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Commodity prices in Argentina. What does move the wind?

1. INTRODUCTION

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

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

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

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

Firstly, exports of primary products were historically the basic way to obtain external liquidity to finance economic growth. Because of this, economic analysis until the financial openness of the seventies focused on the behaviour of commodity prices to explain cyclical patterns and external constraints. This channel lost preeminence once the economy opened to financial markets at least from a theoretical standpoint.[1] However, it continues to be relevant in practice since crisis were recurrent in the last thirty years and consequently, international financial restrictions were very frequent.

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

[1] In financial open countries there is also an indirect effect of commodity prices on external finance. These affect agents' expectations of future wealth and debt sustainability analysis in countries that mainly produce primary products. Therefore, current prices could affect both the cost (sovereign spread) and the availability of finance.

Thirdly, in contrast with other commodity producer economies, the share of this sort of exportable goods in domestic consumption basket of Argentina is highly significant. For this reason, the ups and downs of commodity prices create important distributive effects and directly bear upon poverty line calculations. This fact also differentiates Argentina from developed countries. In the latter case, volatile price of food and energy are partially ignored in monetary policy formulation which is based on the analysis of core inflation.[2] Contrary, monetary policy design in Argentina can not easily neglect these items since their shares in CPI are extremely high.

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

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

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

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

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

[4] Harberger (1950) and Laursen and Metzler (1950) pioneering works suggested that a fall in the terms of trade will reduce national income and consequently decrease savings in order to smooth consumption. Later on this effect became known as Harberger-Laursen-Metzler effect. Subsequent works of Obstfeld (1982) and Kent and Cashin (2003) extended the idea, and demonstrated that longer persistence and duration of negative terms of trade shocks

analyzed commodity dependence highlighting that is something not too different to a curse. The so called natural resource curse (Sachs and Wagner, 1995) establishes that countries with abundant natural resources tend to grow slower than natural resource-scarce economies. Economic theory has proposed no less than three explications for this phenomenon. In the first place, high commodity prices could lead to Dutch Disease effect through the previously mentioned real exchange rate link. In the second place, countries with more natural resources are probably more exposed to volatility which, in turns, impacts negatively on growth.[6] Finally, commodity dependence could have adverse effects on governance.[7]

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

Even good luck has been mentioned as a main factor driving economic performance of primary producers countries. Diaz Alejandro (1984) proposed the commodity lottery idea which emphasized that, from a historical perspective, the exportable resources of each country were basically determined by geography and previous experience with global integration. But later economic development was a result of the economic, political and institutional attributes of each commodity. In fact, the long run temporal behaviour of commodities is far from being homogeneous. As examples of this heterogeneity, consider the prices growth rates of the following commodities[8] over the period 1900-2000 according to Ocampo and Parra (2003): lamb 399%; beef

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result in lower investment rates and higher saving.

[5] Deaton (1999) for instance, documents a strong comovement between commodity prices and growth rates in Africa, while Mendoza (1997) describes the links between terms of trade uncertainty and economic growth. Moreover, Bastourre and Carrera (2004) find that terms of trade volatility increases output volatility using a panel data approach.

[6] See Ramey and Ramey (1995).

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

[8] All these commodity price figures are deflated by the Manufacturing Unit Value (MUV) index developed by the United Nations.

135%; tobacco 100%; cotton -66%; rice -67%; and rubber -94%.

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

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

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

2. DRIVERS OF COMMODITY PRICES

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

[9] The classic wisdom due to Ricardo and Mill was that because of diminishing returns of land the relative price of agricultural products was bound to rise in the long run.

kept all the gains of its productivity increases, the periphery would had conceded the benefits of its own technological progress.

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

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

But contrary to focus on time properties of prices series as such, a smaller group of scholars has raised a different question: Are there some macroeconomic determinants of commodity prices?

These papers emphasize the impact of fluctuations in the value of the dollar on the real value of primary commodities. The pioneering model of Ridler and Yandle (1972) uses comparative static analysis in a single-good model to demonstrate that an increase in the value of the dollar (i.e. a real appreciation) should result in a fall in dollar commodity prices. Moreover, the magnitude of this negative elasticity should be less than one in absolute value

[10] There are many papers that analyzed long run behaviour of commodity prices. Grilli and Yang (1988) devised several series for the period 1900-1986, and found that non-fuel primary commodities prices had felt 0.6% per year. relative to manufactures. Among others, the works of Cuddington and Urzúa (1989); Powell (1991); Bleaney and Greenaway (1993); Lutz (1999), Cashing and McDermott (2002); and Ocampo and Parra (2003) tried to confirm or reject Grilli and Yang (1988) results. The general picture that emerges from these papers is that negative growth rates tend to prevail in the very long run. However there is not a clear consensus. While some works argue in favor of a trend that moves at a constant pace, other papers stress the existence of structural negative shifts that are not fully recovered during the upward phase of commodity prices cycles.

since a 100% general appreciation will cause a $100*(1-v_i)\%$ change in commodity *i,* where v_i measures the relative significance of USA as a producer and consumer of this good.[11] This is the so called denomination effect that have been discussed many times since then.

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

$$S = D\left(\frac{P_c}{P}, Y\right) + D*\left(\frac{P_c*}{P*}, Y*\right) \tag{1}$$

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

$$\frac{P_c}{P} = H(Y, Y*, \frac{P}{eP*}; S) \qquad H_1, H_2 > 0; H3 < 0 \tag{2}$$

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

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

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

$$\frac{\partial \ln\left(\frac{P_c}{P}\right)}{\partial \ln\left(\frac{P}{eP*}\right)} = -\frac{\beta*}{\left(\frac{\beta\eta}{\eta^*} + \beta*\right)} \tag{2'}$$

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

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

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

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

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where η and η^* are the domestic and foreign price elasticities of commodity demand and β and β^* are the shares of home country and the rest of the world in total demand. As it is clear from (2') the left side elasticity should be a fraction. Moreover, if demand elasticities are the same commodity price response to USA real exchange rate is proportional to the importance of USA as global buyer in that good.

2.1 The empirical evidence. Where do we stand?

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

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

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

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

[13] The idea is that debt crisis endogenously created incentives to increase commodity supply and as a consequence prices plummeted over the period 1982-85.

Regarding real interest rates, Frankel (2006) verifies a negative coefficient of the real USA interest rate, a variable which according to him represents global monetary policy. This result was established in previous works of Gilbert (1989) and De Gregorio et al. (2005). Pindyck and Rotemberg (1987) find also a negative link between nominal interest rates and various commodities prices.

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

3. THE STYLIZED FACTS OF THE PRICES OF ARGENTINEAN COMMODITIES

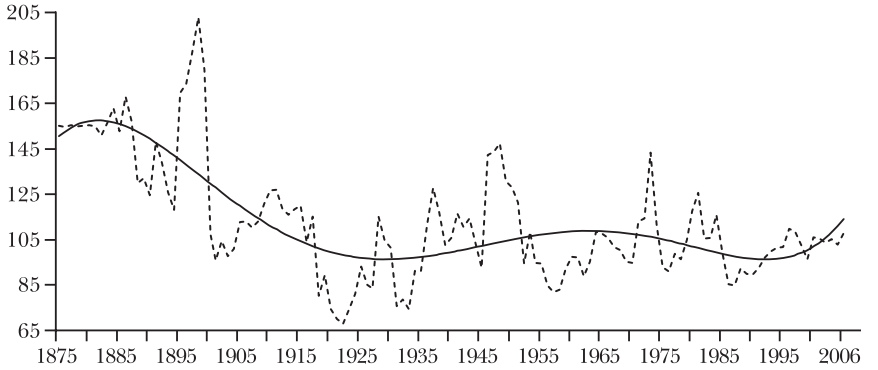
As part of the world trend described in the introduction, the issue of terms of trade and commodity prices has recovered a central place in the economic debate in Argentina. However, many times this debate rest on ideas that are not totally supported by the data. For instance, it has been occasionally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

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

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

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

FIGURE 1. ARGENTINA´S TERMS OF TRADE: THE VERY LONG RUN PERSPECTIVE, 1875-2006



SOURCE: Based on ECLAC Office in Buenos Aires, INDEC, Ministry of Finance and Central Bank of Argentina.

Only from 1987 on we identify an upward trend with some degree of persistence. This latter period have raised an important controversy.

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

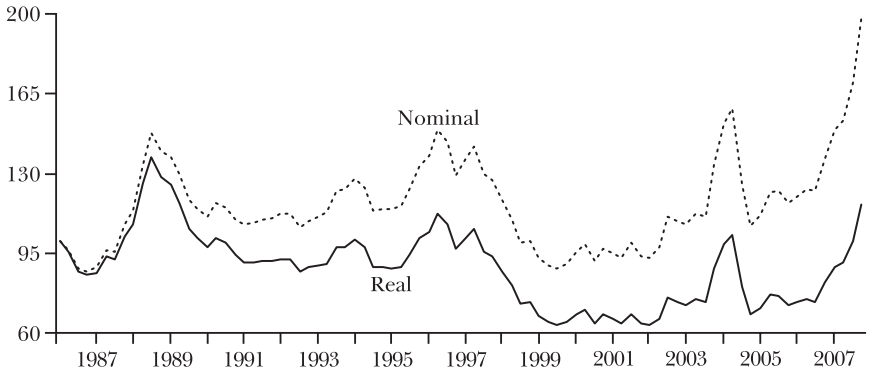
Being the most volatile component of the terms of trade series, commodity prices dynamics is different to some extent. We will concentrate in the 1986-2007 period where it is observed the mentioned rising terms of trade cycle. The analysis of the prices of the main commodities of Argentina will be conducted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

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

We could distinguish again four phases in Figure 2. Firstly, a rising nominal and real prices cycle between 1986 and 1989.

From 1989 on there is a second phase of relative steady nominal prices and slightly decaying real prices which finishes with a new peak at the end of 1996.

FIGURE 2. IPCOM8 INDEX, 1986Q1-2007Q4



SOURCE: Authors' calculations based on IMF and Central Bank of Argentina data.

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

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

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

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

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

4. THE EMPIRICAL MODEL

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

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

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

Regarding world demand, industrial production of China and main emerging Asian countries has been added to the industrial

production of developed economies. In this way, we take into account the impact of these new players in raw materials markets.

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

The empirical model estimated takes the following expression:

$$\Delta X_t = A_0 + \Pi X_{t-1} + \sum_{i=1}^{p-1} \prod_i \Delta X_{t-i} + \varepsilon_t \qquad (3)$$

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

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

5. THE EMPIRICAL RESULTS

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

Since all series are I(1), we estimate an unrestricted vector autoregressive model (VAR) with five lags, following the rule of thumb of considering the seasonal lag plus one. We check, next, the absence of serial autocorrelation and heteroskedasticity in the residuals. These results are shown in section D of the Appendix.

The Johansen (1991, 1995) methodology is employed in order to test if there exists one or more cointegration relationships among the variables. Tests based on trace and maximum eigenvalues statistics are shown in Table 1 and Table 2, respectively.

TABLE 1. TRACE COINTEGRATION TEST

H_0	*Eigenvalue*	*Trace statistic*	*Critical value*	*p-value**
None	0.3251	90.2156	88.8038	0.0394
At most 1	0.2066	55.6169	63.8761	0.2034
At most 2	0.1730	35.2544	42.9152	0.2347
At most 3	0.1542	18.5413	25.8721	0.3087
At most 4	0.0423	3.8061	12.5180	0.7700

TABLE 2. MAX-EIGENVALUE COINTEGRATION TEST

H_0	*Eigenvalue*	*Max-eigenvalue statistic*	*Critical value*	*p-value**
None	0.3251	34.5987	38.3310	0.1263
At most 1	0.2066	20.3626	32.1183	0.6232
At most 2	0.1730	16.7131	25.8232	0.4821
At most 3	0.1542	14.7352	19.3870	0.2084
At most 4	0.0423	3.8061	12.5180	0.7700

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

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

Before analysing these results, impulse-response functions are computed and presented in Figures 3 to 6.[14] Then we will discuss

[14] Cholesky factorization is employed to identify the structural innovations. We have assumed that liquidity shocks of the reduced form are identical to the structural shocks. The remaining variable ordering is as follows: real interest rate, USA real effective exchange rate, world industrial production, and finally real commodity prices. As it is usual, results are measured as a percentage of

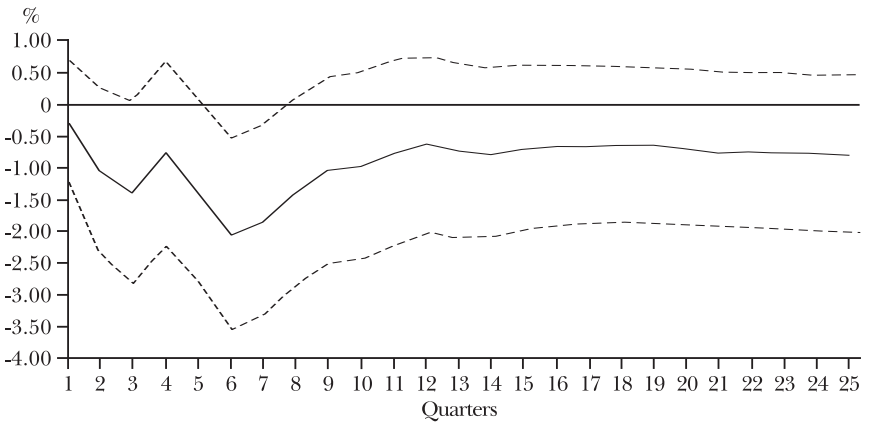
TABLE 3. LONG RUN RELATIONSHIP AMONG IPCOM8 INDEX AND ITS DRIVERS

		t-test	
Variable	*Coefficient*	*t-statistic*	*p-value*
USA REER	-0.7664	-2.2344	0.0295
Real Interest Rate	-4.7588	-1.9338	0.0583
Real Global Liquidity	1.4646	3.0264	0.0038
Industrial Production Index	-1.1327	-1.0893	0.2808
Trend	-0.0257	-3.6622	0.0006

simultaneously both long and short run implications of our model.

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

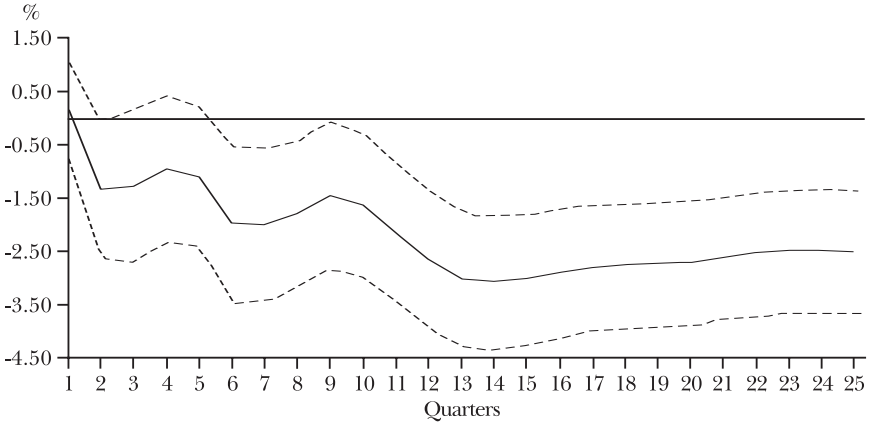
FIGURE 3. ACCUMULATED RESPONSE OF REAL COMMODITY PRICES TO A USA MULTILATERAL REAL EXCHANGE RATE SHOCK



Real effective exchange rate of the USA shows a negative and significative coefficient in the cointegration equation. This is consistent with previous empirical results and with anecdotal evidence

change in the commodity price index after a one-standard deviation shock of each variable.

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



which suggests that dollar depreciations (appreciations) have been associated with rises (decreases) in real commodities prices. As theory predicts, the elasticity lies between zero and minus one. This is a striking feature of our estimations since previous works have systematically found a figure higher than one in absolute value. Regarding short run analysis, we observe an overall negative but small response.

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

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

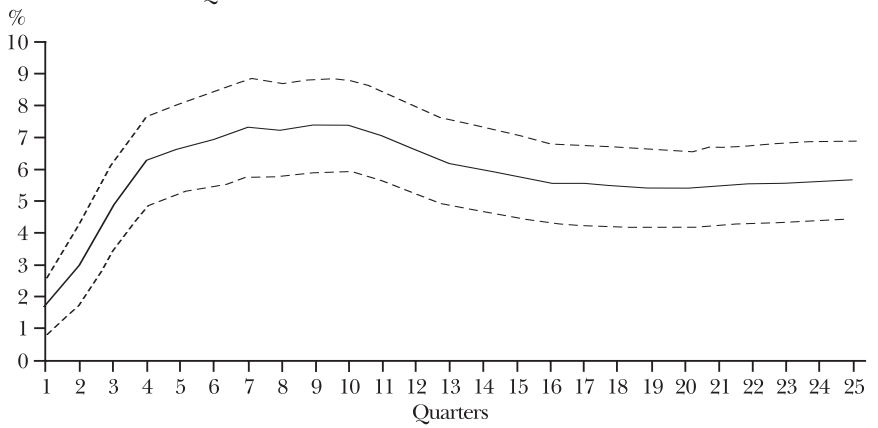
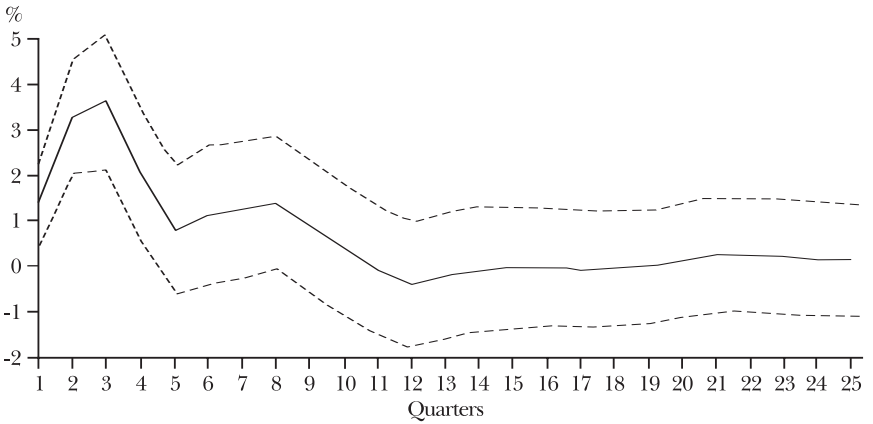


FIGURE 6. ACCUMULATED RESPONSE OF REAL COMMODITY PRICES TO A INDUSTRIAL PRODUCTION SHOCK



slowdown which results in future supply excess that depresses current prices. Besides, short run IPCom8 index response to one standard shock in this variable exhibits an accumulated drop of approximately 1.7% after eight quarters.

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

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

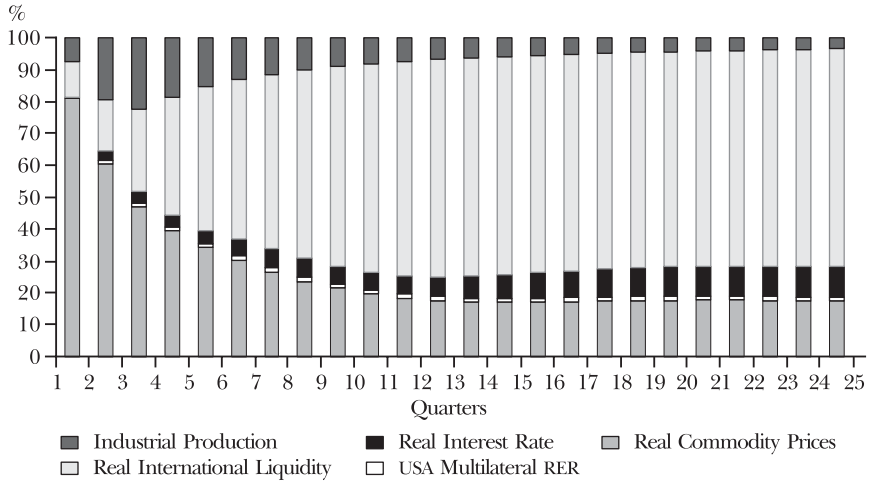
Since our index is dominated by agricultural commodities, it is possible that this short run result is consequence of an immediate reaction to an unexpected demand increase. Supply would only be fixed in the short run, but quite flexible in the medium and long run (i.e. when the harvest is widen or new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

The differentiated impact of the demand on short and long

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

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

FIGURE 7. VARIANCE DECOMPOSITION OF REAL COMMODITY PRICES



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

6. CONCLUSIONS

High commodity prices have gained weight as an explanation of the recent growth cycle in Argentina and Latin America. If we

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

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

Theory indicates that commodity prices are affected negatively by USA real effective exchange rate and positively by demand of raw materials. Some models take into account real interest rates due to their effect on speculative demand: a lower interest rate stimulates speculators to buy commodities instead of financial assets. This phenomenon has been growing in recent years and could be reflecting what is called the "financialization of commodities.[15] As a result, commodities have increased their shares in investment fund portfolios.

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

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

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

[15] According to Domanski and Heat (2006) the number of outstanding contracts on gold and commodities has more than doubled between 2003 and 2006. Bastourre (2008) uses an econometric methodology that allows to identify fundamental and speculative movements in commodity prices.

It is worth mentioning that financial factors (real global liquidity and real interest rate) appeared not only important determinants of commodity prices in the long run but also in the short run.

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

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

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

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

The objective of the first ones would be to reduce volatility, smoothing transitory elements. Measures oriented to this end are, for instance: keep a flexible exchange rate; accumulate international reserve; avoid real exchange rate appreciation with respect to its long run equilibrium; implement taxes-subsidies system for exports accordingly the phase of external price cycle; establish fiscal funds to stabilize expenditure; and adopt countercyclical

regulations of short term capital flows. Among more innovative measures we could find the hedging proposals made by Caballero (2002) to create financial funds that take into account the correlation of commodities to other financial asset, and Frankel's recommendation to use an export price index as monetary policy target.

