables and 19 observations


AR 1- 2 F( 2, 13) =     1.0426 [0.3802]
ARCH 1  F( 1, 13) =    0.12892 [0.7253]
Normality Chi^2(2)=     5.2564 [0.0722]
Xi^2    F( 6,  8) =      1.732 [0.2310]
Xi*Xj   F( 9,  5) =     7.6598 [0.0186] *
RESET   F( 1, 14) =     3.6571 [0.0765]
```



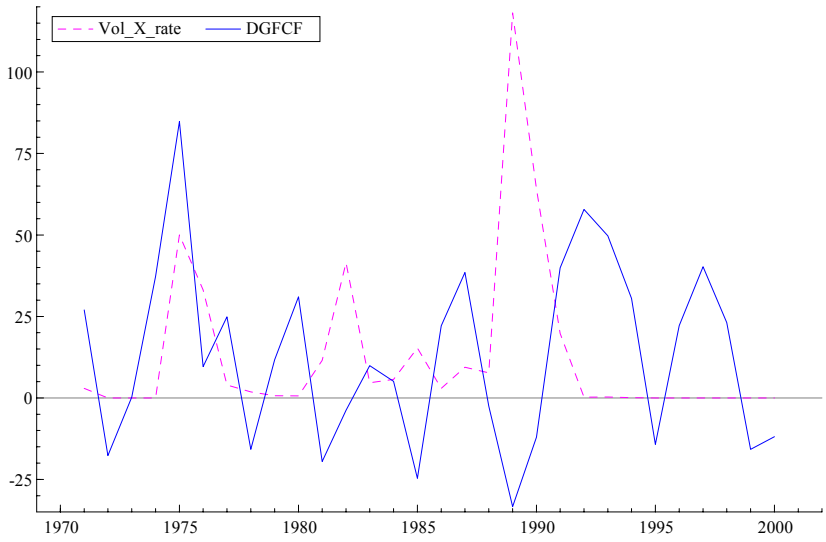
b) including a dummy for 1989 (and keeping the other dummies)

```
EQ(27) Modelling DGFCF by OLS   (using Argentina.in7)
The present sample is:  1972 to 1990

Variable       Coefficient     Std.Error   t-value   t-prob PartR^2
Constant         -0.017094      0.032351    -0.528   0.6068   0.0227
DGFCF_1          -0.024448       0.17721    -0.138   0.8926   0.0016
Vol_X_rate     -0.0028484     0.0023414    -1.217   0.2472   0.1098
Vol_X_rate_1    0.0010637     0.0013947     0.763   0.4604   0.0462
D74               0.15842       0.10961     1.445   0.1740   0.1483
D75               0.55318       0.15473     3.575   0.0038   0.5158
D89               0.11840       0.28071     0.422   0.6806   0.0146

R^2 = 0.662162   F(6,12) = 3.92 [0.0211]   \sigma = 0.104147   DW = 2.15
RSS = 0.1301583533 for 7 variables and 19 observations
```