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

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

Appendix

A.1 Commodity prices index

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

Our index contains the same products included in Index of commodity prices published by the BCRA, but differently to that

TABLE A. 1. COMPOSITION OF THE IPCOM8 INDEX

Commodity	*Share in total exports*	*Price index weight*
Soybeans	3.8	13.3
Soybeans oil	6.0	20.9
Soybeans meal	9.3	32.6
Maize	2.7	9.5
Wheat	3.2	11.1
Aluminium	0.8	2.6
Metals	0.5	1.7
Beef	2.4	8.3
Total	*28.7*	*100.0*

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

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

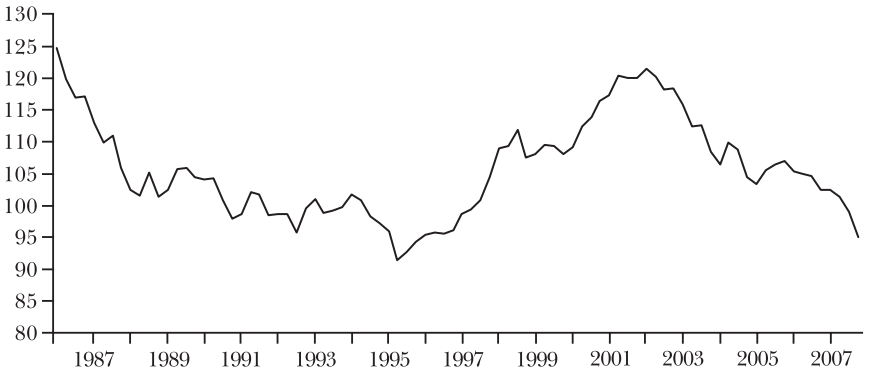
A.2 Description of the international variables

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

USA Multilateral Real Exchange Rate

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

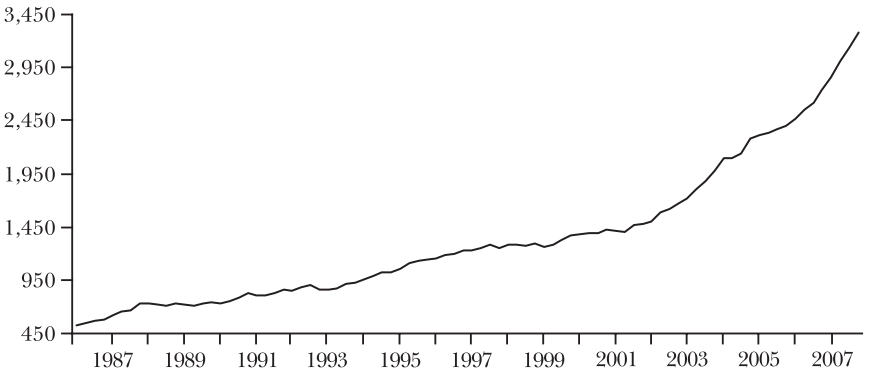
FIGURE 8. US MULTILATERAL REAL EXCHANGE RATE, 1986Q1-2007Q1



Real Global Liquidity

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

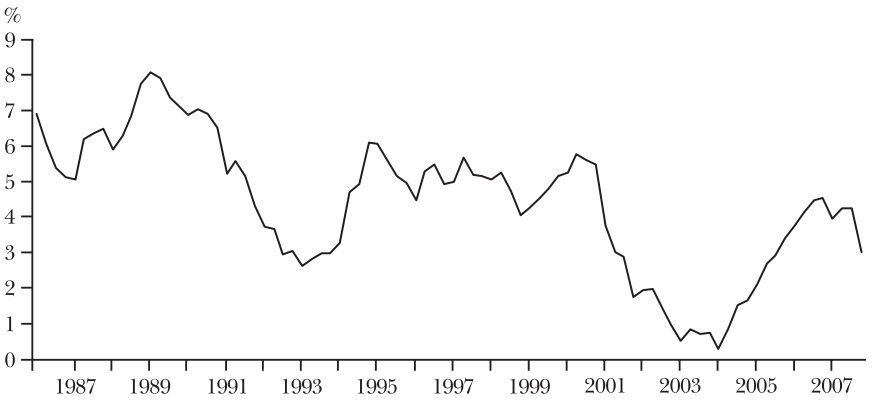
FIGURE 9. REAL GLOBAL LIQUIDITY, 1986Q1-2007Q1



Real Interest Rate

The 1-Year Treasury Constant Maturity Rate from the Board of Governors of the Federal Reserve System was utilized and deflated by the USA GDP deflator.

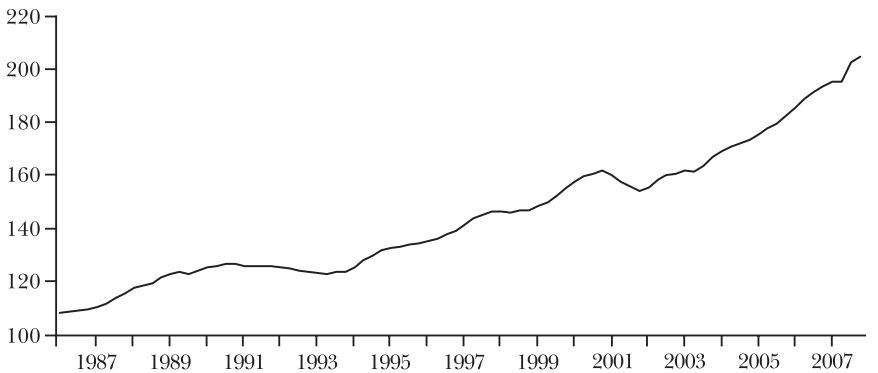
FIGURE 10. REAL INTEREST RATE, 1986Q1-2007Q1



Industrial Production Index

A developed countries plus China industrial production index was built. As there is no industrial production index for the last country, we used the industrial added value employing IFS and World Development Indicators (World Bank) data as an approximate measure. For developed economies IFS IPI series ("11066..IZF..." series) was used. Both indexes were weighted by the respective industrial added value.

FIGURE 11. INDUSTRIAL PRODUCTION INDEX, 1986Q1-2007Q1



A.3 Unit root tests

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

Variable	*Deterministic regressors*		
	None	*Constant*	*Constant and trend*
IPCom8	0.4602	0.1937	0.1168
USA REER	0.7279	0.3954	0.6943
Real Interest Rate	0.3093	0.2927	0.0336
Real Global Liquidity	0.9999	0.9999	0.2687
Industrial Production Index	0.9994	0.9786	0.1736

A.4. Unrestricted VAR residuals

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

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

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

		Normality test		
	Heteroskedasticity white test	*Skewness*	*Kurtosis*	*Jarque-Bera*
Statistic	773.1402	1.9954	37.0321	39.0275
p-value	0.5625	0.8498	0.0000	0.0000

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Juan Carlos Castañeda Fuentes
Juan Carlos Catalán Herrera

Emigrant remittances and the real exchange rate in Guatemala: an adjustment-costs story

I. INTRODUCTION

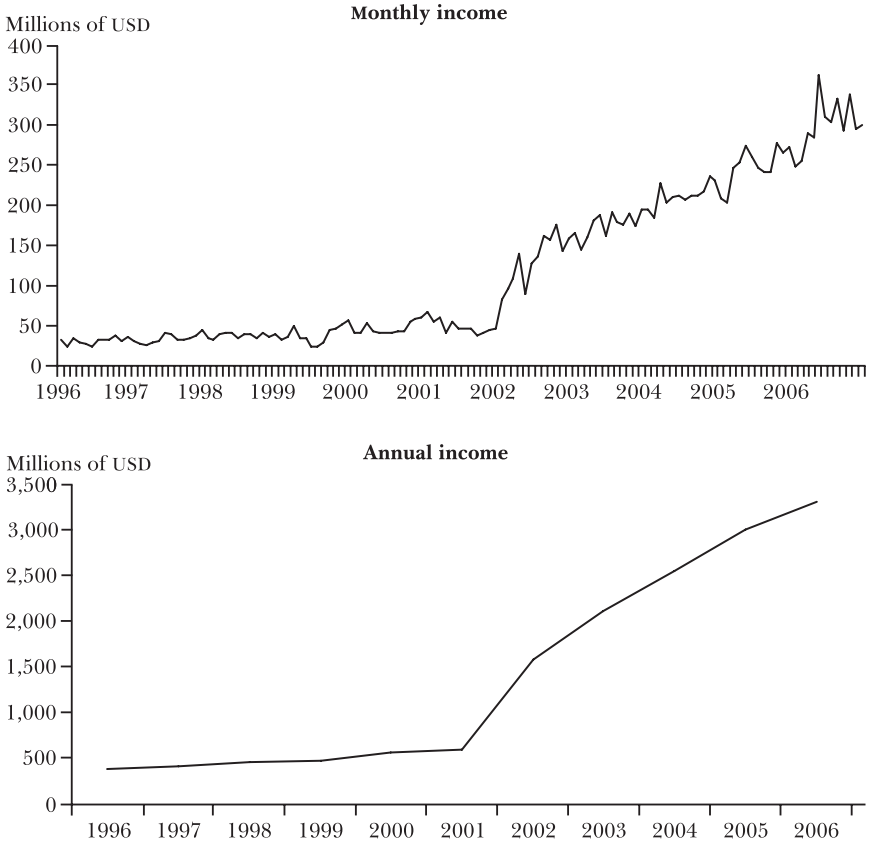
Emigrant remittances have been growing around the world since 1970, but in the past few years, its growth rate has enlarged significantly. According to World Bank (2006), remittances received by developing countries, estimated using officially recorded data,[1] grew up to USD 167 billion in 2005 (a 73% increase from 2001). They have become an important component of the balance of payments for many developing countries and its importance as a source of foreign exchange is reflected in the fact that remittances growth has outpaced private capital flows and official development

[1] The use of officially recorded data tends to underestimate the real magnitude of remittance flows because a substantial portion of these flows is transferred through informal operators or hand carried by travelers (informal channels).

Paper prepared by J. C. Castañeda Fuentes and J. C. Catalán Herrera, Banco de Guatemala, March 2007. Any opinion expressed in this document is responsibility of the authors and does not necessarily reflect those of the Bank of Guatemala. (E-mail address: ⟨jccf@banguat.gob.gt and jcch@banguat.gob.gt⟩.)

assistance over the past decade. For some countries in 2004, remittances were larger than public and private capital inflows and, for some others, even larger than total merchandise exports. This process has not been unfamiliar to Guatemala; remittances have increased their nominal value more than six times over the last decade and their importance as a source of foreign exchange has grown considerably (see Figure 1).

FIGURE 1. REMITTANCES, 1996-2006



SOURCE: Banco de Guatemala.

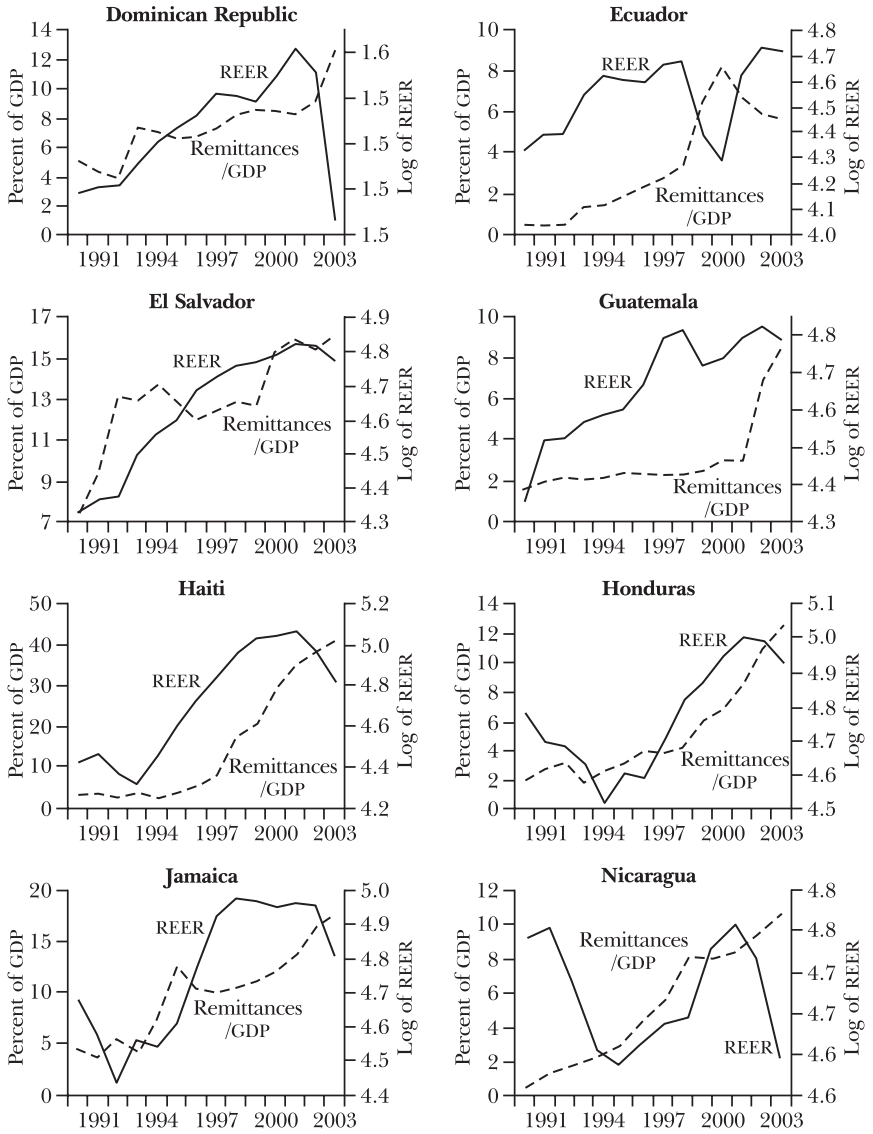
This phenomenon has attracted the attention not only of researchers and policy makers, but also of donors, commercial banks, money-transfer operators and microfinance institutions, among others. This wide spread interest on remittances should not be a surprise since the topic of remittances has many edges

and can be seen from very different points of view. Given the magnitude of workers' remittances and the rising share of foreign income that they represent, we could ask: what are the microeconomic implications, the macroeconomic effects, and the social consequences of these transfers of wealth? It would be very interesting per se trying to answer, for example, how remittances help in poverty reduction, or what the social consequences of having disintegrated families are (because some members had to emigrate seeking better economic opportunities). In fact, a large portion of the existing literature on remittances has focused on the motivation for these transfers and their microeconomic implications, but it has been largely silent on the macroeconomic effects of these flows, at least in the context of a fully specified general equilibrium model.[2]

Undoubtedly, international migration can generate substantial welfare gains for migrants and their countries of origin. For instance, Adams (2004) reports that remittances reduce the level, depth and severity of poverty in Guatemala. However, when workers' remittances are considerably large relative to the size of the receiving economy, they may also bring a number of undesired problems. Among others, we are concerned with the idea that large and sustained remittance inflows can cause an appreciation of the real exchange rate and make the production of tradable goods less profitable, a *Dutch-Disease-like* phenomenon. In Guatemala, there is a special concern about the effects of remittances over the real exchange rate because the latter has been appreciating in the past few years; we have observed an accumulated appreciation of 28.5% in the 2001-06 period, coinciding with a surge in remittances. The idea that remittances can result in a real exchange rate appreciation can be found in many publications of the World Bank; e.g., Fajnzylber and Lopez (2006) show that in seven of the eight Latin American countries with the highest remittances-to-income ratio (Guatemala included, see Figure 2), it is possible to observe a real exchange rate appreciation

[2] More than 260 publications with the word "remittances" in their title and more than 500 publications related to this issue can be found on the Econlit database. Notwithstanding, most of them give a statistical and/or econometric treatment to this issue; only 4 publications were found that study the issue of remittances within a general equilibrium framework.

FIGURE 2



SOURCE: Fajnzylber and López (2003).

that runs parallel to an increase in the remittances-to-income ratio. Also, Amuedo-Dorantes and Pozo (2004) find that a doubling of transfers in the form of workers' remittances result in a real exchange rate appreciation of about 22% in their panel of 13

Latin American and Caribbean countries. More generally, related ideas in the literature can be found. For example Neary (1988), writing about the effects of a transfer over the real exchange rate, points out that an incoming transfer is likely to induce a real appreciation and affirms that this statement has been confirmed empirically by Michaely (1981).

The real exchange rate appreciation is associated with a loss in external competitiveness, but it also has the potential to generate a number of additional macroeconomic effects. What results clear is that remittances will have to be accommodated within the macroeconomic flows of the economy, so the need to understand the impact of remittances on macroeconomic variables is readily apparent. In this paper, we follow closely the work of Catalán (2006) where the same problem is treated within a dynamic stochastic general equilibrium (DSGE) model that takes labor in each sector as a differentiated good. Here we attempt to improve our understanding of the macroeconomic effects of remittance flows by exploring how they affect the real exchange rate in the Guatemalan economy using a DSGE model that considers an inelastic labor supply.

1. Remittances

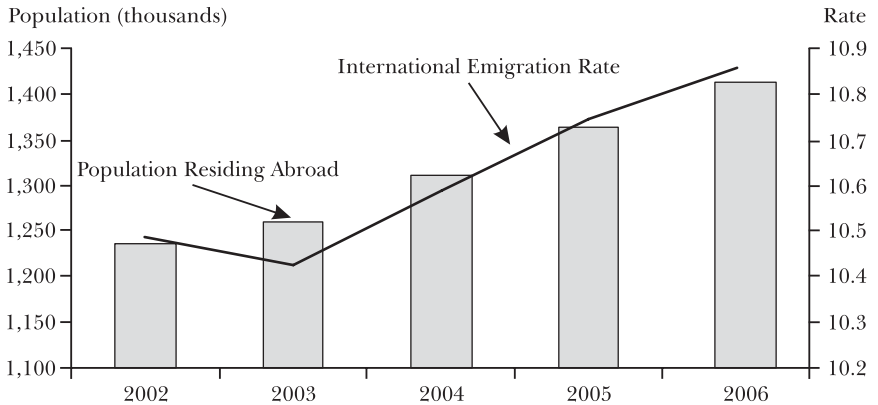
In some way, remittances are the economic expression of migration. In Guatemala, according to OIM (2003), the migratory flow began slowly in the 1970s motivated partially by the effects of the earthquake of 1976. In the 1980s, the number of emigrants was multiplied by four mainly because of the economic crisis and political violence prevailing at that time. The migratory pattern kept its pace and in the 1990s the number of emigrants was trebled. Between 1995 and 2002, more than 90,000 Guatemalans left the country each year, which in average means approximately 250 people per day. This flow led, according to OIM (2006), to an estimate of 1.4 million Guatemalans residing abroad in 2006. The majority of these emigrants chose the United States as a destiny; 98.2 % of remittance senders live in that country.

Both the population residing abroad and the international emigration rate[3] increase each year (as shown on Figure 3). This

[3] The ratio of the population residing abroad over total population of Guatemala.

increasing number of Guatemalans living abroad results relevant to our study because 94% of the Guatemalan emigrants send remittances to their relatives left behind. As mentioned in the introduction, the level of remittances has increased largely in the past five years, and if the emigration pattern keeps its pace, we might think that the remittances flow will also maintain its positive tendency. Hitherto, remittances are the most important single source of foreign exchange in Guatemala, more important than other traditional sources of foreign exchange, like tourism or coffee and sugar exports (the two main export products, see Figure 4). They represent the second largest foreign exchange source measured as a share of total foreign exchange, just behind total exports, and more important than net capital flows (foreign direct investment, FDI, included, see Figure 5).

FIGURE 3. MIGRATORY FLOW, 2002-2006



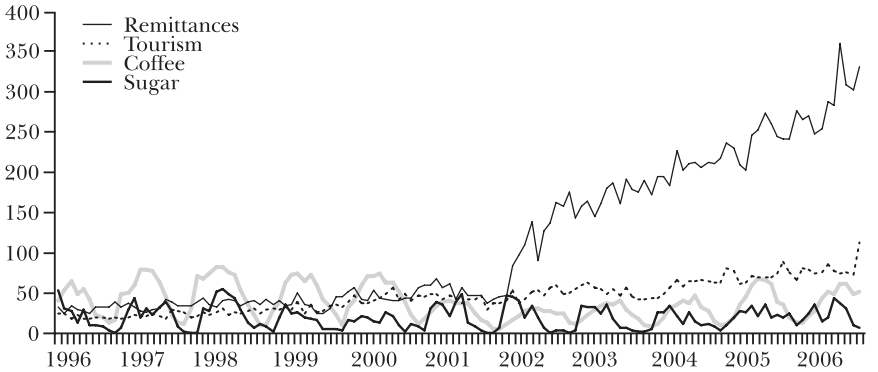
SOURCE: International Organization for Migration. Guatemala.

The emigrant workers' remittances are a well studied phenomenon in Guatemala, at least at a microeconomic level. Adams (2004) uses a large, nationally representative household survey -ENIGFAM-[4] to analyze the impact of internal[5] and international remittances on poverty in Guatemala. In his study, four key findings emerge: first, both internal and international remittances

[4] The national survey of income and expenditure of households from Guatemala. ENIGFAM, by its acronyms in Spanish.

[5] Remittances held within the Guatemalan territory, usually from urban areas to rural ones.

FIGURE 4. FOREIGN EXCHANGE, 1996-2006 (Main Sources)
Millions of USD

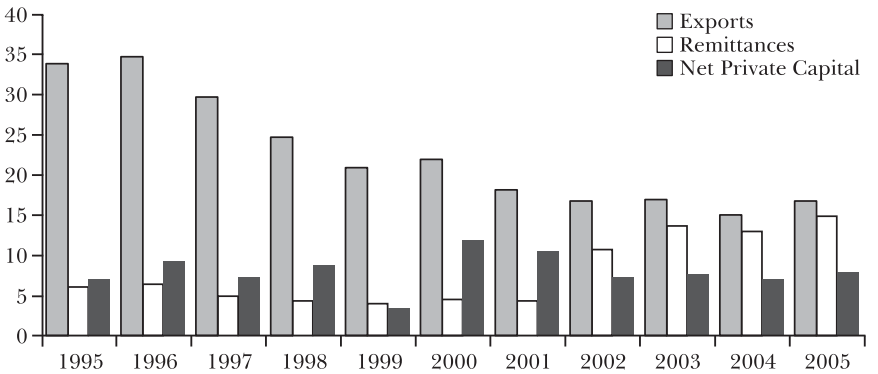


SOURCE: Banco de Guatemala.

represent important components of household income in Guatemala. Second, both types of remittances reduce the level, depth, and severity of poverty. Third, remittances have a greater impact on reducing the severity rather than the level of poverty in Guatemala. Finally, his study shows that including remittances in household income has little impact on income inequality. With the receipt of remittances in Guatemala, income inequality remains relatively stable (Gini coefficient ≈ 0.49).

Adams (2005) also uses the ENIGFAM survey to analyze how the receipt of remittances affects the marginal spending behaviour of households on various consumption and investment goods.

FIGURE 5. GUATEMALA: FOREIGN EXCHANGE, 1995-2005 (Source Structure)
% of total foreign income



SOURCE: Banco de Guatemala.

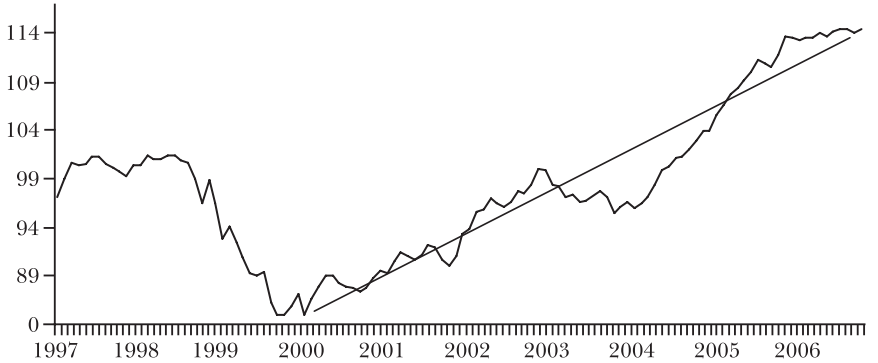
Contrary to other studies, he finds that the majority of remittance earnings are not spent on consumption goods. He reports that while households without remittances spend 58.9% of their increments to expenditure on consumption goods, households receiving international remittances only spend 55.9%. In other words, at the margin, households receiving remittances spend less on consumption than do households without remittances. Adams also finds that the marginal spending behaviour of households receiving remittances is qualitatively different from that of households which do not receive remittances. Instead of spending more on consumption, households receiving remittances tend to spend more on investment than on consumption goods. For example, receiving households spend considerably more on education (although absolute levels of expenditure on education are small). Another relevant finding of his work is that his analysis confirms other studies' findings regarding the amount of remittance money that goes into housing. At the margin, households receiving international remittances spend 2.2% more of their income on housing than those households which do not receive remittances.

It is important to recall that the previous analysis holds "at the margin", therefore, with the observed surge in remittances we could expect Adams' findings to be confirmed, which results very interesting from the standpoint of our investigation in the following sense: The increment in remittance flows could augment the demand of nontraded goods (e.g. education and housing) driving up their prices, which in turn modifies the relative price between traded and nontraded goods and affects the real exchange rate. This idea cannot be addressed without the caveat that, in absolute terms, the remittances are mainly used on consumption goods which include both tradables and nontradables. According to OIM (2006), 50.3% of remittance money is used for consumption (43.1% for food; 3.0% for clothing; 1% for transportation), 21.5% is used for investment and savings, 14.1% for intermediate consumption and 14.2% is destined for health and education.

2. Real Exchange Rate

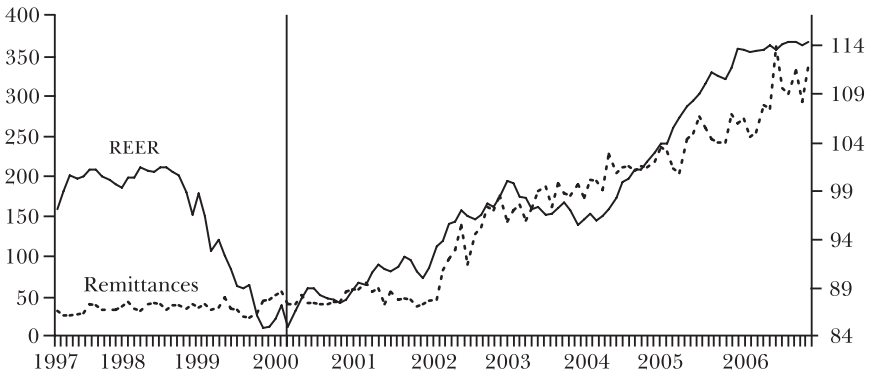
In Guatemala, as mentioned above and shown on Figure 6, the

FIGURE 6. REAL EFFECTIVE EXCHANGE RATE, 1997-2006 (Main Sources)
INDEX



real exchange rate[6] has been appreciating in the last five years (coinciding with the surge in remittances, see Figure 7). The real exchange rate (RER) occupies a very important role in the economy; for example, an appreciation is usually associated with a loss in external competitiveness, but also it has the potential to generate a number of additional macroeconomic effects,[7] among which we can mention the following: a worsening of the current account deficit, weaker monetary control, and sectorial misallocation of investment.

FIGURE 7. REMITTANCES & REAL EFFECTIVE EXCHANGE RATE -REER-, 1997-2006
Millions of USD INDEX



SOURCE: Banco de Guatemala.

[6] Measured using the IMF's real effective exchange rate index.

[7] All of them, subject to actions and reaction of policy makers and the behaviour of many related variables.

Despite the importance of the real exchange rate in macroeconomics, there is no definition or measurement of the RER that is universally accepted. Theoretically, the RER has been defined as the nominal exchange rate amended by the external to internal price ratio. This definition corresponds to the idea that variations of the nominal exchange rate lack a precise meaning in a world with inflation, so variations in the value of external and internal currencies (measured by their respective inflation rates) must be taken into account; in this context, some researchers consider the RER as the purchasing power parity (PPP) exchange rate (Edwards, 1990). On the basis of this definition, people thought of real exchange rate movements as being deviations from PPP, often thinking of them as reflecting misalignments rather than equilibrium responses to real shocks. Despite the fact that the "PPP-RER" is a very common way to measure the real exchange rate, all the problems related to the PPP theory are inherited by this measurement of the real exchange rate. More recently the RER has been defined as the relative price between nontradable and tradable goods (perhaps nowadays the typical theoretical definition), and it is proposed as a better indicator of external competitiveness. This definition of the real exchange rate is not exempt of criticisms. For example, Harberger (2004) argues that the definition of the RER as the relative price of nontradables $-\left({}^{P_N}/_{P_T}\right)-$ can get us into trouble when the disturbances in question are changes in the international prices of particular tradable goods or when we are interested in the consequences of imposing import tariffs or export taxes.

In spite of critics, for the purposes of the present investigation, the $\left({}^{P_N}/_{P_T}\right)-type$ appears to be a sufficient and correct definition of the RER, so in what follows, this definition of the RER is going to be used, unless something else is said explicitly. It is important to point out that, according to Edwards (1990), variations of both definitions[8] of the RER can differ, even go in opposite directions.

The Equilibrium Real Exchange Rate

We consider essential, in the sake of clarity, to define what we understand by the equilibrium real exchange rate (ERER). In the

[8] The "PPP-RER" and the $\left({}^{P_N}/_{P_T}\right)-type$.

literature there are a number of definitions for the ERER, here we brief a few of them and point out an important distinction between the long run ERER and the RER of equilibrium in the short run.

The first definition comes from Dornbusch (1980). He develops an open economy model to study how the equilibrium real exchange rate is determined. In the simplest version of his model, he considers an economy with two goods, one tradable and the other nontradable, and he defines the equilibrium real exchange rate as the relative price between this two goods at which all markets clear. Mundell (1971) provides a formal analysis of the determination of the equilibrium real exchange rate; despite the fact that he does not explicitly use the RER term in his study, his analysis describes rigorously the determination of the relative price between nontradable and tradable goods, and defines the ERER as the relative price between international and internal goods that clears simultaneously the money, the international good, and the internal good markets. The equilibrium real exchange rate has also been defined as the relative price of nontraded to traded goods consistent with balance-of-payments equilibrium, Neary (1988). Finally, Harberger (2004) believes that the real exchange rate is the principal equilibrating variable of a country's trade and payments.

We agree with Harberger that the real exchange rate is an equilibrating variable. We believe that the real exchange rate is essentially an equilibrium variable, a relative price at which internal and external markets clear. We also believe that the equilibrium real exchange rate does not have to be constant, it has to react to important kinds of real disturbances, and here is where we want to make an important distinction. On the one hand, if we think that in the long run there is enough time to allow the adjustment of all productive inputs (capital, labor, land, etc.) and consequently make them perfectly mobile, then it is reasonable to think that the only real disturbances that matter are those coming from changes in the relative productivity of tradable and nontradable sectors. This is a key insight of the celebrated Balassa-Samuelson model.[9] With perfectly mobile and homogenous capital

[9] Balassa (1964) and Samuelson (1964) intended to explain why the absolute version of PPP is flawed as a theory of exchange rates. One of the basic predictions of the Balassa-Samuelson model is that productivity differentials determine the

and labor, the relative price of nontradables is governed entirely by the production side of the economy, therefore, the long run equilibrium real exchange rate is probably going to be affected only by productivity disturbances. On the other hand, in the short run there is not enough time for productive factors to adjust, factor adjustment is a costly and time consuming endeavor. Then, as pointed by Edwards (1990), we could think of a particular value of the RER which reflects an equilibrium situation in the short run regardless it might be misaligned with respect the long run equilibrium. For example, a temporary income transfer from abroad is going to increase the RER that makes possible an equilibrium between internal and external sectors, but it is going to be misaligned with respect to the long run equilibrium until the effects of the transfer disappear. Actually in the short run, the equilibrium exchange rate is going to be exposed to a long list of real disturbances, among which we can mention: productivity shifts, import or export restrictions, rises in real prices of export goods, capital inflows and, of course, remittances.

Based on previous arguments, after presenting some stylized facts of the Guatemalan economy, we develop a general equilibrium model intended to characterize the short run equilibrium RER and establish a theoretical relationship between short run ERER and remittances.

3. Guatemalan Economy: Stylized Facts.

In this section we explore some stylized facts of the Guatemalan economy. We mainly use the results and data of the recently implemented *1993 System of National Accounts*[10] -SNA93-. This system is a conceptual framework that sets the international statistical standard for the measurement of the market economy. It provides an accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision-taking and policymaking. One of

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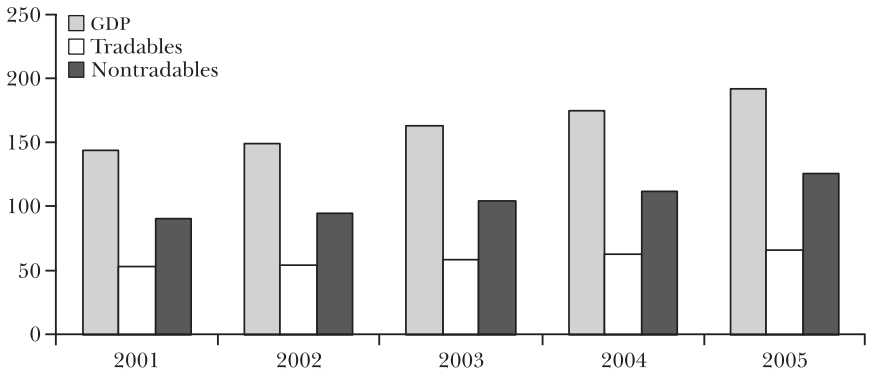
domestic relative price of nontradables, the real exchange rate.

[10] Published jointly by the United Nations, the Commission of the European Communities, the International Monetary Fund, the Organization for Economic Co-operation and Development, and the World Bank. Implemented in Guatemala by the Economic Statistics Department of Banco de Guatemala.

the characteristics of this system that we took advantage of, is that within the compilation framework, the system considers a product nomenclature divided in three levels; the first level is conformed by 65 groups of products, the second level includes 226 products, and the third level comprises 7,308 products. We took the 226 products from the second level, and classified them between tradables and nontradables, then we constructed measurements of production, consumption and investment for both sectors: tradable and nontradable.[11] We also measure the real exchange rate $\left[\left({}^{P_N}/_{P_T}\right) - type\right]$ using the ratio between the implicit output deflator of each sector, and compare its variations with those of the aggregate variables.

In absolute terms, aggregate variables (production, consumption and investment) have grown over the past five years (see Figures 8 through 10). But if we observe these variables in terms of the share of the total GDP that they represent, an interesting story emerges. First, with the observed appreciation, we could expect the nontradable sector to expand and tradable sector to contract;[12] although this is not observed in absolute terms, as a share

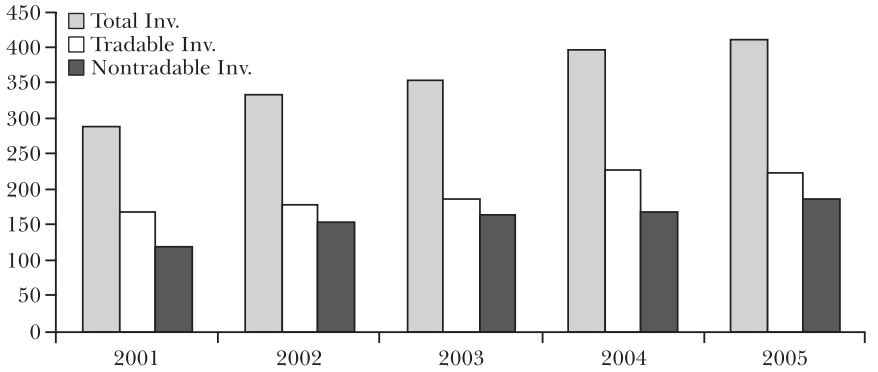
FIGURE 8. PRODUCTION, 2001-2005
Q. (Millions)



[11] In order to perform this classification, we used two criteria: first, we classify goods that are extremely costly to transport as nontradables, but because this is not a clear cut division, we used a second criterion: all goods for which their trade-to-production ratio was below 10%, were classified as nontradables. *Trade* for each product represents the addition of its imports and exports.

[12] If we believe that the appreciation of the real exchange rate is consequence of the surge in remittances, not of an increased productivity in tradable sector.

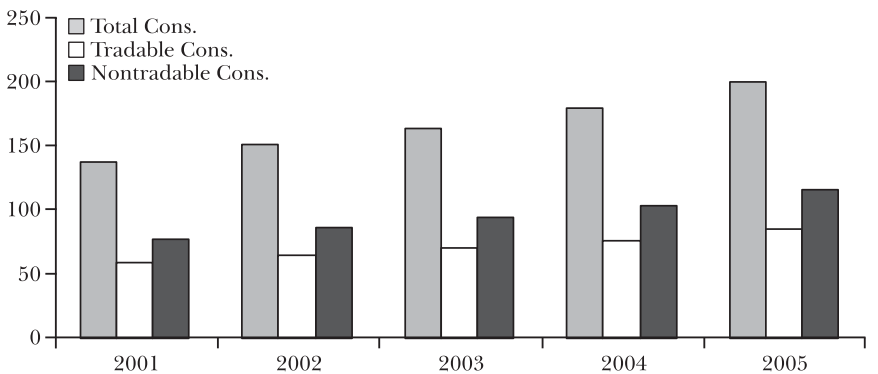
FIGURE 9. INVESTMENT, 2001-2005
Q. (Millions)



of total GDP we do observe that the tradable production diminishes while the RER is appreciating; the same pattern can be observed in tradable investment and tradable consumption: as the RER appreciates, investment in tradable sector and tradable consumption reduce their participation in total investment and consumption respectively (see left side Figures 14 through 16). Only one exception can be observed on year 2004, when tradable production and investment increased while the RER was appreciating.

In contrast, nontradable production, investment and consumption, increase together with the appreciation of the RER. Nontradable production increases as the RER appreciates, the same situation is observed in nontradable sector investment and consumption. Again, the only one exception is observed in year 2004

FIGURE 10. CONSUMPTION, 2001-2005
Q. (Millions)



when both nontradable production and investment decreased for that year despite the RER was appreciating, see left side of Figures 17 through 19.

II. THE MODEL

We develop a dynamic stochastic general equilibrium model, useful to explain the determinants of the real exchange rate. We want to study the relationship between the RER and the demand side of the economy; specifically, its relationship with remittances in a fully optimizing model. We develop a model that includes adjustment costs for capital intended to capture an equilibrium exchange rate compatible with the short run conditions. Because of the absence of policy interventions and nominal rigidities (which in the short-run may be important in practice), both the steady state values and the deviations from it reflect optimal decisions of the economic agents (their best responses given the constraints they face) so the dynamics of the model's variables are *equilibrium dynamics*, and we consider the RER that emerges from our model, as the "short-run equilibrium real exchange rate".

A small open economy that produces two goods, tradables and nontradables, is considered. The main difference between these two goods is that the supply of nontradables is determined exclusively by domestic production, while the supply of tradables does not face this constraint, since it is possible to export or import an unbounded quantity of this good. Outputs of both goods are determined by constant returns to scale production functions that employ capital and labor as inputs. Both goods are traded in competitive markets where their relative price is determined. The tradable good is used as numerator. Assuming a small open economy means that the economy can finance its aggregate expenditure not only internally, but also issuing debt at the international financial market without influencing the international interest rate. We also assume that unanticipated shocks to productivity can occur in both sectors, so the rental price of capital can differ from capital's marginal product ex post, because we suppose that capital must be installed one period ahead of its use.

We are modeling a real economy, so we focus entirely on the relative price of the nontradable good in terms of the tradable

one, not on nominal prices. We do not include a government, since we are not interested on fiscal issues. We are also assuming that there are no nominal rigidities and no monetary side of the economy (of course, there is no feedback from the monetary side to the real side of the economy).

Household's preferences are defined over the two consumption goods. Total endowment of time is normalized to unity and labor supply is assumed to be inelastic. Because we are interested in a model that is compatible with the short run conditions, we introduce capital adjustment costs. This allows us to capture the consequences of the fact that in the short run productive inputs do not adjust immediately. We assume that there are two types of capital, tradable and nontradable, and each one must be produced within the corresponding sector. The law of motion for the capital stock, in both sectors, will include adjustment costs to investment;[13] the specification of the adjustment cost function is such that when the economy is in steady state there are no adjustment costs.

1. Households

The economy is inhabited by infinitely lived households, who obtain utility from consumption of a tradable good, $C_{T,t}$, and a nontradable good, $C_{N,t}$. Households seek to maximize the expected value of their lifetime utility function $\sum_{t=0}^{\infty} \beta^t U\left(C_{T,t}, C_{N,t}\right)$, where $\beta \in (0,1)$ is the subjective discount factor and $U\left(C_{T,t}, C_{N,t}\right)$ is the utility in period *t*, defined as:

$$U\left(C_{T,t}, C_{N,t}\right) = a \cdot \log\left(C_{T,t}\right) + (1-a) \cdot \log\left(C_{N,t}\right) \qquad (1)$$

As aforementioned, we normalize to unity the total endowment of time and assume that households offer labor services inelastically to both sectors. Work hours are compensated with a wage w_t. They own the stock of capital installed in tradable, $k_{T,t}$, and nontradable, $k_{N,t}$, sectors, which they rent at the tradable-denominated rental prices r_t^T and r_t^N, respectively. They receive income transfers from abroad, Rem_t (remittances), and we introduce them in the model as a share of aggregate output (Y_t):

[13] Without which investment flows appear to be implausibly volatile.

$RSH_t = \frac{Rem_t}{Y_t}$. We assume that households are able to borrow or lend freely in international financial markets by buying or issuing risk-free bonds denominated in the tradable good and paying the interest rate i_t; total foreign liabilities are introduced as a share of aggregate output, f_t. Because households own the capital, they use some of their resources for capital formation, so we define $x_{T,t}$ and $x_{N,t}$ as gross investment in each sector. Finally, a is a weight parameter.

The budget constraint for households, normalized by P_t^T (price of the tradable good), can be written as:

$$\begin{aligned} C_{T,t} + Q_t \cdot C_{N,t} + (1+i_t) f_t \cdot Y_t + x_{T,t} + Q_t \cdot x_{N,t} = w_t + \dots \\ \dots r_t^T k_{T,t} + r_t^N k_{N,t} + f_{t+1} \cdot Y_{t+1} + RSH_t \cdot Y_t \end{aligned} \tag{2}$$

where $Q_t = \frac{P_t^N}{P_t^T}$, is the relative price of nontradables in terms of tradables.

2. Some Definitions and Conventions

Capital stock is formed separately within each sector and there is a sector-specific law of motion for capital:

$$k_{T,t+1} - (1-\delta) \cdot k_{T,t} - g_T\left(\frac{x_{T,t}}{k_{T,t}}\right) \cdot k_{T,t} = 0 \tag{3}$$

$$k_{N,t+1} - (1-\delta) \cdot k_{N,t} - g_N\left(\frac{x_{N,t}}{k_{N,t}}\right) \cdot k_{N,t} = 0 \tag{4}$$

Where:

$$g_J\left(\frac{x_{J,t}}{k_{J,t}}\right) = c_2\left(\frac{x_{J,t}}{k_{J,t}}\right)^2 + c_1\left(\frac{x_{J,t}}{k_{J,t}}\right) + c_0; \qquad J = T, N.$$

Function $g_J(\bullet)$ is concave[14] and twice continuously differentiable, it reflects investment adjustment costs in capital. Parameter c_2 is set in order to replicate investment's volatility and parameters c_1 and c_0 are determined by de fact that there are no adjustment costs at the steady state. Parameter $\delta \in (0,1)$ is the depreciation

[14] Since c_2 is negative.

rate of capital that we assume it to be equal across sectors.

Households are subject to a *no-ponzi game* constraint of the form:

$$\lim_{j\to\infty} E_t \frac{f_{t+j}}{\prod_{s=0}^{j}(1+i_s)} \leq 0 \tag{5}$$

Finally, we assume that the following equation must hold in equilibrium:

$$i_t = i_t^* + \psi\left(\exp^{(f_t-\overline{f})} - 1\right) \tag{6}$$

Where i_t^* is the international risk-free interest rate, $\overline{f}$ is the steady state level of net foreign debt position and ψ is a scale parameter. With this equation we are assuming that international financial markets are not complete, which is evident by observing that foreign financing cost is increasing with the net foreign debt position. This can be interpreted as households facing a country specific risk premium.

The households' problem can be summarized as follow:

$$\max_{\{C_{T,t}, C_{N,t}, x_{T,t}, x_{N,t}, k_{T,t+1}, k_{N,t+1}, f_{t+1}\}} E_t\left\{\sum_{t=0}^{\infty}\beta^t\left[a\cdot\log\left(C_{T,t}\right)+\left(1-a\right)\cdot\log\left(C_{N,t}\right)\right]\right\}$$

Subject to equations: (2)–(5). Letting λ_t, η_t and θ_t denote the Lagrange multipliers on (2),(3) and (4) respectively, the first-order conditions of the households' maximization problem are (2) to (5) holding with equality and:

$$\frac{\partial U}{\partial C_{T,t}} = \beta\cdot E_t\left[\lambda_{t+1}\right] \tag{7}$$

$$\frac{\partial U}{\partial C_{N,t}} = \beta\cdot Q_t\cdot E_t\left[\lambda_{t+1}\right] \tag{8}$$

$$\eta_t = \beta\cdot E_t\left[\lambda_{t+1}\cdot r_t^T + \eta_{t+1}\left(g_T + \frac{\partial g_T}{\partial k_{T,t}}\cdot k_{T,t}\right) + \eta_{t+1}\left(1-\delta_T\right)\right] \tag{9}$$

$$\theta_t = \beta\cdot E_t\left[\lambda_{t+1}\cdot r_t^N + \theta_{t+1}\left(g_N + \frac{\partial g_N}{\partial k_{N,t}}\cdot k_{N,t}\right) + \theta_{t+1}\left(1-\delta_N\right)\right] \tag{10}$$

$$\lambda_t = \beta \cdot E_t\left[\lambda_{t+1}\right] \cdot \left(1 + i_t\right) \tag{11}$$

$$E_t\left[\lambda_{t+1}\right] = E_t\left[\eta_{t+1}\right] \cdot \frac{\partial g_T}{\partial x_{T,t}} \cdot k_{T,t} \tag{12}$$

$$Q_t \cdot E_t\left[\lambda_{t+1}\right] = E_t\left[\theta_{t+1}\right] \cdot \frac{\partial g_N}{\partial x_{N,t}} \cdot k_{N,t} \tag{13}$$

3. Firms

There are two firms that seek to maximize their benefits by choosing optimal levels of labor, given the salary, and optimal levels of capital, given capital's rental rate. The first firm produces a tradable good and the second one a nontradable good. Both goods can be used for consumption and investment; one unit of the consumption good can be transformed into a unit of capital at the cost imposed by g_J; $J = N, T$. In each sector, the corresponding firm operates a Cobb-Douglas production function with constant returns to scale.

Tradable Sector

There is a single firm that produces a tradable good combining labor and capital in the production function: $y_t^T = z_t \cdot (k_t^T)^{\alpha^T} \cdot (h_t^T)^{1-\alpha^T}$. Because we are normalizing by the tradables' price, P_t^T, the problem that the firm solves, period by period, can be presented as:

$$\max_{\left\{k_t^T,\, h_t^T\right\}} \Pi_t^T = y_t^T - r_t^T \cdot k_t^T - w_t \cdot h_t^T$$

Where z_t is a stochastic productivity factor. Parameter $\alpha^T \in (0,1)$ determines capital's participation within the production function. We can write the firm's first-order conditions for capital and labor, respectively, as

$$r_t^T = \alpha^T \cdot z_t \cdot \left(k_t^T\right)^{\alpha^T - 1} \left(h_t^T\right)^{1-\alpha^T} \tag{14}$$

$$w_t = \left(1 - \alpha^T\right) \cdot z_t \cdot \left(k_t^T\right)^{\alpha^T} \left(h_t^T\right)^{-\alpha^T} \tag{15}$$

Nontradable Sector

There is a single firm that also uses capital and labor as inputs to produce a nontradable good. It has access to the technology described by a Cobb-Douglas production function of the form: $y_t^N = A_t \cdot \left(k_t^N\right)^{\alpha^N} \cdot \left(h_t^N\right)^{1-\alpha^N}$. It sells its output at a price P_t^N, so the problem that the firm solves in every period is given by:

$$\max_{\left\{k_t^N,\ h_t^N\right\}} \Pi_t^N = Q_t \cdot y_t^N - r_t^N \cdot k_t^N - w_t \cdot h_t^N$$

Where A_t is a stochastic productivity factor and $\alpha^N \in (0,1)$ is the parameter that determines the participation of capital and labor respectively within the production function. We can write the firm's first-order conditions for capital and labor, respectively, as:

$$r_t^N = Q_t \cdot \alpha^N \cdot A_t \cdot \left(k_t^N\right)^{\alpha^N - 1} \left(h_t^N\right)^{1-\alpha^N} \tag{16}$$

$$w_t = Q_t \cdot \left(1-\alpha^N\right) \cdot A_t \cdot \left(k_t^N\right)^{\alpha^N} \left(h_t^N\right)^{-\alpha^N} \tag{17}$$

Where $Q_t = \frac{P_t^N}{P_t^T}$, as before.