```
AR 1- 2 F( 2, 10) =     1.6226 [0.2453]
ARCH 1  F( 1, 10) =    0.18814 [0.6737]
Normality Chi^2(2)=    0.86204 [0.6498]
RESET   F( 1, 11) =    0.49816 [0.4950]
```



Looking at the graphs of the exchange rate volatility and the change in GFCF explains the reason for these results.



In 1975, both variables commove positively, so the dummy for that year is significant. In 1989, both variables strongly commove negatively, so this year is crucial to obtain the negative relation between volatility and investment.

These experiments show that the results are very much dependent on the important outliers present in the data.

In the conclusion, the authors claim that (pg. 35) "Our analysis is more appropriate for countries and time periods during which there are no violent regime shifts. Our results should become relevant when MERCOSUR countries have shifted to a "normal" regime (…)".

But we would argue that it is precisely the occurrence of those "violent regime shifts" **that may be driving some of the empirical results of the** paper[2].

4.4. Three specific comments

Still regarding the empirical evaluation described in the paper, three further comments can be highlighted:

- The regressions presented by the authors could usefully be complemented with an explicit analysis of impulse response functions. These would allow making a more precise evaluation of the sign and statistical significance of the relations in study, in particular when the VARs allow for potentially rich dynamics.
- To test the robustness of the relation between the exchange rate variability and employment/investment, the authors decided to include a third variable in the regression, to proxy for misalignments of the real exchange rate (pages 29-32). However, the chosen variable was simply the first difference of the real exchange rate. This does not seem to be appropriate since it neglects the level against which we are measuring the misalignment. A better variable would be the deviations of the real exchange rate from an "equilibrium path", defined by an HP filter or an estimated exchange rate equation (see Lafrance and Tessier (2000)).
- During the sample period, both Brazil and Argentina were characterised by several different exchange rate regimes. Argentina, for example[3], was characterised by a fixed exchange rate regime in the beginning of 1970 and in 1973/74; a period with strong devaluations in 1974/75 which was followed by crawling pegs (until the beginning of the 80's); a floating exchange rate regime from 1981 until 1985; a period with sharp exchange rate instability (in the end of the 80's and beginning of the 90's); and, the implementation of a currency board from 1991 until 2001. Even excluding the period of the currency board it is hard

[2] One could also argue that missing third variables may also impact on the results. The authors acknowledge that on pages 39-42.
[3] This brief summary draws on Table 4 of the first version of the paper.

to escape the critique of regime shifts in the sample period. Thus it would seem necessary – though the number of observations is a severe shortcoming – to perform some stability tests of the results, otherwise a word of caution on the results is warranted.

5. Conclusions

This is a thought provocative paper, which surveys and discusses some interesting arguments as to the relation between financial market instability and real variables in Mercosur countries.

Despite some criticisms on the empirical front and on the theoretical applicability of the model to the countries in the Southern cone, the paper is a good contribution to an ongoing debate concerning the impact of the exchange rate regime and the real behaviour of the economies on developing countries.

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Discussion

Eduardo Levy-Yeyati

The authors discuss the impact of exchange rate (and interest rate) volatility on investment and employment, and relate this impact to the debate on monetary unions (MUs) and, in particular, on the pors and cons of a MU among members of Mercosur. As I understand it, the implicit assumption that ties both themes is the association between having a common currency and reducing exchange rate volatility. In passing, they argue that Mercosur countries are different from EMU in that they are less open economies (and, accordingly, economies with weaker trade links with each other), but that they are similar in terms of labor market rigidity, substantial in both cases.

After a middle section in which they present an irreversible investment *à la* Dixit-Pyndick model to illustrate the negative impact of exchange rate volatility on employment, they present an empirical section in which they run small-sample country regressions using annual data to show that various measures of exchange rate (and interest rate) volatility are negatively correlated with investment and employment in Argentina and Brasil, from which they conclude that a MU between these two countries would lead to higher employment and investment, in line with their analytical model. To address potential endogeneity problems they report Granger causality tests on pairs of dependent (i.e., real) and independent (i.e., nominal) variables (e.g., exchange rate volatility and employment) and finds that nominal variables lead real ones.

At this point, I would like to note that the title seems to be somewhat at odds with the contents: What is exactly the difference between Mercosur and EMU mentioned there? While, as the authors state, labor markets are as rigid in Mercosur countries as they are in EMU, the reported correlation between exchange rate volatility and employment is presumably also present in EMU countries (they authors may want to include a comparison along these lines in the paper).