4. Exogenous Stochastic Processes

We model three sources of uncertainty: the first two are productivity shocks in each sector, tradable and nontradable; the third one is a stochastic process for foreign transfers. As usual, we assume that all shocks follow an autoregressive process of order one.

$$z_{t+1} = (1-\rho_z) \cdot zee + \rho_z \cdot z_t + \varepsilon_{t+1}^z \tag{18}$$

$$A_{t+1} = \left(1-\rho_A\right) \cdot Aee + \rho_A \cdot A_t + \varepsilon_{t+1}^A \tag{19}$$

$$RSH_{t+1} = \left(1-\rho_R\right) \cdot RHSee + \rho_R \cdot RSH_t + \varepsilon_{t+1}^R \tag{20}$$

Where $\rho_j \in (0,1)$ for $j = z, A, R$. We assume:

$$\varepsilon_t^j \sim N\left(0, \sigma_{\varepsilon^j}^2\right)$$

i.e. all random shocks are white noise.

5. Market Clearing

In equilibrium, all markets must clear. For capital and labor markets this means:

$$K_t^T = k_t^T = k_{T,t}; \quad \forall t \tag{21}$$

$$K_t^N = k_t^N = k_{N,t}; \quad \forall t \tag{22}$$

$$h_t^T + h_t^N = 1 \tag{23}$$

The clearing condition for the nontradable's market is easy to define, because it is constrained by domestic production,

$$C_{N,t} + x_{N,t} = y_t^N; \quad \forall t \tag{24}$$

The tradable sector does not face this constraint, so in equilibrium, it must be true that:

$$C_{T,t} + (1 + i_t) f_t \cdot Y_t + x_{T,t} = y_t^T + f_{t+1} \cdot Y_{t+1} + RSH_t \cdot Y_t; \quad \forall t \tag{25}$$

With this market clearing conditions, the exogenous stochastic processes and the optimal conditions described before for each agent in the economy, we fully characterize our artificial economy.

III. SOLUTION ALGORITHM AND CALIBRATION

1. Solution

In order to solve the model, after some simplification, we transformed the complete system of equations by expressing it in terms of logarithmic deviations from the steady state, *i.e.* we used transformed variables: $\overline{j_t} = \log\left(\frac{j_t}{j_{ee}}\right)$ for every variable j. Then we made a first-order approximation using a Taylor's expansion, and solved the model using the method of Klein (2000). We obtained matrices **P** and **F,** using Klein's algorithm, which generated the dynamic solution by iterating on the following two linear equations:

$$\mathbf{x}_t = \mathbf{P} \cdot \mathbf{x}_{t-1} + \mathbf{B} \cdot \omega_t$$

$$\mathbf{y}_t = \mathbf{F} \cdot \mathbf{x}_t$$

Where $\mathbf{y}$ is a vector composed by controls and co-state variables, $\mathbf{x}$ is a vector of endogenous and exogenous states, $\mathbf{F}$ characterizes the policy function (including the optimal dynamics of co-state variables) and $\mathbf{P}$ is a transition matrix for the states. Matrix $\mathbf{B}$ determines which variables can experience an exogenous shock and in what magnitude and ω_t is an innovation vector.

2. Calibration

We set the parameter values so that the behaviour of the model economy matches the features of some measurements that are taken from the Guatemalan economy, in as many dimensions as there are unknown parameters. Some of the parameters are of common use in the literature and some others deserve a more detailed explanation. To perform this calibration, we use information from national accounts, the national survey of income and expenditure of households, ENIGFAM, and the national survey of income and employment, ENEI.[15] We employ some relationships obtained from the deterministic steady state in order to be consistent with the model. It is important to mention that the information that comes out of the SNA93 is very rich and allows separation of data into many levels. Unfortunately, the frequency is annual and for Guatemala it is only available for 5 years (2001-2005). The data for these few years is enough to estimate some parameters, but for others, especially those that need econometric estimation, the information available is insufficient. A detailed explanation about the calibration of model's parameters can be found in appendix A, as well as the parameter values.

IV. MODEL RESULTS

We believe that it can not be said, a priori, if the change in the remittances flow observed in the Guatemalan data for this decade is going to be permanent or temporary. Thus, we report the response of the model to an unanticipated and temporary shock to the remittances-to-income ratio, RSH_t, and the response of the model to a permanent change in the level of the same ratio. We

[15] By its acronyms in Spanish.

perform these exercises in order to evaluate if the reaction of the real exchange rate (and other endogenous variables) correspond to a setting in which rational agents perceive the change in the flow of remittances as temporary or to one in which they perceive it as permanent. This process will also help us to evaluate the capacity of the model to mimic observed data in the Guatemalan economy.

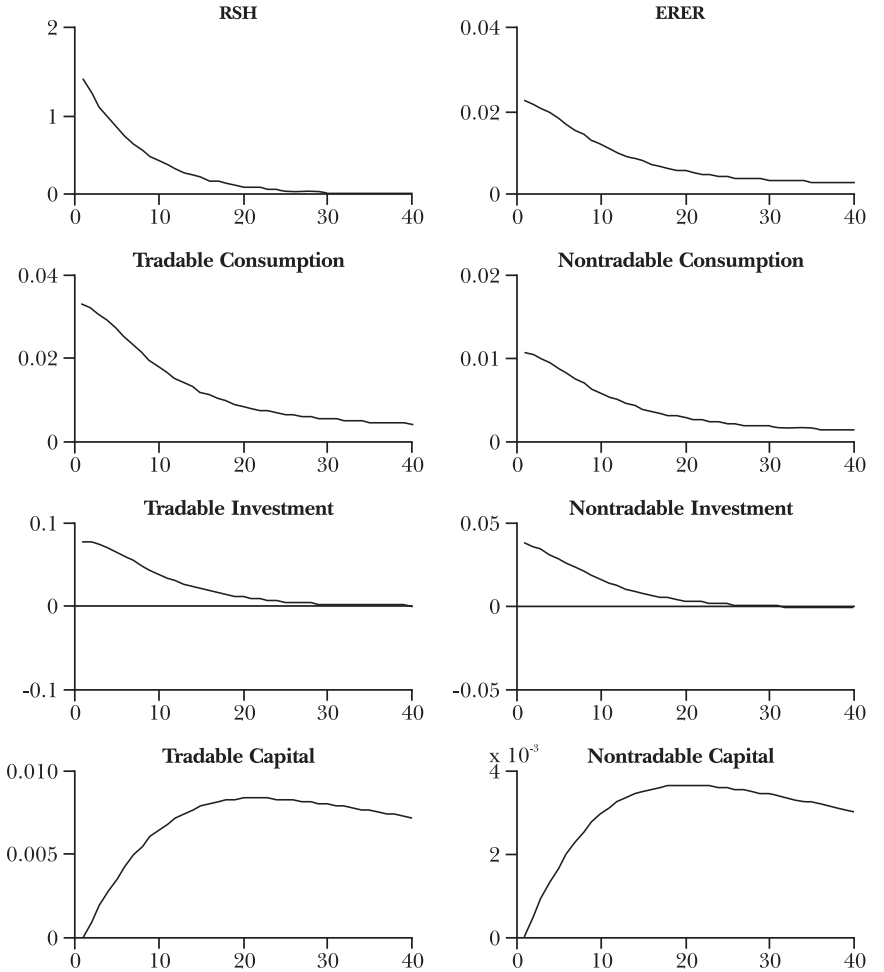
1. Impulse Response: Temporary Shock to Remittances-to-Income Ratio

We report the response of the model to a transitory, but persistent remittances-to-income ratio shock.[16] When RSH_t increases, an appreciation of the equilibrium real exchange rate is observed, see Figures 11(a) and 11(b). The enlarged flow of remittances provides the household with additional disposable income, and the household spreads these resources over the two consumption goods and investment in both sectors. The work hours devoted to nontradable sector show an increase of almost 2% and the work hours in tradable sector decrease in 4.4%. Also the *gift* received by households allows them to increase consumption and investment in both sectors at the same time; nontradable consumption shows a contemporaneous increase of 1.05% while tradable consumption shows an increase of 3.3%. Investment is also higher in tradable sector (7.7%) than in nontradable sector (3.8%). The economy accumulates net foreign assets, which in turn, drive down the risk premium of the interest rate. Remittance flows also affect production of both goods; nontradable production increases contemporaneously with the shock (about 2% over its steady state value), while tradable production decreases for about twenty quarters after the shock (then goes a little bit over its steady state value).

It is interesting to notice that after the shock we do observe an equilibrium real exchange rate appreciation, but it is rather small (2.2%), and the optimum path followed by the RER after the shock is a depreciation path, totally different from the appreciation

[16] A 7.7 standard deviations shock is needed to generate an increase of 308% in the remittances-to-income ratio. This corresponds to the observed shift in the remittances-to-income ratio, from 2.5% in 2001 to 10.2% in 2006.

FIGURE 11(a). REMITTANCES-TO-INCOME RATIO SHOCK



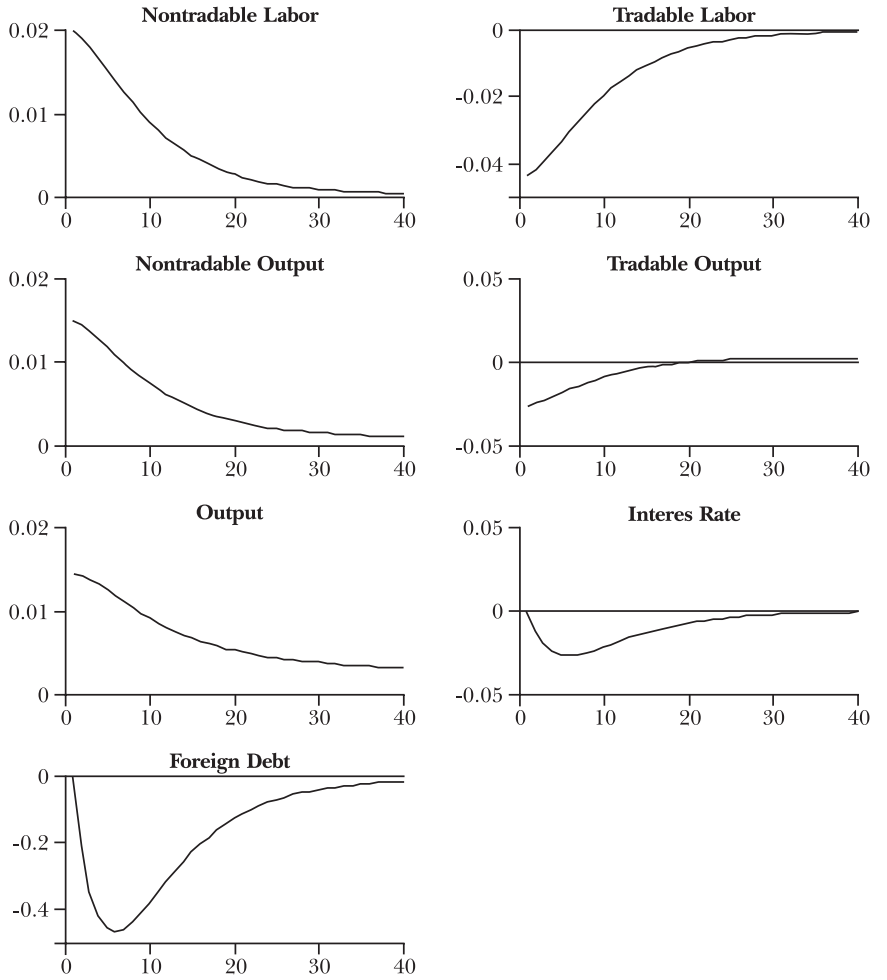
observed year after year since 2001. This depreciation *story* emerges even when the model includes quadratic investment costs, no matter how big or small the shock is. When the shock is transitory, we observe a small contemporaneous appreciation and then a story of depreciation until the RER converges to its steady state.

2. Permanent Increase in Remittances-to-Income Ratio

In this subsection, a permanent change in the remittances-to-income ratio is simulated. We want to model the transition dynamics

of the equilibrium real exchange rate that emerge from shifting the steady state value of the remittances-to-income ratio that prevailed before 2001 (2.595%) to the current level of remittances-to-income ratio (10.2%). We are making two assumptions here. The first assumption is obviously that the observed increase in the remittances flow is going to be permanent; the second one is that remittances will stabilize in some value; we are assuming that this value is near the current ten percent of GDP. Despite this is an arbitrary assumption, we believe that from the perspective of the present investigation, it is of no use trying to guess if the remittances

FIGURE 11(b). REMITTANCES-TO-INCOME RATIO SHOCK



flow is going to keep growing or if it is going to stabilize in one or another value. We work based on what we have observed (i.e. an increase in the remittances-to-income ratio of 308%, going from 2.5% to 10.2%).

We show in Figures 12(a) and 12(b) the transition displayed by the model's variables. In these Figures, the dashed line represents the previous steady state; the solid line represents the resulting steady state after the exogenous change in the steady state value of *RSH* and the doted line represents the transition dynamics. The first thing to notice is that when we simulate a permanent change in the remittances-to-income ratio not only we do observe a stronger appreciation of the short run ERER, but also an *appreciation story* afterwards. In other words, the dynamics followed by the ERER show an appreciation for several quarters, as the one that we have witnessed in the Guatemalan economy. It results very interesting that when we model a permanent change in the *RSH* we observe the appreciation dynamics that we do not observe when a temporary

FIGURE 12(a). PERMANENT CHANGE IN RSHs STEADY STATE

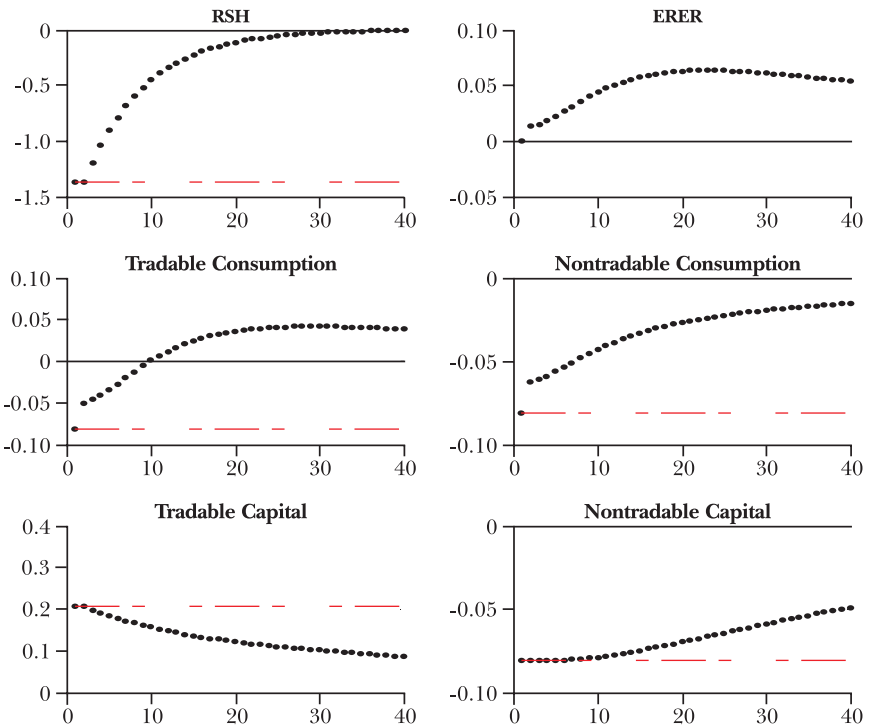
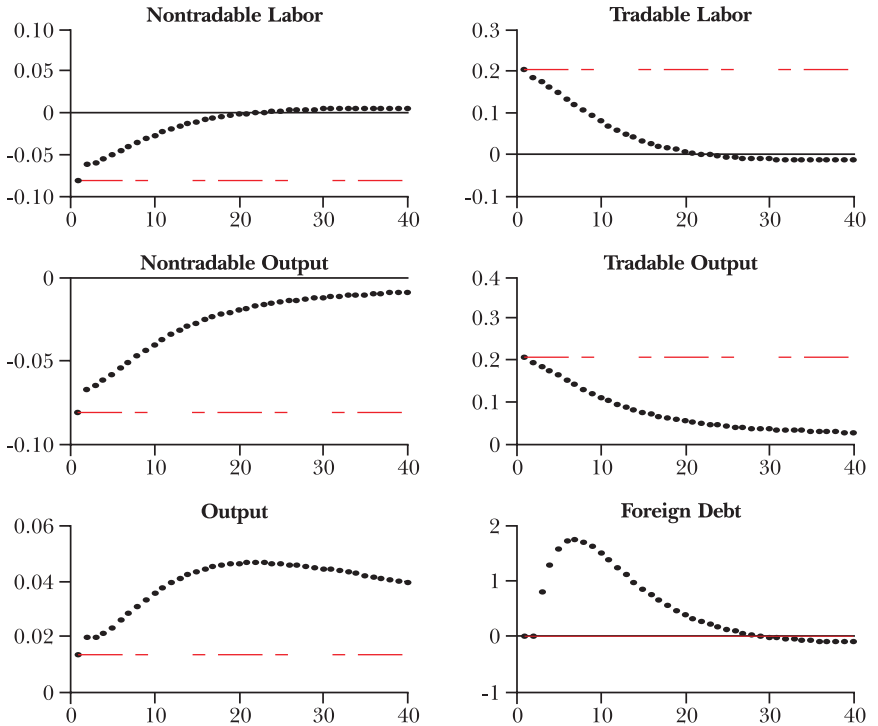


FIGURE 12(b). PERMANENT CHANGE IN RSHs STEADY STATE



shock is simulated. This result gives us the idea that the economic agents in Guatemala perceive the change in the remittances-to-income ratio as permanent. Also it is worthy to mention that, despite it is the same model, when we simulate a permanent increase in the remittances-to-income ratio we observe a more persistent response of almost all model's variables than when we simulate a temporary shock. In the case of a temporary shock to the remittances-to-income ratio, the induced response of most variables disappears in the same time in which the shock does. In the case of a permanent change of the same ratio, the path followed by most of the endogenous variables towards the new steady state takes more time to converge than the ratio itself. This is so mainly because in the permanent change simulation the change in the wealth of households is permanent and they can afford a slower adjustment, there is no need to adjust investment in a short period of time because they are going to be wealthier for ever.[17]

[17] The remittances-to-income ratio converges almost in the same time in

Both consumptions (tradable and nontradable) are higher in the new steady state; both tradable and nontradable consumptions in steady state increase more than 8%, but the first one (tradable consumption) rises faster and it even goes above its new steady state before it converges. Also in the new steady state, less tradable capital is used; a 20% reduction is observed. Nontradable capital's new steady state is 8% higher than the previous one, but it converges slowly. Labor hours behave as expected. On the one hand, because households receive an increased endowment of the tradable good in the form of a foreign transfer, they do not need to produce large amounts of this good. On the other hand, nontradable consumption is constrained by domestic production, so the only way in which households can increase their nontradable consumption in the new steady state is that the economy produces more nontradable good, for which they increase the work hours (and capital) in the nontradable sector. Regarding to production, we observe that nontradable output increases more than 8% with respect to its original steady state while tradable production's new steady state is 20% lower than its previous value. Total output decreases in the long run, but shows a boom for several quarters going above its original steady state. In the whole process, the economy accumulates foreign liabilities which are reimbursed before the transition ends.

In addition, we want to evaluate how the results of the model compare to what has been observed in the Guatemalan economy. The most important fact that we wanted the model to mimic was the marked RER appreciation of the last 6 years and we also wanted to establish if this observed RER appreciation was somewhat generated or caused by the (also observed) surge in emigrant remittances. Figure 12(a) shows that when we simulate the shift in the remittances-to-income ratio as permanent, the model generates a persistent ERER appreciation that increase for 24 quarters, then it stays around an appreciation of 6% for nine more quarters and starts to converge to its (unchanged) steady state. We take this quarterly ERER generated by the model, and convert it into an annual index, then we take this index and compare it with the $\left({}^{P_N}/_{P_T}\right) - type$ RER index obtained from the SNA93.

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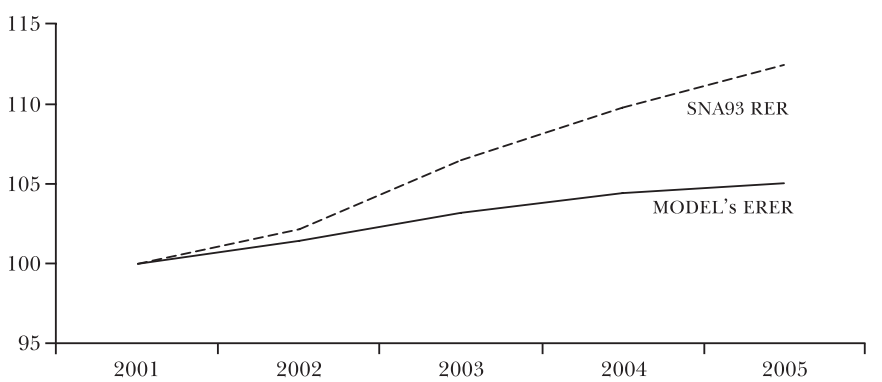
both, the permanent and in the temporary cases, because it is modeled as an exogenous process.

As shown on Figure 13, the model generates an appreciation of the short-run ERER of 5% which is weaker than the observed RER appreciation (12.4%).

FIGURE 13. REAL EXCHANGE RATE, 2001-2005 (Observed RER and Model's Short Run ERER)



The model generates a contraction in tradable sector similar to that observed in the national accounts. According to the model, tradable production reduces its share of total GDP in 14.9%, going from 35.5% (of total GDP) in the first year to 30.2% in the fifth year while tradable production in national accounts reduces its share in 7.2% (going from 37.1% in 2001 to 34.5% in 2005, see Figure 14). We also observe in the national accounts data that nontradable production has increased its share of total output in 4.26% from 2001 to 2005; the model replicates this fact very well. On Figure 15 we can see that nontradable production generated by the model rises from 65.2% to 70%, accounting an increase of 7% in the same period. Regarding to model's investment both, tradable and nontradable (as shares of total GDP), appear to be stable; investment in tradable sector increases from 5 to 6% in the model, while it fluctuates between 11 and 12% in national accounts (see Figure 16). Nontradable investment fluctuates around 8% and 9.5% in national accounts while it fluctuates between ten and eleven percent in the model, see Figure 17. Tradable consumption in national accounts represent an average for 2001-2005 period of 41.2% of total GDP, fluctuating between 40.9% and 41.5% so it appears to be very stable. It can be seen in Figure 18 that in our model, tradable consumption represents a smaller

FIGURE 14. TRADABLE PRODUCTION, 2001-2005

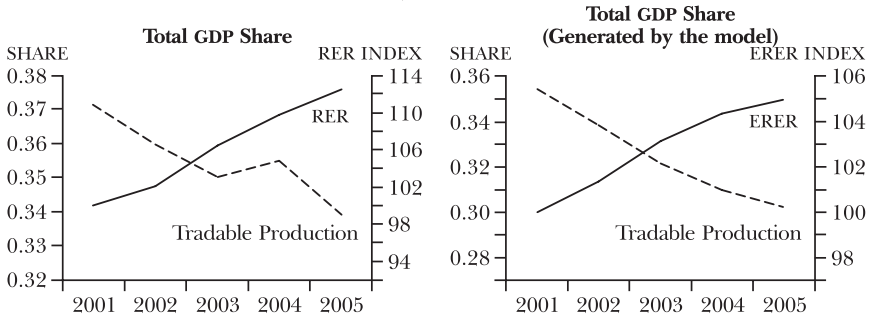


FIGURE 15. NONTRADABLE PRODUCTION, 2001-2005

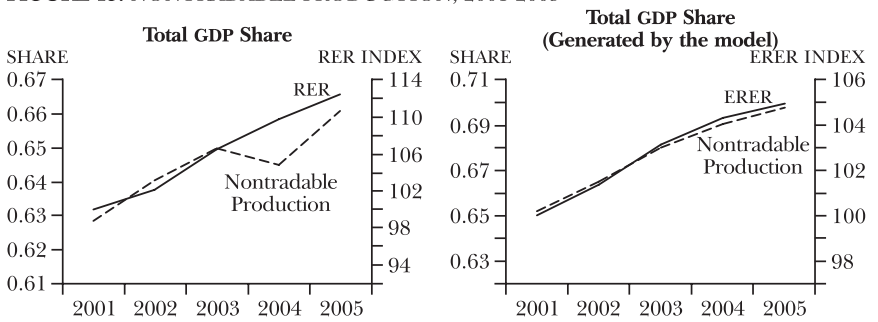
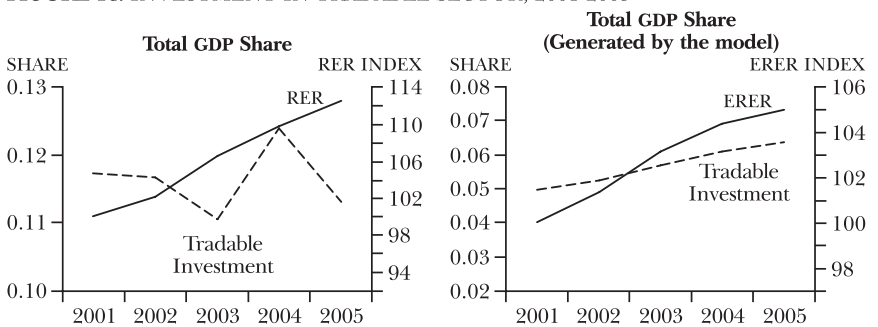


FIGURE 16. INVESTMENT IN TRADABLE SECTOR, 2001-2005



fraction of total output, 31.4% in average for the five year period and it increases during the five year period going from 30.4% to 32.2%. Finally, nontradable consumption seems to increase as a share of total GDP in both, the national accounts and the model. It represents 55% of total GDP in national accounts and 57.1% of total output in our model, both averages of the five year period, see Figure 19.