On the paper itself, I have a general comment that relates to what appears to be the broad objective of the paper. The paper's underlying silogism seems to be the following: i) nominal volatility has negative real effects; ii) a MU reduces nominal volatility; therefore iii) a MU has positive real effects. This silogism is open to an obvious remark:[1] A MU reduces exchange rate volatility *only* between member countries. Hence, even if we accept that the peso-dollar volatility (one of the exchange rate volatility measures used in the paper) significantly harms investment in Argentina, a Mercosur MU does not mitigates this problem. In other words, the only volatility measure that might be potentially relevant to the discussion is the intra-Mercosur exchange rate volatility,

[1] Interestingly, the authors acknowledged this point by quoting Levy Yeyati and Sturzenegger (1999), where the remark is made.

namely, the bilateral exchange rate volatility between this two countries. Accordingly, I would have concentrated the empirical analysis in the paper on this variable.

Instead, the paper reports a number of tests on differente measures of exchange rate and interest rate volatility. I am concerned with the robustness of these tests. Take, for example, the case of Argentina. The paper presents regressions of employment, unemployment and investment, using lags of the dependent variable and a contemporaneous measure of exchange rate (alternatively, interest rate) volatility, based on a sample of 18 observations (the authors exclude the currency board period, but not the previous hyperinflation episodes). In turn, they find that years with high volatility coincided with years of an increase in unemployment (or a decline in investment). At first sight, this is not surprising, particularly after a quick look at the charts included in the paper: it is clear from them that, at the time of the currency crises that led to hyperinflation, nominal volatility increased and employment and investment ratios declined possibly reflecting the slowdown in economic actrivity. But the evidence points at a nominal instability that goes beyond what the bilateral exchange rate volatility between Mercosur countries that a MU might eliminate. My conjecture is that the results would change, if not disappear altogether, if a currency crisis dummy (or other macroeconomic control such as the inflation rate) were included in the regression, or the hyperinflation period were excluded from the sample. More in general, one has to bear in mind that it is extremely difficult to identify causality between macroeconomic variables in times of distress using annual data.[2]

The causality test do not quite address these concerns. The fact that nominal variables Granger-cause real ones is not surprising in emerging economies, probably due to the fact that real variables take more time to fully adjust to the new macreoconomic context.[3] At any rate, the Granger tests presented in the paper are not enough to dispel my concerns that the findings may suffer from a ommited variable problem.

In light of the above, two unexpected results (at least, unexpected for me) deserve some discussion. On the the impact of the Euro-dollar exchange rate volatility for Argentina (they are much weaker for Brazil), I can only conjecture that this is reflecting the strong dollar indexation of the Argentinean peso, but more rigorous testing (and a good consistent hypothesis) would help place this finding in context. At any rate, it is not straightforward to articulate this result with the question about a common Mercosur currency.

On the impact of intra-Mercosur volatility on real variables (which, as I mentioned, is the relevant test for the purposes of the paper), I wonder to what extent it is actually being driven by the peso-dollar volatility (which is highly correlated with peso-real volatility).

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[2] A good illustration of this problem is provided by the financial crisis literature, where most of the action is explained by contemporaneous variables and causality issues are left to the authors' interpretation.

[3] Indeed, it is easy to verify that a simple regression of Argentine GDP growth on the EMBI_AR sovereign risk index shows that the index explains about half of quarterly GDP variation in Argentina since its creation in 1993, and Granger causality test indicates that the index always leads GDP growth by one to two quarters, depending on the period of analysis. See, e.g., Levy Yeyati (2001).

Again, the question is not easy to illuminate. Take, for example, the Brazilian devaluation of January 1999 or the Argentine devaluation of January 2002. Since in both cases, both measures of volatility (within Mercosur and vis a vis the U.S. dollar) increased substantially, and their specific effects cannot be disentangled if they are tested separately. This problem can be partially addressed by controlling for the peso-dollar (alternatively, the real-dollar) exchange rate volatility while testing for the impact of intra-Mercosur exchange rate volatility.

The finding of an independent real impact of the real-peso volatility in this context would provide some preliminary support for the argument in favor of a common Mercosur currency, and the first step for a rigorous and more comprehensive analysis that addresses the small sample problem[4] while introducing additional controls as suggested above. If, on the contrary, intra-Mercosur nominal volatility is found to be irrelevant for real variables (either because the correlation is explained by common ommited factors or dominated by the variability against U.S. variables), we could then safely exclude the nominal variability argument from the debate on a monetary union within Mercosur.

[4] The authors may want to check their findings using a 2-country panel as an alternative to country-specific regressions.

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1) vergriffen (out of print)
2) In abgeänderter Form erschienen in Berichte und Studien Nr. 4/1990, S 74 ff
3) In abgeänderter Form erschienen in Berichte und Studien Nr. 4/1991, S 44 ff
4) In abgeänderter Form erschienen in Berichte und Studien Nr. 3/1991, S 39 ff
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