FIGURE 17. INVESTMENT IN NONTRADABLE SECTOR, 2001-2005

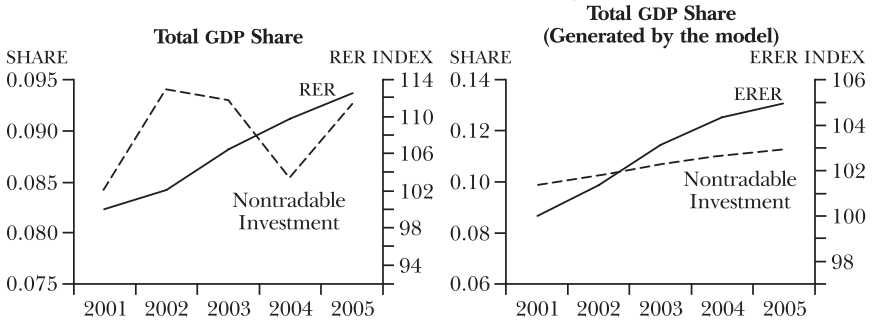


FIGURE 18. TRADABLE CONSUMPTION, 2001-2005

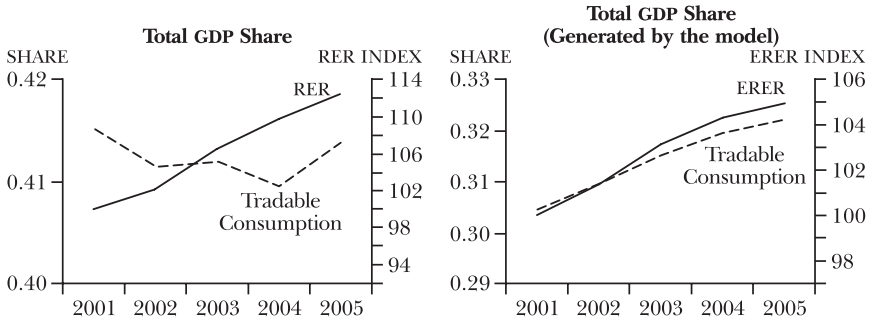
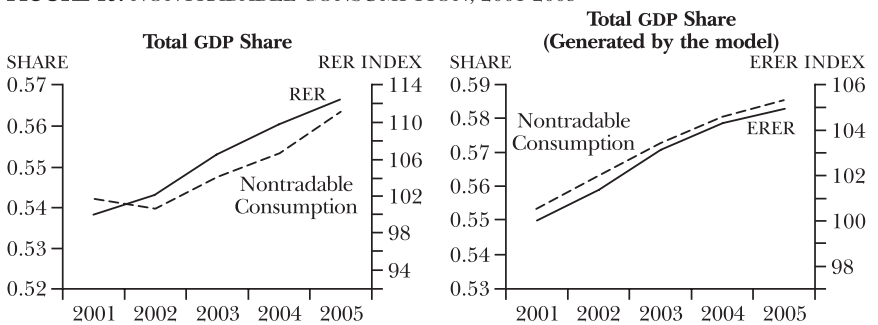


FIGURE 19. NONTRADABLE CONSUMPTION, 2001-2005



V. FINAL REMARKS

Our work began trying to characterize some aspects of the Guatemalan economy, and we did some interesting discoveries. The first one is that tradable production (as total output share) has been contracting during a period in which the remittances flow

has enlarged and the real exchange rate has been appreciating, years 2001-2005. Also nontradable production (as total output share) has been expanding during the same period and under the same conditions (an increase in remittances flow and RER appreciation). These findings are very suggestive that the observed real exchange rate appreciation was influenced primarily by demand factors. Let us consider one of the most common determinants of the real exchange rate that can be found in the literature: *differential technological process*. One of the basic predictions of the Balassa-Samuelson model is that productivity differentials determine the domestic relative price of nontradables; movements of the relative price of nontradables reflect divergent trends of productivity between tradable and nontradable productions. Now, suppose that the observed appreciation in Guatemala arises from a Balassa-Samuelson effect, let us say, from higher productivity in the tradable sector. Then we should observe an expanding tradable sector seizing the greater productivity and a nontradable sector experiencing a contraction. But what we actually observe is totally the opposite, an expansion in nontradable sector and a contraction in tradable sector. This behaviour (of tradable and nontradable productions) is better associated with the argument that a positive transfer of resources to a country hurts its competitiveness in world markets; the reduction of the tradable sector takes place because the transfer appreciates the country's real exchange rate, Obstfeld and Rogoff (1996).

The real exchange rate appreciation has imposed an unintended economic cost on the producers of tradable goods in Guatemala. This is analogous to the concern raised in the well known Dutch Disease case, where resource discoveries result in real exchange rate appreciation and the subsequent shifting of resources from the tradable to the nontradable sectors of the economy. Another finding is that the observed appreciation is not as sturdy as suggested by the IMF's real effective exchange rate (21.6%).[18] We measure the real exchange rate using the ratio between the implicit output deflator of each sector and we obtained a smaller real appreciation (12.4%).[19]

[18] 2001 - 2005 period.

[19] See Harberger (2004) and Montiel (1999) for an explanation of why symmetric and PPP-based approaches of the real exchange rate are flawed.

Then we develop a dynamic stochastic general equilibrium model that generates a short-run ERER appreciation, a tradable sector contraction, and a nontradable expansion, similar to those that are observed in national accounts data. Using this data, we raise the possibility of emigrant remittance flows appreciating the real exchange rate and, hence, reducing Guatemala's competitiveness in world markets. With our model, we provide an analytic framework within which this can occur, where capital adjustment costs play an important role in mimicking the dynamics of the observed real exchange rate. In addition, our model implies that in a world of rational and optimizing agents, the observed dynamic of the real exchange rate can be mimicked only when the increment in remittances is modeled as permanent; this result suggests that in Guatemala, economic agents perceive the observed shift in the remittances flow as permanent.

It is important to notice that the model generates a short-run ERER appreciation (5%) that is weaker than the observed RER appreciation (12.4%). We believe that this 5% is an appreciation of the short-run *equilibrium* real exchange rate, and therefore, economic policies directed to reduce such appreciation would be ineffective and could result merely in a loss of resources. This is important because the rest of the observed appreciation could be related to transitory factors or temporary overvaluations that impose higher costs to the tradable sector and tend to reduce its growth prospects. This overvaluation of the real exchange rate may perhaps be subject of policy intervention. The first course of action in which one could think is sterilization, but if sterilizing operations are required on a sustained basis, they may prove unfeasible mainly because the unsustainable quasi-fiscal costs that these operations could imply when remittances are considerably large. Other government interventions, like efforts aimed at making domestic markets more efficient and more flexible (especially productive factor markets), could ease exchange rate pressures without imposing other macroeconomic costs. It is essential to keep in mind that policy makers will have to accept some real exchange rate appreciation, to us the short-run ERER appreciation, because of the substantial and sustained nature of remittances flows in Guatemala.

It is important to better understand the different impacts of remittances over the receiving economy in order to formulate

economic policies that take full advantage of these transfers of wealth and enhance its development impact. In such sense, this paper constitutes part of an extensive research agenda whose primary objective is to achieve a better understanding of the effects of demand shocks over the equilibrium real exchange rate. In the model presented here the shift in remittances, either transitory or permanent, does not affect the long run equilibrium real exchange rate (the steady state value of the RER); we believe that an interesting next step could be exploring if demand shocks are capable of generating a permanent ERER appreciation, given some non-competitive market structures or segmented input markets. For the moment, we conclude saying that it is ironic that emigrant remittances, intended to relief poverty and benefit the relatives left behind may, in turn, compromise Guatemala's international competitiveness through a Dutch-Disease-like phenomenon.

Appendix A

Calibration

Because the production functions are Cobb-Douglas (in both sectors) and they exhibit constant returns to scale, each input is paid its marginal product. In this case, the parameter $\left(1-\alpha^{j}\right)$ is referred to as the labor's share and α^{j} is the capital's share (both in sector j), because they will earn that fraction of output. These parameters are of common use in the literature so we take the values used for the Colombian[20] economy: $\left(1-\alpha^{T}\right)=0.6651$. Which implies a participation of capital in the production function of $\alpha^{T}=0.3349$. Also, for the nontradable sector we use a labor's share of $\left(1-\alpha^{N}\right)=0.7088$. Which in turn, implies a participation of capital of: $\alpha^{N}=0.2912$. The steady state level of net

[20] See Hamman and Rodriguez (2006). We did not calibrate these parameters with Guatemalan data because in order to find labor and capital shares for each sector, we need information of the input-output matrix of national accounts and by the time we calibrated our model this matrix was not available. Nevertheless, we show further that model's results are robust to reasonable changes in these parameters. In appendix B, we present some sensitivity analysis.

foreign asset position, $\overline{f}$, is calibrated in such a way that the model imitates the ratio of trade balance-to-output of the Guatemalan data (16.74%) in the 1995-2006 period. We set the scale parameter of the risk premium in a value that allows the model to exhibit the same variability of the trade balance-to-output ratio that is observed in the Guatemalan economy, this is $\psi = 0.00081$. Capital's quarterly depreciation rate is set to 0.012 which is equivalent to an annual depreciation rate of 0.048.

Participation of tradable consumption $C_{T,t}$ and nontradable consumption $C_{N,t}$ in the utility function of households: (a)

From households' first-order conditions, we take equations (7) and (8) in steady state, and combining them we get:

$$\frac{C_{N,ee}}{C_{T,ee}} \cdot \frac{a}{(1-a)} = \frac{1}{Q_{ee}} \tag{26}$$

From this relationship, we can find the value of parameter a that is consistent with the model. We add up the final consumption expenditure in both sectors and take averages to obtain the relationship $\overline{\left(\frac{C_{T,t}}{C_{N,t}}\right)} = 1.33418$. For $\overline{Q_t} = \overline{\left(\frac{P_t^N}{P_t^T}\right)} = 1.06162$, we use the implicit output deflator of tradable and nontradable sectors obtained from national accounts. Then, using equation (26) we solve for $a = 0.4138$.

Steady state value of net foreign asset position: (fee)

In order to calibrate the steady state value of debt in our model, we first took the definition of trade balance of the model and the equation that governs the accumulation of external debt inside the model, equation (25):

$$TB_t = y_t^T - C_{T,t} - x_{T,t} \tag{27}$$

$$C_{T,t} + (1+i_t) f_t \cdot Y_t + x_{T,t} = y_t^T + f_{t+1} \cdot Y_{t+1} + RSH_t \cdot Y_t; \tag{28}$$

Taking (28) in steady state:

$$C_{T,ee} + (1+i_{ee}) f_{ee} \cdot Y_{ee} + x_{T,ee} = y_{ee}^T + f_{ee} \cdot Y_{ee} + RSH_{ee} \cdot Y_{ee}; \tag{29}$$

and rearranging we get,

$$i_{ee} f_{ee} = \frac{y_{ee}^{T} - C_{T,ee} - x_{T,ee}}{Y_{ee}} + RSH_{ee}; \tag{30}$$

So, we would have a debt-to-GDP ratio:

$$i_{ee} f_{ee} = \overline{\left(\frac{TB_t}{Y_t} \right)} + RSH_{ee} \tag{31}$$

Steady state value of remittances: $(Remee)$

We took quarterly data and estimated the remittances to GDP ratio for the period 1995-2001. In this period, the ratio appears to be stationary.

Also we confirm the stationarity of this ratio by a Dickey-Fuller test, which rejected at a 5% significance level the null hypothesis that remittance to GDP ratio had a unit root.[21] The mean level of this ratio appears to be 2.595%, so we set the steady state level of remittances to $Remee = 0.02595$. The evolution of remittances in recent years can be interpreted as a transition to a higher steady state value of remittances flow, so we use the 2006 level of remittance-to-GDP ratio (10.2%) as a the new steady state value, $Remee_2 = 0.10259$.

International risk-free interest rate: (i^*)

We took the 3-month USA Treasury bill as the riskless asset, and its rate as proxy of the international risk-free interest rate. We computed the average of the annual rate of return for the past 6 years (2.9391%), and then calculated a quarterly equivalent rate, to set $i^* = 0.0073$.

Subjective discount factor (β):

The subjective discount factor is determined by equation (11)

[21] The remittances-to-income ratio appears to be stationary before 2001; after that, the series shows a clear structural break, displaying an increasing trend from 2001 to 2006. If we consider a sample including the last 6 years, the series is not stationary.

in steady state, it is easy to see from that equation that:

$$\beta = \frac{1}{1+i^*}$$

With an international risk-free quarterly interest rate of 0.0073, we have that $\beta = 0.9927$.

Remittances shock persistence (ρ_R) :

We take quarterly data of remittances $-Rem_t-$ and estimate by OLS:

$$\log\left(\frac{Rem_t}{Remee}\right) = \rho_R \cdot \log\left(\frac{Rem_{t-1}}{Remee}\right) + \varepsilon_t^R \tag{33}$$

We used logarithmic deviations from the steady state instead of the plain variable, to be in consonance with the model where variables are transformed in this way. From the regression, we obtained the estimators $\widehat{\rho}_R$ and $\widehat{\sigma}_{\varepsilon^R}$ that were used as the values of parameters ρ_R and σ_{ε^R}, respectively. From this procedure, we set $\rho_R = 0.891437$ and $\sigma_{\varepsilon^R} = 0.178223$.

Parameters values:

PARAMETER VALUES

i^*	β	a	α^T	α^N	δ	$Remee$
0.00735	0.9927	0.4138	0.3349	0.2912	0.012	0.02595

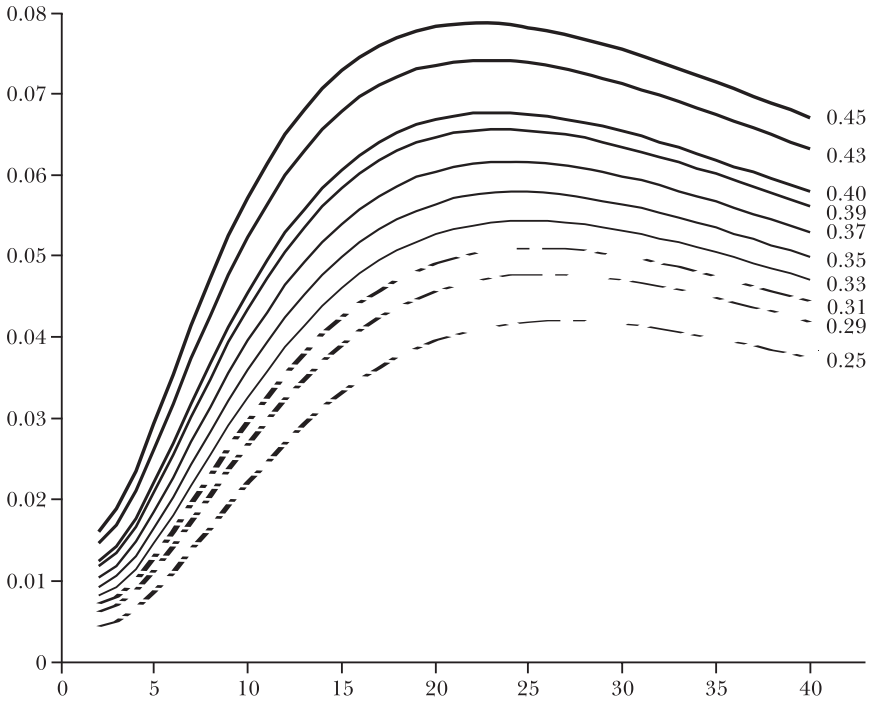
$Remee_2$	ρ_R	σ_{ε^R}	ψ
0.1025	0.8914	0.1782	0.00081

Appendix B

Sensitivity Analysis

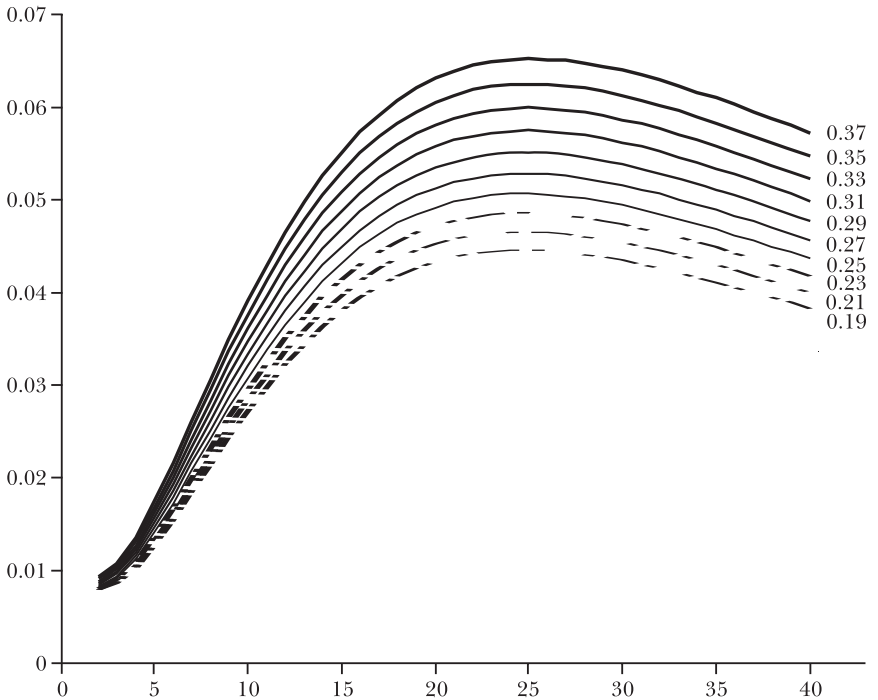
As aforementioned, we take the value of the parameters of the share of each productive input, inside each production function

FIGURE A.1. CHANGES IN THE TRADABLE-CAPITAL SHARE PARAMETER



$\left[\alpha^T, \left(1-\alpha^T\right), \alpha^N, \left(1-\alpha^N\right)\right]$ from the Colombian economy. However, we perform some sensitivity analysis to confirm that our results do not depend on specific values of these parameters. In figure A. 1, we can observe that the ERER shows the same dynamics regardless of how big or small is the share of tradable capital within the production function (it runs from 0.25 to 0.45). The same can be said in regard of the nontradable sector: the dynamics of the ERER are robust to changes in the value of the nontrdable-capital's share parameter as shown on figure A. 2. Nevertheless, we do observe changes in the magnitude of the appreciation, but this is as expected, since the degree in which each sector is capital-intensive or labor-intensive will determine the intensity of the struggle for resources between tradable and nontradable sectors.

FIGURE A.2. CHANGES IN THE NONTRADABLE-CAPITAL SHARE PARAMETER



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Labour market flexibility in small island developing states

I. INTRODUCTION

Increased labour market flexibility has been advocated by some economists (see MacCulloch and Di Tella, 2005) as a means of lowering long-term unemployment. The concept of labour market flexibility is generally derived from general equilibrium theory. In this framework, in a (perfectly) flexible market resources are allocated in a manner where no one individual can be made better off without making some individual worse off (pareto efficiency). To operationalise this concept, Earnets and Masso (2004) recommend that flexibility should be thought of as a process rather than a state: a flexible labour market is one that moves towards the pareto efficient outcome faster than a comparable market. A flexible labour market quickly adjusts to shocks and new demand conditions without producing large amounts of long-term unemployment.

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This definition, which is very broad and has been utilised in many studies in the area (see Lazear, 1990; Layard, Nickell and Jackman, 1991; OECD *Jobs Study*, 1994; Forteza and Rama, 2001) is a theoretical construct. At the operational level, labour market flexibility is commonly associated with the number/intensity of labour market regulations or institutions in place (see Baker, Howell and Schmitt, 2002 for a review of this literature). There is considerable variation in regulation across countries, covering unfair dismissals, restrictions on lay-offs for economic reasons, compulsory severance payments, minimum notice periods and working hours.

Equally, there is considerable, although highly controversial empirical work attesting to the view that fewer regulations, (which is taken as an indicator of greater job market flexibility) lead to better labour market outcomes: lower unemployment and reduced time between being in and out of the employed labour force. Lazear (1990) provides one of the earliest studies in the area. Using legislation on severance pay for 22 countries, the author finds that more restrictive severance pay legislation leads to higher unemployment and greater preference by employers for part-time rather than full-time employees. More recently, MacCulloch and Di Tella (2005), using data from the *World Competitiveness Report,* find large employment effects of labour market flexibility. The authors estimate that if France were to increase the flexibility of its labour market to US levels, the employment rate would increase by 1.6 percentage points.

Unfortunately, due to data (un)availability, very few studies consider developing countries in their analysis. Yet, from developing countries' perspective, an examination of the extent of labour market regulation is especially pertinent given the highly labour-intensive nature of most production and the likely constraint labour market inflexibility can pose to their ability to accelerate their economic growth process. Those studies that do consider developing countries obtain conflicting results. Botero, *et al.* (2004), found an insignificant relationship between regulations and labour market outcomes in developing countries, which they attributed to the lack of labour regulation enforcement. In contrast, Anaya (2002), using data on 13 Latin American countries, found a strong relationship between labour market outcomes and regulations. As a result of high levels of labour market

rigidity in these countries, most adjustment is achieved through changes in real wages rather than levels of employment.

Some work has also been done in the area for Barbados, a small island economy in the Caribbean; the focus has been largely on identifying the extent of labour market flexibility. These previous studies (Downes and ILO, 1999) did not attempt to compare and contrast the intensity of labour market regulations or collective bargaining practices relative to other countries. Such a comparison would allow policymakers to identify problem areas and guide labour legislation changes.

An International Labour Office's (ILO) country employment policy review on Barbados (1999), noted that historically, Barbados had relied more on the collective bargaining process. However, faced with the uncertainties of collective bargaining outcomes and the power of the unions, employers were pressing for a clear regulatory environment. Barbados is one of the few remaining countries in the Commonwealth Caribbean that have not enacted a comprehensive body of legislation aimed at providing intervention instruments, opting instead for a voluntary system governing employers and trade union relations. In Barbados, the state, while not involved in dispute settlement, sets minimum labour standards and ensures their observance. Arising from the structural adjustment programme of the early 1990s, a tripartite agreement, with employers, government and trade unions, was reached called the Prices and Incomes Protocol that initially included a two-year wage freeze. Subsequent Protocols have been negotiated, although without explicit wage guidelines. The objective is to guide prices and incomes in a direction oriented towards the achievement of the country's overall economic policy objectives.

Arguably, collective agreements and social pacts such as those employed in Barbados in recent years make it more difficult and expensive for employers to dismiss workers (ILO, 1999). Downes (1999), through a survey of local establishments, found results that supported this conclusion. Most respondents to the survey cited the high cost of severance pay and the provisions in the local labour legislation on shop assistants as the greatest barriers to increasing employment. Although insightful, the results presented by Downes do not allow one to compare and contrast the intensity of labour market regulations or collective bargaining practices relative to *best practice* countries.

Apart from the employment effect of labour market inflexibility, there are wider implications for developing countries. For these resource-constrained economies, attracting foreign investment is an important part of the overall development strategy and an inflexible labour market can serve as a disincentive to potential investors. This raises the wider issue of how Barbados compares with the rest of the world and is one of the main motivations for this study.

Following the introduction, the paper presents a brief survey of previous techniques used to measure labour market flexibility. Section III presents the methodology used in the study, while Section IV provides the indices of labour market flexibility for Barbados and compares these with those for countries at similar and higher levels of development. Section V concludes with suggestions for improving labour market flexibility in Barbados based on the deficiencies identified in Section IV.

II. PREVIOUS LITERATURE ON MEASURING LABOUR MARKET (IN)FLEXIBILITY

There is no single procedure employed to measure labour market flexibility. Economic researchers have approached the problem of quantifying barriers using three broad approaches: comparative studies of labour market outcomes, econometric models, and indices of the variation in the intensity of constraints.

Some comparative studies examine the differences in worker flows into and out of unemployment, and implicitly exploit the notion of the Beveridge (1945) curve. The Beveridge curve is the (negatively sloped) relation between the vacancy rate (the number of jobs unfilled as a proportion of the labour force) and the unemployment rate. A perfectly flexible labour market would immediately match unfilled jobs with an unemployed worker: vacancies and unemployment would never coexist. Labour market rigidities are then assumed to be those factors that allow vacancies and unemployment to coexist. Studies in this area usually use the United States of America as an approximation of a perfectly flexible market. Using this approach, authors such as Bertola and Rogerson (1997), Blanchard and Wolfers (2000) Ljungqvist and Sargent (2003) propose that the generous unemployment benefits

and high firing costs are behind the relatively higher rate of unemployment in Europe. The advantage of the comparative approach is its simplicity; most of the data required to carry out the analysis can be obtained from national labour market surveys. The main drawback of the approach, however, is that for the analysis to be relevant the two countries must be at relatively similar stages of development, which is a relatively subjective classification.

The econometric approaches generally use the coefficients obtained from a behavioural model of the labour market to derive an index of labour market flexibility. One of the earliest approaches in the literature is that by Layard, Nickell and Jackman (1991) who generated a wage rigidity index as the reciprocal of the response of real wages to unemployment, estimated from a standard wage equation. The framework assumes that in a flexible labour market, wages adjust fully to a shock so that unemployment remains at its natural rate. Therefore, the larger the index, the higher is unemployment. A similar approach is employed by Balmaseda, Dolado and López-Salido (2000) and Anaya (2002), but using different econometric techniques.

The index generated using the Layard, Nickell and Jackman approach, however, depends on union power and other structural parameters of an economy. As a result, cross-country comparisons could be misleading, as two economies with the same labour market rigidity indicator might behave quite differently. As an alternative, Albagli, García, and Restrepo (2003) construct the labour market rigidity index as the number of periods that unemployment takes to decrease to one half of its maximum value. This approach exploits the fact that after a shock, a rigid labour market only slowly returns to its long-run level.

The final broad approach to measuring labour market flexibility requires the researcher to compile information on labour market characteristics and combine the information into indices that can be employed to undertake cross-country comparisons. One of the earliest studies to collect information on cross-country labour market regulations was Lazear (1990). This study focused on two main indicators of labour market flexibility: the number of months of salary given to workers as severance pay upon dismissal after ten years of service and the number of month's notice required before termination to workers with ten years of service.

Subsequent studies have built upon this approach and have added numerous other indicators to obtain a more accurate indicator of labour market flexibility. MacCulloch and Di Tella (2005) use data from the *World Competitiveness Report* on the opinion of top and middle managers regarding the flexibility of enterprises to adjust compensation and employment as economic realities change. A similar approach is employed by Downes (1999) for Barbados. Frenkel and Ros (2003), propose the use of the number of ratified ILO conventions as an indicator of the nominal "thickness" of labour market regulations or the willingness and scope of government intervention in the labour market. Forteza, A. and M. Rama (2001) construct a composite labour market rigidity index based on the ratio of minimum to average wages, mandated benefits, trade union membership and the share of government employment. An international study directed by Alphametrics Ltd. (2001) attempted to construct labour market adaptability indices for all EU member states. The index consisted of indicators of labour supply availability, access to education and training programmes, mobility of labour and the flexibility of working-time arrangements.

The most comprehensive study on labour market regulations is that by Botero, *et al.* (2004). The authors combine information on employment, collective relations and social security laws into indices for 85 countries. The approach has been subsequently incorporated into the World Bank's *Doing Business* (2004) report that provides cross-country indices on the difficulty of hiring, rigidity of hours, difficulty of firing, rigidity of employment and firing costs. This is the methodology employed in this study.

III. RESEARCH METHODOLOGY

Utilising the World Bank doing business approach to investigate the rigidity of employment, we undertook a detailed study of employment laws and regulations, relevant constitutional provisions, as well as industry practice. The latter was necessary because formal legal rules are not fully indicative of what happens in practice, especially where a voluntary system governing employers and trade union relations exists. More specifically, in Barbados, there is a reliance more on the collective bargaining

process, with industry practice playing an important role. In the original World Bank approach, several assumptions were made about business[1] and workers,[2] to ensure comparability across countries. In Barbados, labour market regulation is more generic and so these assumptions are less relevant. Industry practice information is obtained from the Barbados Workers Union and confirmed by the Ministry of labour and other relevant sources.

In the World Bank study, with which country comparisons are made, the data on hiring and firing workers was based on a detailed study of employment laws and regulations, as well as relevant constitutional provisions. Most of the information is taken from the online publication of the International Labour Organization (ILO), the NATLEX database and confirmed through secondary sources including the International Encyclopaedia for Labour Law and Industrial Relations and Social Security Programs throughout the world. Finally, all data are verified and completed by law firms within surveyed countries through a detailed survey on employment regulations.

For Barbados, the data obtained is used to construct an index of employment rigidity and a cost of firing indicator based on the calculation of several sub-indices that represent the different aspects of employment determination. The Rigidity of Employment index is the average of three sub-indices: a Difficulty of Hiring index, a Rigidity of Hours index, and a Difficulty of Firing index. All sub-indices have several components and take values between 0 and 100, with higher values indicating more rigid regulation. These sub-indices are aggregated to give the overall index, with higher values corresponding to greater rigidity of employment across the economy.

[1] The business is a limited liability company; operates in the country's most populous city; is 100 percent domestically owned; operates in the manufacturing sector; has 201 employees, and; abides by every law and regulation, but does not grant workers more benefits than legally mandated.

[2] The worker is a non-executive, full-time male employee who has worked in the same company for 20 years; earns a salary plus benefits equal to the country's average wage during the entire period of his employment; has a nonworking wife and two children and the family resides in the country's most populous city; is a lawful citizen who belongs to the same race and religion as the majority of the country's population, and; is not a member of the labour union, unless membership is mandatory.

The indices are calculated as follows:

1. Rigidity of employment

— The *Difficulty of Hiring* index measures (i) whether term contracts can only be used for temporary tasks; (ii) the maximum duration of term contracts; and (iii) the ratio of the mandated minimum wage (or apprentice wage, if available) to the average value-added per working population. A country is assigned a score of 1 if term contracts can only be used for temporary tasks, and a score of 0 if term contracts can be used for any task. A score of 1 is assigned if the duration of term contracts is 3 years or less; 0.5 if the duration is between 3 and 5 years; and 0 if term contracts can last more than 5 years. Finally, a score of 1 is assigned if the ratio of minimum wage to average value added per worker ratio is higher than 0.75; 0.67 for ratios between 0.50 and 0.75; 0.33 for ratios between 0.25 and 0.50; and a score of 0 if the ratio is below 0.25 (World Bank, 2004).

— The *Rigidity of Hours* index has five components: (i) whether night work is restricted; (ii) whether weekend work is allowed; (iii) whether the workweek consists of five-and-a-half days or more; (iv) whether the workday can extend to 12 hours or more (including overtime); and (v) whether the annual paid vacation days are 21 days or less. If the answer is yes to question (i) and no on any of the other questions, the country is assigned a score of 1, otherwise a score of 0 is assigned (World Bank, 2004).

— The *Difficulty of Firing* index has eight components: (i) whether redundancy is not grounds for dismissal; (ii) whether the employer needs to notify the labour union or the labour ministry for firing one redundant worker; (iii) whether the employer needs to notify the labour union or the labour ministry for group dismissals; (iv) whether the employer needs approval from the labour union or the labour ministry for firing one redundant worker; (v) whether the employer needs approval from the labour union or the labour ministry for group dismissals; (vi) whether the law mandates training or replacement prior to dismissal; (vii) whether priority rules apply for dismissals; and (viii) whether priority rules apply for re-employment. If

the answer to any question is yes, a score of 1 is assigned; otherwise a score of 0 is given. Questions (i) and (iv) have double-weight in the construction of the final index (World Bank, 2004).

2. The cost of firing indicator

— The cost of firing indicator measures the cost of advance notice requirements, and severance payments and penalties due when firing a worker, expressed in terms of weekly wages. This methodology was developed by Juan Botero, Simeon Djankov, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer (2004).

IV. THE FLEXIBILITY OF THE BARBADOS LABOUR MARKET

1. Basic results

The results of the survey for Barbados are shown in Table 1 below.

It should be noted that, in general, industry practice was far more rigid than what was specifically prescribed by law, reflecting the unique social partnership arrangements in Barbados. For example, the overall Rigidity of Employment Index for Barbados was 40 when calculated based on industry practice, compared with just 10 when based on legal provisions. Breaking out this score into its three components – difficulty of hiring, rigidity of hours and difficulty of firing – it is evident that the most restrictive aspect of labour in Barbados is the rigidity of working hours, followed by the difficulty of firing, then the difficulty of hiring.

The relative rigidity of working hours was largely influenced by legislative restrictions on night work (the Shops Act limits night work to 10:00 p.m. unless permission is obtained from the Chief Labour Officer), as well as practical considerations such as the lack of reliable after-hours transportation for workers. A comparatively long workweek, extendable workdays and high overtime premiums, all of which form part of standard industry practice, were also important factors in this outcome. Most of the difficulty of firing workers in Barbados was found to lie in the need

for employers to notify and seek approval from the union or ministry for group dismissals under the Social Partnership Agreement, as well as the existence of priority rules for dismissals and re-employment formulated by collective agreement. On the other hand, hiring workers was found to be relatively simple in Barbados, since the only constraint was the comparatively high wage rate.

TABLE 1. INDICATORS OF LABOUR MARKET FLEXIBILITY

	Industry Practice	*Law*
Rigidity of Employment Index	40	10
Difficulty of Hiring Index	*11*	*11*
Term contracts are only temporary tasks	0	0
Maximum duration of terms contracts	0	0
Ratio of the mandated minimum wage to GNI Per Capita	33	33
Rigidity of Hours Index	*60*	*20*
Night work is restricted	100	100
Weekend work is allowed	0	0
Workweek consists of five-and-a-half days or more	100	0
Workday can be extended to 12 hours or more	100	0
Whether the annual paid vacation days are 21 days or less	0	0
Difficulty of Firing Index	*50*	*0*
Redundancy is not grounds for dismissal	0	0
Employer needs to notify the union or ministry to fire one redundant worker	0	0
Employer needs to notify the union or ministry for group dismissals	100	0
Employer needs approval from the union or ministry to fire one redundant worker	0	0
Employer needs approval from the union or ministry for group dismissals	100	0
The law mandates training or replacement prior to dismissal	0	0
Priority rules apply for dismissals	100	0
Priority rules apply for re-employment	100	0
Cost of Firing Indicators		
Firing Costs (Weeks)	*7.5 weeks*	*7.5 weeks*
Notice for redundant worker	4 weeks	4 weeks
Severance payment required for redundant worker	3.5 weeks	3.5 weeks
Firing Costs (USD)	*USD1,549*	*USD1,549*
Average salary	USD206.5	USD206.5

SOURCE: Survey (2005).

The other indicator used was the cost of firing expressed in terms of the number of weeks of notice and severance pay required for workers to be made redundant. In the original Botero *et al.* (2004) study, the number of weeks thus calculated was multiplied by the average weekly wage in order to give a cost of firing in USA dollars (USD). For Barbados, this cost amounted to USD1,549.00. However, for comparative purposes, the cost in weeks (7.5 weeks) was also used, as this was how the indicator was expressed in the cross-country comparison in the World Bank study.

Overall, these results were broadly consistent with the findings of Downes (1999), which were as follows:

- With regard to terminations, most establishments did not have an established policy for deciding which workers would be terminated first. Over one-third of establishments surveyed wanted to terminate workers but did not, primarily because of the level of severance involved. This would indicate that the severance payment system was a hindrance to operations.
- Current union contracts impact on operating costs and, to a lesser extent, the ability to hire or terminate workers.
- Existing labour laws have little or no effect on employment in establishments. There was a 75 percent incidence of responses indicating no effect, while 31 percent indicated a positive effect. However, the high cost of severance pay and the provisions in the Shops Act were most cited for discouraging establishments from increasing employment.

2. Cross-country comparisons

Generally, labour market flexibility in Barbados was shown to be about average relative to the countries analysed in the World Bank Study, as illustrated in the table below. A comparison of Barbados' scores with world and regional averages, reveals that while the rigidity of employment index is lower than the world average, as well as the averages for Latin America and the Caribbean, Europe and Central and South Asia, it is higher than the averages for the OECD, East Asia and the Pacific and the Middle East and North Africa. Comparing the sub-indices, whereas it appears that in Barbados the hours worked are more rigid and it is

harder to fire workers, hiring new workers appears to be relatively easier than in most other countries and firing costs compare favourably with regional averages.

TABLE 2. REGIONAL COMPARISON OF LABOUR FLEXIBILITY INDICATORS

Region or Economy	*Difficulty of Hiring Index*	*Rigidity of Hours Index*	*Difficulty of Firing Index*	*Rigidity of Employment Index*	*Firing Costs (Days)*
East Asia & Pacific	20	30	22	24	52
Europe & Central Asia	31	51	42	41	38
Latin America & Caribbean	44	53	34	44	70
Middle East & North Africa	22	52	40	38	74
OECD: High income	26	50	26	34	40
South Asia	37	36	53	42	84
Sub-Saharan Africa	53	64	50	56	59
World	35	51	38	42	56
Barbados	*11*	*60*	*50*	*40*	*37*

SOURCES: Survey (2005) and World Bank (2004).

Looking at Barbados' scores against the ten best and ten worst performers in terms of labour market flexibility (Table 3) serves to highlight the relative rigidity of Barbadian employment. Indeed, the rigidity of employment index for Barbados is closer to the scores of the worst performers – who are, without exception, all Sub-Saharan African countries – than those of the best performers.

However, labour market flexibility should not be considered in isolation from an assessment of the economic performance of a country. Given that labour market flexibility is suppose to enhance the attractiveness of a location to investors, leading to higher foreign direct investment (FDI) flows and lower unemployment, it would be useful to observe differences across countries in these variables. In this regard, it is noteworthy that many of the "best performers" have relatively low rates of unemployment. Furthermore, it is expected that the "best performers" would have greater FDI flows relative to the worse performers. Indeed, on average this seems to have been the case with few exceptions. Moreover, the fact that most of the best performers are ranked high with respect to the human development index would

suggest that labour market flexibility can co-exist with adequate living and working conditions, contrary to the expectations of many opponents of labour market flexibility. Indeed many of the worse performers, those with relatively inflexible labour markets, have a low ranking for human development.

TABLE 3. BEST AND WORSE PERFORMERS – LABOUR MARKET FLEXIBILITY

Region or Economy	*Difficulty of Hiring Index*	*Rigidity of Hours Index*	*Difficulty of Firing Index*	*Rigidity of Employment Index*	*Firing Costs (Days)*	*FDI as a Average Growth (1999 – 2003)*	*FDI as a % of GDP (1999 – 2003)*	*Human Development Index Rank*
Palau	0	0	0	0	0	0.4	-	-
Singapore	0	0	0	0	4	3.6	75.3	25
Hong Kong, China	0	0	0	0	13	3.8	82.0	23
United States	0	0	10	3	8	2.8	9.2	8
Malaysia	0	0	10	3	74	5.0	15.5	59
Canada	11	0	0	4	28	3.6	20.6	4
Marshall Islands	22	0	0	7	0	1.2	-	-
Micronesia, Fed. Sts	22	0	0	7	0	1.8	-	-
New Zealand	11	0	10	7	0	3.8	14.7	18
Tonga	0	20	0	7	0	2.8	8.4	63
Uganda	0	20	0	7	12	6.2	14.0	146
Barbados	*11*	*60*	*50*	*40*	*37*	*0.4*	*5.1*	*29*
Angola	44	80	100	75	116	5.9	98.7	166
Burkina Faso	100	100	70	90	80	5.0	2.0	175
Central African Republic	89	80	60	76	37	-0.1	1.9	169
Chad	100	80	60	80	47	6.0	120.5	167
Congo, Dem. Rep.	72	100	60	77	62	-0.9	7.4	168
Congo, Rep.	89	80	90	86	42	3.0	47.4	144
Niger	100	100	70	90	76	2.7	3.4	176
Rwanda	89	80	60	76	54	6.6	1.3	159
Sierra Leone	78	80	70	76	188	2.5	8.1	177

SOURCES: Survey (2005) and World Bank (2004).

Another notable feature of is the high proportion of Small Island Developing States (SIDS) among the front-runners. The following table therefore shows a comparison of Barbados's scores against all of the SIDS that were captured in the World Bank study.

TABLE 4. LABOUR MARKET FLEXIBILITY IN SIDS

Region or Economy	*Difficulty of Hiring Index*	*Rigidity of Hours Index*	*Difficulty of Firing Index*	*Rigidity of Employment Index*	*Firing Costs (Days)*	*Average Growth (1999–2003)*	*FDI as a % of GDP (1999–2003)*	*Human Development Index Rank*
Palau	0	0	0	0	0	0.4	-	-
Marshall Islands	22	0	0	7	0	1.2	-	-
Micronesia, Fed. Sts	22	0	0	7	0	1.8	-	-
Tonga	0	20	0	7	0	2.8	8.4	63
Jamaica	11	20	0	10	12	1.3	7.0	79
Samoa	11	20	0	10	42	4.2	0.1	75
Kiribati	0	0	50	17	46	3.3	-	-
Papua New Guinea	11	20	20	17	38	1.2	3.2	133
Fiji	22	40	0	21	28	3.7	0.5	81
Puerto Rico	22	20	20	21	0	4.5	1.2	-
Solomon Islands	22	20	20	21	52	-4.1	-0.6	124
Vanuatu	22	40	0	21	55	0.0	7.2	129
Haiti	11	40	20	24	26	0.5	0.3	153
Dominican Republic	11	80	30	40	70	4.4	4.7	98
Barbados	*11*	*60*	*50*	*40*	*37*	*0.4*	*5.1*	*29*

SOURCES: Survey (2005) and World Bank (2004).

Again, Barbados' relative inflexibility in every area except firing costs is underlined. Indeed, with the exception of the Dominican Republic, all of the SIDS, particularly those located in East Asia and the Pacific, outperformed Barbados by a significant margin. Yet, surprisingly FDI flows to Barbados are relatively higher than for most of the countries for which data is available. This would indicate that there are other equally important determinants of FDI flows.

Of particular interest also is the comparison between the Barbadian, Jamaican and Haitian scores, given that the three countries are members of CARICOM and are soon to become part of the CARICOM Single Market and Economy, of which free movement of labour (and perhaps eventually full labour market integration) will be a feature. Furthermore, potential investors into the region are likely to consider the relative flexibility of the various labour markets in order to make decisions as to location. Here, the extreme rigidity of working hours in Barbados (60 to Haiti's 40 and Jamaica's 20) and the relative difficulty of firing (50 to Haiti's 20 and Jamaica's 0) place Barbados at a distinct disadvantage. Overall, Haiti and Jamaica recorded rigidity of employment

scores of 26 and 12, respectively, well beneath Barbados' 40. In addition both Haiti and Jamaica have much lower firing costs, at 26 and 12 days, respectively, than Barbados. However, these countries rank below Barbados for human development, and in case of Haiti have negligible FDI flows, perhaps the result of the political instability there.

Also of interest is the comparison of Barbados with the Dominican Republic and Puerto Rico – both Caribbean neighbours – which may be seen as competing for the same investment flows in some respects, for example in the tourism sector. While Barbados and the Dominican Republic have equivalent scores in terms of difficulty of hiring, the Dominican Republic has a much lower difficulty of firing score, whereas Barbados has less rigid working hours. Puerto Rico outperforms Barbados in all areas except the difficulty of hiring index, where Barbados' score was 11, as compared to 22 for Puerto Rico. At the same time, Barbados' FDI as a percentage of GDP is greater than Dominican Republic and Puerto Rico, which also ranked below Barbados in the human development index.

In a more recent World Bank (2005) study, selected labour market flexibility indicators were calculated for a wider selection of CARICOM countries, excluding Barbados. Comparing the results on Barbados with these countries (see Table 5 below), we find that Barbados' employment rigidity score is higher than all of its CARICOM counterparts covered in the survey.

Similarly, Barbados is found to have greater rigidity in working hours, with a score of 60 compared to an average score of 26 for

TABLE 5. LABOUR MARKET FLEXIBILITY IN SELECTED CARICOM COUNTRIES

Region or Economy	*Rigidity of Hours Index*	*Difficulty of Firing Index*	*Rigidity of Employment Index*
Dominica	0	60	37
Grenada	0	60	20
Haiti	40	20	24
Jamaica	20	0	10
St. Kitts and Nevis	0	20	7
St. Lucia	20	30	39
St. Vincent & the Grenadines	0	30	10
Barbados	60	50	40

SOURCE: World Bank (2005).

the group of countries. Dominica and Grenada are the only countries to score above Barbados in any of the three categories, notably the difficulty of firing index.

Overall, our results are broadly consistent with the findings of previous research on labour market flexibility in Barbados and the Caribbean. Barbados was covered in a study by Marquez and Pages (1998), in which they calculated an employment protection index for Latin America and the Caribbean. While, the methodology[3] employed was different and the approach was ordinal, the results showed that Barbados had a relatively low level of job protection when compared to most of the Latin American countries. Furthermore, Barbados ranked above Jamaica as it related to the level of job protection, which is similar to our findings (see Marquez and Pages, 1998).

V. CONCLUSIONS

In summary, it is evident from our earlier review of the literature that there are drawbacks to excessive labour market regulation. The literature points to limited benefits and added costs, with more protective employment laws leading to higher unemployment. With regulation cited among the top concerns of investors, developing countries like Barbados can ill-afford to be disadvantaged by an overly regulated labour market in the race to global competitiveness. This study shows that for Barbados there are areas where some inflexibility exists vis-a-vis the rest of the world. Barbados' relative inflexibility in every area.

Indeed, among its CARICOM counterparts covered in the study, Jamaica and Haiti, Barbados is found to have more extreme rigidity of working hours and relative difficulty of firing. To its credit, Barbados still attracts a greater proportion of FDI flows relative to GDP than Haiti, although less than Jamaica, and ranks above these two countries and the rest of CARICOM with regards

[3] Marquez and Pages (1998) ranked the following components of dependent work regulation: (1) length of probation periods; (2) advance notice periods; (3) the actual cost of dismissing a worker; (4) whether dismissals related to firms' difficulties are likely to be deemed as just or unjust cause for dismissal; and (5) whether reinstating the worker in its job is mandatory once a dismissal is deemed unjust. Simple average are taken across the first four elements.

to the human development. These comparisons would suggest a need to balance incentives, not necessarily having an unregulated labour market, as clearly there are social repercussions of such a position. Indeed, the evidence indicates that labour market flexibility can exist with high human development. Therefore, a balancing of incentives is needed with a view to creating an enabling environment for business activity while protecting and safeguarding employee rights. In this regard, Barbados needs to consider the benefits of greater transparency in the regulatory environment that could arise from a comprehensive approach to labour market regulation. Barbados is one of the few remaining countries in the Commonwealth Caribbean that have not enacted a comprehensive body of legislation. Harmonisation in the context of Caribbean integration and the push by employers in Barbados for a clear regulatory environment, in preference to the uncertainties of collective bargaining outcomes, would indicate an urgent need for such legislation.

Based on the comparative analysis conducted in this study, the rigidity in hours worked and working conditions in Barbados need to be addressed. This position is substantiated in Downes' study (1999). Reducing severance payment, changing working conditions as outlined in the Shops Act, reducing NIS payments and the number of sick leave days and making the workweek more flexible were the recommendations made by the businesses surveyed in this study. Policymakers should consider these recommendations in the context of creating an environment to facilitate economic activity. Indeed, the recently drafted comprehensive employment rights bill suggests that they are cognizant of the need for reforms and less reliance on industry practice.

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The sources of capital flows volatility: empirical evidence for emerging countries

1. INTRODUCTION

Over the last decades, capital flows' volatility has become a major source of concern for policymakers in emerging and developing economies. Indeed, sudden reversals in capital flows originated by abrupt shifts in investors' appetite for risk have all too often triggered financial crises with sometimes devastating consequences for the real economy. Several countries have tried to hedge against that risk through "self-insurance", namely the accumulation of an unprecedented volume of foreign exchange reserves.[1] However,

[1] See IMF (2007a) for a recent and very general description on the process of

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this process has its own risks and is costly both for the reserves accumulators themselves and for the global economy as a whole: large-scale and protracted interventions in foreign exchange markets hamper the adjustment of global imbalances, carry significant sterilization costs and can generate, inter alia, inflationary pressures, unsustainable increases in credit and asset prices and difficulties for the conduct of monetary policy.[2]

In contrast with the ample body of literature which has focused on the determinants of the levels of capital flows, relatively few empirical contributions have tried to identify the factors that shape the volatility of such flows. This may seem surprising given the aforementioned relevance of this topic for policymakers. However, identifying a satisfactory measure for capital flows' volatility has proved to be far from straightforward. Most existing papers have used the standard deviation of capital flows over a rolling window as the measure of capital flows' volatility. However, this measure tends to smooth processes and generates an excessive persistence which, as we shall see, gives an unrealistic picture of the dynamics of capital flows. The aim of this paper is precisely that of uncovering the sources of capital flows' volatility in emerging markets by means of an inferred measure which tries to overcome these problems.

As in Broner and Rigobon (2004), Alfaro et al. (2005) and Neumann et al. (2006), the focus is placed on quantities rather than prices or rates of return. Furthermore, as in Neumann et al. (2006), a dynamic approach is developed through the construction of a time-varying measure of volatility. However, rather than using the standard deviation of capital flows within a predetermined rolling window, we follow Bekaert and Harvey (1997) and compute volatility by means of a GARCH (1,1) analysis applied to each series. With this measure of volatility we construct a panel for a sample of 48 emerging and developing countries for the period 1980 to 2006, and estimate correlations with a relatively broad set of domestic macroeconomic and financial factors, global factors and institutional and geopolitical factors. As opposed to most of the other contributions in this field of research, we clearly

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accumulation of foreign exchange reserves.

[2] See Moharty and Turner (2006) for a more detailed analysis on the domestic implications of the accumulation of foreign exchange reserves.

distinguish between the three main categories of capital flows, namely foreign direct investment (FDI), portfolio flows, and other investment flows.

The following trends stand out in particular. The volatility of the different types of capital flows appears to be shaped by different factors. Global conditions are of particular relevance for portfolio and other investment flows, but not for foreign direct investment. Turning to domestic macroeconomic and financial factors, countries in an intermediate level of economic development and with lesser competition in the banking industry display a higher volatility of FDI flows. As we would expect, the level of development in equity markets is particularly relevant as a determinant of the volatility of portfolio flows. Surprisingly, however, the structure and development of the domestic banking sector contributes little to explain the behaviour of other flows. Countries' institutional framework turns out to be a significant determinant of the volatility of the three types of capital flows.

The remainder of this paper is organized as follows. Section 2 briefly reviews the literature on the determinants of capital flows volatility, with a special focus on the contributions that are relevant to our analysis. Sections 3 and 4 introduce and motivate the data, whereas section 5 introduces the methodology used in our analysis. Section 6 presents and comments the results. Finally, section 7 concludes.

2. LITERATURE OVERVIEW

A number of theoretical contributions have focused on the determinants and consequences of capital flows' volatility. Bachetta and van Wincoop (1998), for instance, show that the presence of incomplete information tends to generate volatility, a problem which is particularly acute during processes of financial liberalization such as the ones undergone recently by most emerging markets. Volatility, however, tends to fall over time as investors gradually gain knowledge about their new investment opportunities. Aghion et al. (2004) develop a dynamic open economy model in which capital flows volatility is higher in countries that open the capital account in the context of an intermediate level of financial development. In turn, Martin and Rey (2007) analyze the

interaction of trade and financial globalization in terms of their potential impact on the risk for liberalizing countries of undergoing a self-fulfilling financial crash. In their model, the volatility of capital flows is higher in countries that have initiated their integration into the global financial system without liberalizing trade. Consequently, in order to fully rip the benefits of globalization, emerging markets should start by opening to international trade.

Turning to the empirical literature, as mentioned above, there are relatively few contributions. Broner and Rigobon (2004) try to explain why capital flows are much more volatile in emerging countries than in advanced economies. Indeed, using a sample of 58 countries, they find that the standard deviations of capital flows to emerging countries were 80% higher than to developed countries during the period 1965-2003. In a first step, they run a series of regressions focusing on the residuals and the explanatory power of fundamentals rather than on independent variables' coefficients. Domestic fundamentals and external factors (international interest rates) turn out to explain relatively little of the differential in the volatility of capital flows to emerging and developed countries. Instead, differences in the persistence of shocks to capital flows and in the likelihood of contagion fares much better in explaining the higher volatility of capital flows to emerging economies. In a second step, they take a more direct approach fitting the unconditional standard deviation of aggregate capital inflows on a number of country characteristics during the period 1990-2003. Volatility appears to fall with higher levels of per capita GDP, institutional quality and financial development.

In a similar fashion, Alfaro et al. (2005) pool data from 122 advanced and emerging economies for the period 1970-2000 and run a series of cross-country regressions. As opposed to Broner and Rigobon (2004), however, they disaggregate capital flows and focus on total equity flows (foreign direct investment and portfolio flows), arguing that debt flows tend to reflect government decision rather than market incentives. In order to measure volatility they divide the standard deviations of inflows of total equity per capita by the mean gross for the sample period.[3] Their results

[3] They experiment with other measures of volatility such as the standard deviation alone or the standard deviation of de-trended inflows. Their analysis

point at the significance of institutional quality and sound macroeconomic policies as negatively correlated determinants of capital flows. Instead, bank credit tends to increase volatility. They recognize, however, that these results do reflect correlation rather than causality.

Neumann et al. (2006) focus on the impact of financial liberalization on the volatility of capital flows. For this purpose, as opposed to previous contributions, they construct a time-varying measure of volatility: the standard deviation of capital flows relative to GDP within a five-year rolling window. They carry out their analysis for FDI, portfolio flows and other debt flows. This specification generates a number of econometric complications resulting mainly from serial correlation, which they tackle through a modification of the Newey-West correction proposed by Bekaert and Harvey (1997) within a Generalized Method of Moments (GMM) framework.[4] Using a 26 countries panel data set of overlapping data for 1973-2000 and the Kaminsky and Schmukler (2003) financial liberalization chronology and index, they evaluate the dynamic evolution of the determinants of capital flows volatility. Financial integration into global markets tends to increase the volatility of FDI in the specific case of emerging economies. Instead, financial liberalization appears to reduce the volatility of other flows in mature economies. Surprisingly, no significant effect is found for portfolio flows neither in emerging nor mature economies.

The September 2007 Global Financial Stability Report (IMF, 2007b) uses a similar approach to assess the domestic determinants of the volatility of capital inflows for the period 1977-2006. Departing from a sample of 56 countries (15 advanced and 41

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shows that de-trending has no effects on the final results. The same does not hold true for the non-normalized version of volatility.

[4] Bekaert and Harvey (1997) focus on the impact of financial liberalization on the volatility of economic growth measured as the standard deviation of growth within a five year rolling window. The use of overlapping observations results in the residuals featuring a moving average. In order to solve this problem they develop a cross-sectional extension to Hansen and Hodrick (1980) and estimate the model using a GMM estimator with pre-determined regressors. They present Monte Carlo evidence on the accuracy of the estimator, which appears to be unbiased, although for significance t-values need to be slightly higher than under a normal distribution.

emerging economies) they regress the standard deviation of each capital inflow computed using a five-year rolling window on a series of indicators of domestic financial markets' depth and liquidity, institutional quality and other macroeconomic measures. Converse to Neumann et al. (2006), however, they do not try to correct for the serial correlation of the errors, although they acknowledge that this problem may be affecting the statistical significance of the coefficients. Financial openness and institutional quality appear to be negatively correlated with the volatility of capital inflows.

Another approach to analyze the volatility of capital flows is to focus on prices or returns rather than quantities, as is done in the aforementioned contributions. Bekaert and Harvey (1997) adopt this approach, and try to assess the determinants of the volatility of stock markets' returns by means of a GARCH model. In a first step they carry out a country-specific analysis on the determinants of stock markets volatility for a sample of 20 countries. Then, they construct a panel in which the independent variable is the implied volatility obtained through the GARCH estimation to assess the cross-sectional determinants of volatility. Their estimation uses a generalized least squares correcting for both groupwise heteroskedasticity and serial correlation. The main conclusion of their paper is that financial liberalization has tended to reduce the volatility of stock market returns.

3. DATA ON CAPITAL FLOWS

In this section we analyze annual data on capital inflows obtained from the IMF's International Financial Statistics (IFS). Our sample period starts in 1980 as prior available data is scarce, and finishes in 2006. As opposed to Broner and Rigobon (2004) and Alfaro et al. (2005), we establish a clear distinction between the various types of capital flows. The literature on the determinants of the levels of capital flows has highlighted differences in the determinants of the various types of investments.[5] Consequently, we

[5] For a more complete review of the literature on the determinants of the various categories of capital flows see Díaz-Cassou et al. (2006) or Goldstein and Razin (2006), which explain formally some empirical facts regarding FDI and portfolio flows, such as the greater volatility of FDI inflows relative to portfolio inflows

would also expect the volatility of each category of flows to be shaped by different determinants, which we try to disentangle in this paper. Therefore, data for foreign direct investment (FDI), portfolio flows (which include bonds, debt and stocks) and other flows (which include mostly cross-border bank lending and derivatives) are collected.[6]

Our sample of countries consists of 48 emerging and less developed economies (see Appendix A for the complete list of countries). The sample selection is mostly based on the availability of information. In fact, our sample is limited to those countries for which information is available for the three types of capital flows for at least 10 out of the 27 years covered in the study. However, we also included other countries that did not meet this standard for considering them relatively important emerging markets and therefore relevant to our analysis (such as Singapore and South Africa). In addition, we included some other African countries (such as Lesotho or Ethiopia) in order to have a more geographically balanced sample.

3.1. Some empirical regularities

As a first step we summarize some basic statistics on the evolution of capital flows. Table 1 shows that capital flows dried up during the debt crisis of the 1980s, and recovered in the 1990s and thereafter. In spite of the growing importance of portfolio flows (on average, such flows increased from 0.2% of GDP in the 1980s to 1% of GDP in the period 2001-2007), FDI has constituted the most important category of capital flows for the countries covered in this analysis, representing about half of total flows throughout our sample period. A preliminary analysis shows important variations and differences in the volatility of the various categories of capital flows. While the volatility of FDI and portfolio flows remain on average at around 0.037 and 0.027, the standard deviation for the category of *other flows* ranges from 0.158 in the 1980s to 0.765 for the period 2001-2007. This points at the stability and resilience of FDI flows even during financial crises, which

[6] Particularly, the IFS series codes analyzed correspond to "Direct investment in reporting economy n.i.e."(78bed); "Equity securities liabilities"(78bmd); "Debt securities liabilities"(78bnd) and "Other investment liabilities"(78bid).

TABLE 1. FLOWS AS PERCENTAGE OF GDP. SUMMARY STATISTICS

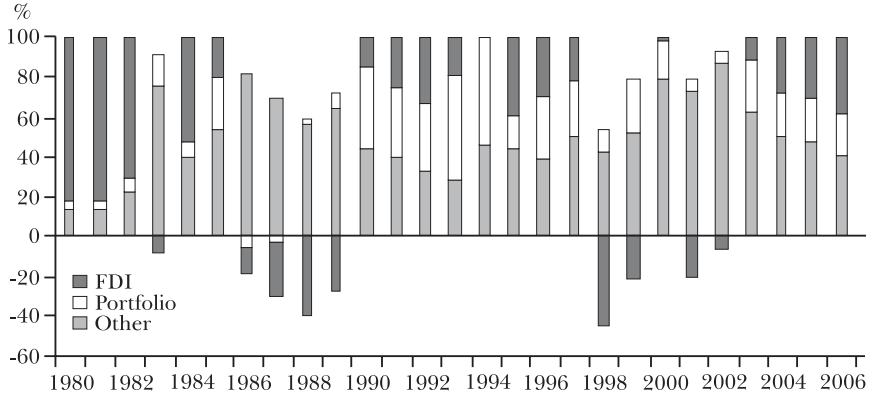
	1980-2007				*1980-1990*				*1991-2000*				*2001-2007*			
Flow type	*Mean*	*SD*	*SK*	*k*	*Mean*	*SD*	*SK*	*k*	*Mean*	*SD*	*SK*	*k*	*Mean*	*SD*	*SK*	*k*
Portfolio	*0.006*	*0.027*	*3.810*[a]	*100.7*[a]	*0.002*	*0.021*	*15.829*[a]	*284.103*[a]	*0.009*	*0.034*	*1.360*[a]	*67.337*[a]	*0.008*	*0.022*	*0.058*	*8.275*[a]
Latin America	0.005	0.033	1.005[a]	91.577[a]	0.003	0.033	10.555[a]	119.541[a]	0.008	0.038	-5.996[a]	62.510[a]	0.002	0.018	-1.425[a]	6.515[a]
Asia	0.007	0.027	8.910[a]	102.303[a]	0.003	0.008	3.605[a]	20.079[a]	0.009	0.041	6.696[a]	52.665[a]	0.01	0.018	1.371[a]	4.989[a]
East Europe	0.008	0.021	0.769[a]	9.113[a]	0.001	0.003	3.916[a]	18.349[a]	0.008	0.02	1.353[a]	7.434[a]	0.014	0.028	-0.260[a]	7.141[a]
Africa	0.003	0.015	4.456[a]	25.329[a]	-0.002	0.001	-3.890[a]	20.049[a]	0.01	0.024	2.700[a]	9.346[a]	0.003	0.011	0.631[a]	5.579[a]
FDI	*0.024*	*0.037*	*3.52*[a]	*21.94*[a]	*0.008*	*0.019*	*4.497*[a]	*26.592*[a]	*0.031*	*0.043*	*3.741*[a]	*22.848*[a]	*0.039*	*0.038*	*2.026*[a]	*8.271*[a]
Latin America	0.02	0.022	1.597[a]	6.155[a]	0.007	0.009	1.920[a]	7.977[a]	0.029	0.025	1.439[a]	5.177[a]	0.032	0.021	0.411[a]	3.884[a]
Asia	0.024	0.042	3.293[a]	18.538[a]	0.014	0.029	2.974[a]	11.511[a]	0.03	0.047	3.565[a]	21.672[a]	0.032	0.048	2.243[a]	7.286[a]
East Europe	0.03	0.032	1.850[a]	9.013[a]	0.0005	0.001	2.969[a]	11.785[a]	0.031	0.026	0.991[a]	3.278	0.048	0.037	2.161[a]	9.755[a]
Africa	0.025	0.059	3.386[a]	14.602[a]	0.003	0.008	2.974[a]	12.954[a]	0.043	0.089	2.228[a]	6.368[a]	0.047	0.043	0.745	2.729
Other	*0.021*	*0.426*	*-2.3*[a]	*213.7*[a]	*0.005*	*0.158*	*-14.403*[a]	*249.085*[a]	*0.032*	*0.331*	*4.719*[a]	*69.767*[a]	*0.027*	*0.765*	*-2.448*[a]	*90.204*[a]
Latin America	0.024	0.75	-1.364[a]	70.387[a]	-0.029	0.247	-9.632[a]	105.407[a]	0.074	0.598	2.573[a]	21.698[a]	0.042	1.464	-1.325[a]	25.101[a]
Asia	0.019	0.082	-4.598[a]	56.908[a]	0.034	0.043	1.970[a]	9.752[a]	0.009	0.11	-4.725	40.814[a]	0.008	0.069	1.131[a]	12.759[a]
East Europe	0.024	0.05	0.043[a]	6.044[a]	0.0021	0.051	-0.456	5.378[a]	0.022	0.046	-0.416[a]	6.523[a]	0.044	0.05	1.084[a]	5.044[a]
Africa	0.016	0.035	0.856[a]	3.361	0.03	0.039	0.714[a]	2.424	0.012	0.028	0.438	2.215	-0.008	0.022	-0.07	2.468
Total	*0.053*	*0.121*	*-12.5*[a]	*290.5*[a]	*0.016*	*0.157*	*-14.618*[a]	*259.143*[a]	*0.07*	*0.09*	*-2.337*[a]	*31.888*[a]	*0.073*	*0.091*	*1.337*[a]	*9.532*[a]
Latin America	0.014	0.173	-13.120[a]	208.001[a]	-0.011	0.244	-10.362[a]	116.617[a]	0.033	0.086	-3.078[a]	13.811[a]	0.035	0.065	-2.632[a]	14.551[a]
Asia	0.05	0.098	-0.440[a]	28.179[a]	0.052	0.063	2.378[a]	10.230[a]	0.047	0.116	-2.135[a]	29.975[a]	0.05	0.117	2.396[a]	9.399[a]
East Europe	0.064	0.074	0.374[a]	4.098[a]	0.003	0.052	-0.477	5.184[a]	0.063	0.063	0.154	4.500[a]	0.108	0.074	0.52	3.482
Africa	0.031	0.04	0.657[a]	2.917	0.033	0.045	0.812[a]	2.568	0.03	0.037	0.25	2.587	0.026	0.029	-0.651	2.558

SOURCE: IFS and own calculations.
[a] Significant at 5%; SK: Skewness; k: Kurtosis.

is in line with Lipsey (2001) or Sarno and Taylor (1999). Furthermore, from 1990 onwards the standard deviation of FDI is slightly larger that the corresponding standard deviation of portfolio flows, reinforcing the result of Goldstein and Razin (2006). Finally, total capital flows on GDP exhibit excess skewness and kurtosis with respect to the normal distribution, illustrating the possibility of nonlinearities in the series under study.

Figure 1 shows the changing composition of net capital flows throughout our sample period. Consistent with the above, the largest swings in this composition are observed for net other investment flows, which registered negative values during the second half of the 1980s as a result of the debt crisis, and at the turn of the century during the wave of emerging markets' crises. These swings were particularly pronounced in Latin America and Europe during the 1980s and in Latin America and Asia during the late 1990s and early 2000s. Probably as a result of the opening up of the capital accounts, portfolio flows became an important source of finance during the 1990s. This trend was especially clear in the Latin American and African countries of our sample. Net portfolio flows, however, quickly turned negative or insignificant in periods of financial turbulence such as the 1980s or during more recent crises. FDI, in turn, displays a more stable pattern. Its relative weight in total net capital flows has tended to increase precisely during turbulent phases, as other sources of finance dried up.

FIGURE 1. NET CAPITAL FLOWS BY TYPE OF FLOW. FULL SAMPLE, 1980-2006



SOURCE: IFS.

TABLE 2. SUMMARY STATISTICS FOR THE VOLATILITY OF FDI, PORTFOLIO AND OTHER INVESTMENT FLOWS

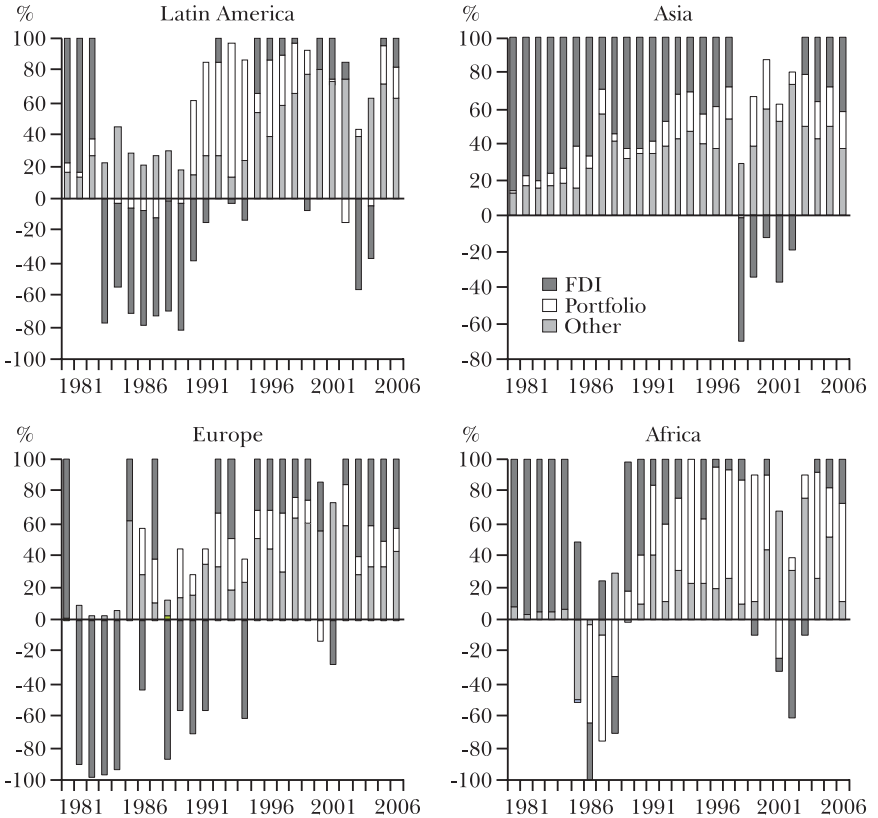
		FDI					*Portfolio*					*Other flows*				
		Latin America	*Asia*	*Europe*	*Africa*	*Total*	*Latin America*	*Asia*	*Europe*	*Africa*	*Total*	*Latin America*	*Asia*	*Europe*	*Africa*	*Total*
1980-2005	mean	0.0121	0,0136	0.0179	0.0262	0.0151	0.0252	0.0147	0.0223	0.0136	0.0199	0.1994	0.0340	0.0426	0.0188	0.0874
	sd	0.0071	0.0204	0.0140	0.0294	0.0171	0.0370	0.0207	0.0153	0.0108	0.0265	0.6909	0.0474	0.0362	0.0112	0.4006
	obs	298	292	196	73	859	214	242	152	34	642	323	334	227	119	1,003
1980-1989	mean	0.0087	0.0088	0.0018	0.0178	0.0091	0.0123	0.0123	0.0096	0.0093	0.0122	0.1347	0.0311	0.0400	0.0247	0.0711
	sd	0.0048	0.0113	0.0010	0.0291	0.0116	0.0205	0.0128	0.0010	0.0010	0.0163	0.3306	0.0374	0.0188	0.0155	0.2117
	obs	110	97	15	19	241	65	74	4	5	148	130	123	42	44	339
1991-1999	mean	0.0140	0.0160	0.0167	0.0269	0.0165	0.0376	0.0154	0.0234	0.0154	0.0244	0.2200	0.0371	0.0517	0.0166	0.0933
	sd	0.0082	0.0240	0.0114	0.0302	0.0181	0.0487	0.0245	0.0143	0.0129	0.0331	0.6356	0.0557	0.0458	0.0056	0.3586
	obs	110	129	111	34	399	94	108	83	19	304	130	140	115	50	435
2001-2005	mean	0.0144	0.0157	0.0231	0.0331	0.0193	0.0195	0.0162	0.0218	0.0124	0.0189	0.2905	0.0329	0.0293	0.0129	0.1005
	sd	0.0057	0.0222	0.0161	0.0279	0.0184	0.0184	0.0212	0.0167	0.0088	0.0185	1.1801	0.0452	0.0173	0.0040	0.6271
	obs	63	66	70	20	219	55	60	65	10	190	63	71	70	25	229

SOURCE: IFS and own calculations.

Table 2 presents some basic statistics on the volatility of foreign direct investment, portfolio flows and other flows. The mean values suggest that throughout the complete sample period, other investment flows displayed the highest level of volatility, followed by portfolio flows and FDI in this order. In addition, volatility has tended to increase over time both for foreign direct investment and other flows. Portfolio flows, instead, appear to have been more volatile during the 1990s than during the first half of the present decade, again, probably as a result of the recent phase of stability in emerging markets.

When comparing across regions, we observe that Latin America has displayed the highest levels of volatility for other investment and portfolio flows, followed by Asia, Europe and Africa in this order. Surprisingly, however, when it comes to foreign direct

FIGURE 2. NET CAPITAL FLOWS BY TYPE OF FLOW AND REGION, 1980-2006



investment, Latin America turns out to be the least volatile region, as opposed to Africa which displays the highest level of volatility. As regards temporal patterns, it is worth noting that all of the aforementioned increase in the volatility of other flows observed after year 2000 is explained by Latin America alone. In fact, during those years the volatility of other flows decreased in the other three regions. This divergence may be due to the effects of the Argentine crisis. Turning to the evolution of the volatility of FDI and portfolio flows, Asia constitutes an exception given that, as opposed to the other regions, the former slightly fell after year 2000 while the latter increased.

The standard deviation gives us an idea of the dispersion of volatility across years and countries. Again, this dispersion has been greater for other flows, followed by portfolio flows and FDI. It has also tended to increase over time, with the exception of portfolio flows, for which the highest dispersion is observed during the 1990s. When comparing across regions, the highest dispersion in the volatility of FDI is observed for Africa, followed by Asia, Europe and Latin America in this order. This pattern is reversed for portfolio flows and other investments, for which Latin America and Asia appear to be the least homogeneous regions in terms of volatility, while Africa displays the lowest levels of dispersion.

3.2. How to measure the volatility of capital flows?

Measuring capital flows' volatility is not straightforward. The existing literature has relied primarily on the standard deviation of capital flows to GDP over an overlapping window.[7] If capital inflows' volatility for country i in period t is denoted as vol_{it}, the standard deviation measure of volatility can be expressed as:

$$vol_{it} = \left(\frac{1}{4} \sum_{j=t-3}^{t} (flow_{ij} - \mu)^2 \right)^{\frac{1}{2}} \quad (1)$$

where $flow_{ij}$ is the level of capital inflows in country i at time j, and:

[7] Neumann et al. (2006) and IMF (2007b) use a five-year window. Alternative measures are based on the standard deviation around a simple time trend or a forecasted trend.

$$\mu = \frac{1}{4} \sum_{j=t-3}^{t} flow_{ij}$$

This methodology for measuring capital flows' volatility is subject to various drawbacks. First, it entails the loss of the first three or four observations depending on the window's length. Second, given that the dynamics of vol_{it} strongly depend on the three previous periods, it may generate problems of endogeneity and serial correlation, which may result in non-robust estimates. Third, the computation of vol_{it} assigns the same weight to $flow_{ij\text{-}1}$ and $flow_{ij\text{-}3}$ which gives an unrealistic measure of persistence in the dynamics of capital flows and tends to generate smooth processes, creating difficulties for the estimation procedure. As a result, the volatility of capital flows tends to be under-estimated in the years in which a shock takes place, and over-estimated thereafter. This problem is especially acute when working with annual data.

In order to overcome these drawbacks, we fit a standard GARCH (1,1) model to a stationary transformation of $flow_{it}$ for all countries.[8] The use of this measure of capital flows' volatility is in line with Bekaert and Harvey (1997), which applies it to an analysis on the volatility of emerging equity markets' returns. The transformation that we apply in order to obtain a stationary series with no dynamics in the mean process is the regular difference, that is $\Delta flow_{it}=flow_{it}-flow_{it\text{-}1}$.[9] If we denote $y_t=\Delta flow_{it}$, the GARCH (1,1) process, as originally proposed by Bollerslev (1989), is defined as:

$$y_t = y_t^* \sigma_t$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 y_{t-1}^2 + \alpha_2 \sigma_{t-1} \qquad (2)$$

where y_t^* is a Gaussian white noise process and σ_t^2 is the corresponding conditional variance, and parameters α_0, α_1 and α_2 satisfy

[8] Although our paper focuses on this alternative measure of volatility, we check the robustness of our empirical results with those obtained using a rolling window, which are available upon request. Given that the choice of the window's length is fundamentally an arbitrary decision, we use a four-years window in order to have more observations at our disposal. Comfortingly most results were similar for both measures.

[9] In order to get the stationary process previous to the computation of the volatility of capital flows we have also tried alternative measures, as the arithmetic return and the logarithmic return, but the existence of negative observations of capital inflows on total GDP makes those measures unfeasible.

the usual conditions to guarantee the positivity and stationarity of σ_t^2.[10]

4. SCOPE OF THE ANALYSIS: VOLATILITY DETERMINANTS

Most of the existing empirical literature on the determinants of capital flows' volatility has focused on a relatively narrow set of variables mostly related with countries' domestic macroeconomic conditions. We try to expand this approach by exploring the impact of a larger set of factors and contrasting our results with those of previous studies. These factors can be grouped in four broad categories: domestic factors, global factors, legal and institutional and geopolitical factors. See Appendix B for a detailed summary of all explanatory variables and their corresponding sources.

4.1. Domestic factors

A greater availability of financial data has allowed for a broadening of the traditional focus on macroeconomic factors as determinants of the behaviour of capital flows. We reflect this pattern by clearly distinguishing between domestic macroeconomic and financial variables.

The macroeconomy

We include the following macroeconomic variables in our analysis: per capita GDP in levels and rates of growth in order to reflect both the level of economic development and dynamism of our sample countries; inflation and public deficits to reflect the "quality" of macroeconomic policies; the stock of foreign exchange reserves in months of imports as a measure of vulnerability to a balance of payment crisis; and trade openness as a reflection of countries' level of integration into global goods markets.

[10] In some cases GARCH (1,1) estimates do not converge due to the lack of data as estimation is performed with the annual dataset. In those cases estimation is performed in a quarterly basis and then volatility estimates are transformed to an annual basis. Results of the GARCH(1,1) estimates are available upon request.

A priori, the relationship between the level of economic development (per capita GDP) and capital flows' volatility is not straightforward. Less developed countries are likely to display low levels of volatility, given that they rely primarily on official flows. Low levels of volatility could also be expected from more advanced economies, given that these countries tend to be characterized by a more stable macroeconomic and institutional outlook. Consequently, we would expect the relationship between per capita GDP and capital flows' volatility to be non-linear. Broner and Rigobon (2004), however, find per capita GDP to be negatively associated with the volatility of total capital flows.

As regards the measures that portray the quality of macroeconomic policies, we would expect capital flows to be more volatile in countries with higher inflation rates and public deficits. Indeed, the former tends to reflect erratic monetary conditions, while the latter increases the probability of undergoing a debt crisis. This is consistent with Alfaro et al. (2005), which find a significant correlation between inflation volatility and capital flows volatility.

The stock of foreign exchange reserves in months of imports may have an impact on the volatility of capital flows through various channels. On the one hand, countries with a low level of reserves are more prone to suffering self-fulfilling runs and, therefore, should display more volatile capital flows. On the other hand, however, higher volumes of foreign exchange reserves may precisely be reflecting countries' need to self-insure against sudden stops. Consequently, and given that we are capturing correlations rather than causality, countries with high volumes of reserves may also display capital flows' volatility. In addition, the stock of foreign exchange reserves can give us an idea on countries' level of interventionism in currency markets. The relationship between interventionist practices in currency markets and capital flows' volatility is, however, ambiguous and goes beyond the scope of this paper.

The relationship between trade openness and capital flows' volatility is not straightforward. As mentioned above, Martin and Rey (2007) have developed a theoretical model in which emerging countries are better off if they liberalize the current account prior to the capital account. If this holds true, we should expect trade openness to be negatively correlated with

the volatility of capital flows. On the other hand, those countries that rely more heavily on international trade may also be more vulnerable to changes in global conditions, especially if their export base is narrow, as is the case in many of the commodities' exporters included in our sample. In this context, if foreign investment is directed mainly to the export sectors of these economies, trade openness may be correlated with a higher capital flows' volatility.

Previous studies have focused on the following macroeconomic variables: per capita GDP or its standard deviation (Broner and Rigobon (2004); Neumann et al., 2006), growth expectations (IMF, 2007b); inflation volatility (Alfaro et al., 2005) and exchange rate volatility (Bekaert and Harvey, 1997). We therefore add three factors to this list: foreign exchange reserves in months of imports, public deficit and trade openness.

Financial factors

We include various measures to capture the main features of our sample countries' financial systems. A first set of factors focus on the domestic banking systems: the ratios of commercial banks' assets and private credit to GDP, financial system's deposits to GDP, and interest rate spreads (the gap between the interest rates paid on deposits and on loans). Higher asset, credit and deposit ratios should portray more developed domestic banking systems. However, it is also true that high levels of domestic credit could signal episodes of over-heating which could be expected to increase volatility. In turn, lower interest rate spreads should reflect tighter and more competitive systems. A second set of factors focus on equity markets: the ratio of stock market capitalization to GDP, and the stock market turnover ratio. Again, a higher value for both indicators should indicate more developed and liquid financial markets.

The relationship between the level of development of domestic financial systems and capital flows' volatility is ambiguous. Indeed, as mentioned above, Aghion et al. (2004) point at a non-linear relationship between those two variables: according to their model, economies at an intermediate stage of financial development display a higher volatility. From an empirical perspective, however, Broner and Rigobon (2004) and IMF (2007b) do find a

negative correlation between domestic financial development and capital flows' volatility.

A number of financial factors used in our analysis are shared with previous contributions. Indeed both Broner and Rigobon (2004) use variables that capture the size of banks' domestic credit, while both the IMF (2007b) and Bekaert and Harvey (1997) use measures of equity markets' turnover and capitalization. The main novelties are the comparison between both types of factors and the inclusion of a variable representing the degree of competition within the banking industry.

4.2. Global factors

We use two sets of global factors. In the first one we include both the rate of growth of world GDP and a measure of global liquidity[11] and, in the second, we portray conditions in the USA economy, including inflation, the 3-months T-bill rate and the value of the Standard & Poor's stock exchange index. Most of these variables have been identified by the relevant literature as push determinants of the levels of capital flows in one or the other direction. However, their relationship with capital flows volatility is far less obvious. This is so because global factors altering investors' risk aversion in one or the other direction tends to generate capital flows' volatility. For instance, a decrease in world GDP growth and global liquidity or a rise in the USA T-bills rate are likely to spark a flight to quality, while the opposite should hold true for a movement of these variables in the other direction. The response of capital flows' volatility to these global factors is, therefore, ambiguous.

Surprisingly, global factors have received little attention in previous studies on the determinants of capital flows' volatility. Indeed, neither Broner and Rigobon (2004), Alfaro et al. (2005) nor Bekaert and Harvey (1997) include global measures in their analysis. Instead, Neumann et al. (2006) use world interest rates and industrial production growth as control variables, while the IMF (2007b) includes a measure of global liquidity and real interest rate

[11] Global liquidity is measured as an index representing developments of a GDP-weighted sum of M2 measures for more than 50 countries. See Erce (2006) for details.

spreads as a proxy for relative liquidity conditions and risk premia.

4.3. Institutional and geopolitical factors

Most of the existing literature has included institutional factors in the analysis. On top of the usual institutional variables, we include a series of geopolitical variables that may be of relevance to explain the behaviour of international capital flows.

Institutional factors

We include the following variables to capture our sample countries' institutional and legal features: an average of the Freedom House country scores on economic and political liberties, the mean value of the International Country Risk Guide ratings for "corruption", "law and order" and "bureaucracy quality", and a series of dummies capturing the legal system's origin (English or French). In principle, we expect capital flows to be more volatile in countries with lesser levels of institutional quality. This would be consistent with Broner and Rigobon (2004), Alfaro et al. (2005), the IMF (2007b) and Bekaert and Harvey (1997). The link between capital flows' volatility and the origin of the legal system is unclear. Alfaro et al. (2005) find this variable to be non-significant as a determinant of volatility.

Geopolitical factors

Drawing from Reynaud and Vauday (2007), we include a number of geopolitical factors in our regressions: a variable which adds up the volume of oil and gas reserves and the length of pipelines and a variable capturing the countries nuclear capacity for both civil and military purposes. In addition, we include our sample countries' IMF quotas. Although geopolitical considerations have gained weight as determinants of the allocation of international capital flows after the attacks of September 11, no previous studies have assessed their impact on the volatility of capital flows.

5. EMPIRICAL MODEL

As mentioned above, the first empirical contributions in this field

of research (Alfaro et al. (2005) and Broner and Rigobon (2004)) were cross-sectional studies performing OLS regressions with corrections for the standard errors. More recent studies such as Neumann et al. (2006) performed a dynamic panel data analysis of volatility with a two-step GMM estimator accounting for serial correlation. In a similar fashion, the IMF (2007b) presents estimates obtained by GMM. This framework, which allows for cross-section fixed effects with a 2SLS instrument weighting matrix, uses lags of the independent variables as instruments. On the other hand, Bekaert and Harvey (1997) fit a GARCH model to measure volatility. Then, they employ both pooled-OLS and fixed effects (FE) estimators. In their more sophisticated specifications, Generalized Least Squares (GLS) are used, as they allow to correct for group-wise heteroskedasticity and serial correlation.

The estimation approach in this paper is very similar to that on Bekaert and Harvey (1997). Once we obtain our dynamic volatility measure after estimating a GARCH (1,1) model for all countries and types of capital flows, we use it to construct a panel dataset, within which we analyze the different types of factors have in explaining the observed patterns on volatility. The estimated equation is presented below:

$$\sigma_{it} = \Gamma X_{it} + \varepsilon_{it} \tag{3}$$

In the estimation we included fixed country effects. This, in terms of the model above implies that:

$$\varepsilon_{it} = \eta_i + \omega_{it} \tag{4}$$

where η_i represents the fixed effect, and ω_{it} is an error term that as explained below can serially and spatially correlated. The matrix X contains the various sets of factors aimed at explaining cross country differences.

As already mentioned, most previous dynamic studies on the sources of volatility have tried to overcome the problems posed by the existence of serially correlated errors. Both, in GARCH-based and rolling window-based models, methods to calculate our dependent variables imply that the residuals will have a moving average component, that is $\text{Cov}(\omega_{it}, \omega_{it-k}) \neq 0$ for some $k \neq 0$. That is why a correction on the standard errors is required.

There can be, however, an additional econometric problem. A

priori it seems very plausible that, due for instance to contagion effects, the residuals can suffer from spatial (cross-sectional) correlation, $\text{Cov}(\omega_{it}, \omega\_\{_{jt}\}) \neq 0$ for some $j \neq k$, which would again bias the estimated standard errors. Using the Pesaran's (2004) CD test, we tested for this hypothesis and analyzed the errors obtained from standard fixed effects estimation. The results showed that, indeed, the errors are spatially correlated and, therefore, that a correction is required.[12]

To cope with both drawbacks we used the Driscoll and Kraay's (1998) correction for the covariance matrix estimator, which handles not only the usual serial correlation and heteroskedasticity problems, but also spatially correlated errors.[13]

Finally, all estimations were performed using lagged variables for the explanatory variables, so as to minimize the possibility of suffering problems of endogeneity and matching the estimator requirement of exogeneity.[14]

6. RESULTS

For the sake of robustness, we performed a number of estimations using the aforementioned categories of explanatory variables. The analysis for each type of flow begins with regressions in which each group of factors is included individually. Subsequent estimations combine different groups of factors. The variables representing institutional and geopolitical factors are grouped together because, when combined individually with the other types of factors, the number of observations available for analysis falls dramatically.

6.1. Foreign direct investment

Results for the analysis of FDI flows' volatility are collected in Table 3. Columns 1, 2, 3, 4 and 9 present estimates for each

[12] Results for these tests are not presented on the text.

[13] Estimations were performed allowing the correction for serial correlation of fourth order. This was done to be able to compare directly the estimations obtained using the rolling window and those obtained after fitting a GARCH (1,1).

[14] The Appendix C contains a more detailed description of Driscoll's and Kraay's (1998) correction.

group of factors when introduced individually. Not surprisingly all types of factors seem to have a close relation with the observed pattern of FDI volatility. However, this significance is substantially altered when the different categories of factors are combined (columns 5, 6, 7 and 8). As in Aghion et al. (2004), and contrary to Neumann et al. (2006) and to IMF (2007b) which find no significant correlation, we find evidence of a significant non-linear relation between economic development, as measured by the GDP pc, and the volatility of FDI flows. This "inverted-U" relation indicates that volatility tends to be higher in countries where GDP pc is around the average of our sample. There is also a consistent and positive relation between "self-insurance", as measured by reserves in months of imports, and volatility. This may be indicating that countries do in some sense self select, and that it is in regions where volatility tends to be higher where we observe a larger level of self-protection against outflows. The coefficients associated with trade openness and inflation are less robust. In the individual analysis (column 1) only the first appears to be significant. However, when we look at more complete analyses (columns 5 to 8) this result is reversed and only inflation seems to be related to the observed pattern of volatility, surprisingly with a negative sign.

Only two of our financial indicators seem to have a robust relation with the observed patters of volatility. These are private credit and the interest rate spread. Both come out as being positively related to the volatility of FDI. The first result may be indicating that large volume of private credit is somewhat associated with phases of overheating and, therefore, with a higher volatility. On the other hand, the positive coefficient of the spread variable could be indicating that less competitive banking sectors are associated with larger swings in FDI flows. Interestingly, and in line with results on IMF (2007b), there is no consistent relation between stock market development and the volatility of this kind of flows.

As can be seen when comparing column 4 to columns 7 and 8, global factors seem to have no significant role in shaping the volatility of FDI flows. Although the estimation that uses only this type of factors suggests that they matter, once we account for domestic conditions this role evaporates. This contrasts with the finding in Neumann et al. (2006), where a negative correlation between USA

TABLE 3. FDI

	Macro (1)	*Financial* (2)	*Financial* (3)	*Global* (4)	*M-F* (5)	*M-F* (6)	*M-G* (7)	*M-F-G* (8)	*Institutional Geopolitical* (9)
GDP pc	2.6E-06				3.7E-06	4.8E-06	4.5E-06	6.1E-06	
	(2.2)[b]				(3.33)[c]	(2.61)[b]	(2.95)[c]	(3.61)[c]	
Squared (GDP pc)	-1.3E-10				-2.2E-10	-3.1E-10	-3.0E-10	-2.8E-10	
	(1.66)				(3.61)[c]	(2.99)[c]	(3.25)[c]	(3.36)[c]	
GDP pc growth	4.2E-05				1.4E-04	4.7E-05	7.5E-05	3.4E-07	
	(1.25)				(3.57)[c]	(0.45)	(0.86)	(0.01)	
Inflation	1.1E-07				-7.2E-07	-9.5E-06	1.6E-07	1.3E-06	
	(0.31)				(2.16)[b]	(2.77)[c]	(0.41)	(2.18)[b]	
Trade openess	5.0E-05				1.6E-05	-4.8E-05	5.2E-05	7.1E-05	
	(2.12)[b]				(0.50)	(1.32)	(1.32)	(1.62)	
Reserves to imports	9.1E-04				7.8E-04	5.5E-04	2.3E-04	6.9E-04	
	(7.44)[c]				(2.30)[b]	(1.75)[a]	(1.03)	(1.76)[a]	
Public deficit	-0.00608								
	(0.55)								
DMB Assets/GDP		-0.0103	-0.032		0.0059	0.0069		0.0040	
		(2.13)[b]	(1.76)[a]		(0.89)	(0.46)		(0.45)	
Private credit (DMB)/GDP		0.0354	0.0425		0.0091	0.0088		0.0150	
		(2.85)[c]	(2.76)[c]		(1.25)	(0.76)		(1.96)[a]	
FSD/GDP		-0.022	-0.0248		-0.0099	-0.0109		-0.0300	
		(1.26)	(2.23)[b]		(0.89)	(1.22)		(2.53)[b]	
Interest rate spread		4.3E-06	5.7E-06		1.0E-05	3.7E-05		1.1E-05	
		(2.53)[b]	(2.87)[c]		(3.30)[c]	(3.70)[c]		(2.36)[b]	
SMC/GDP			0.0238			8.77E-04			
			(4.59)[c]			(0.14)			
Squared (SMC/GDP)			-0.009			0.001			
			(6.04)[c]			(0.52)[c]			
Stock market turnover ratio			0.001						
			(0.63)						

USA 3 month T-Bill				1.2E-04			6.5E-06	2.5E-04	
				(0.43)			(0.03)	(0.65)	
S&P index				-2.6E-06			4.9E-07	-1.2E-06	
				(6.31)[c]			(0.61)	(1.08)	
USA inflation rate				6.0E-04			-2.8E-04	-1.3E-04	
				(2.73)[c]			(0.86)	(0.27)	
World GDP growth				8.0E-04			4.2E-04	7.5E-04	
				(2.73)[c]			(1.10)	(1.97)[a]	
Global liquidity				5.5E-05			-1.7E-05	-7.4E-06	
				(2.46)[b]			(0.60)	(0.17)	
Economic-political stability									-0.002
									(5.72)[c]
Quality of governance									0.077
									(0.82)
English legal origin									-0.010
									(5.38)[c]
French legal origin									-0.007
									(5.11)[c]
Pipelines (oil and gas)									-9.7E-08
									(3.06)[c]
Reserves (oil and gas)									4.9E-05
									(5.07)[c]
Nuclear power									1.8E-07
									(1.19)
IMF quota									-8.8E-10
									(1.97)[a]
Constant	0.00195	0.0197	0.0211	0.0118	0.0047	0.0047	0.0065	0.0032	0.0230
	(0.86)	(5.65)[c]	(7.69)[c]	(3.65)[c]	(2.12)[b]	(0.91)	(1.53)	(0.58)	(5.95)[c]
Observations	618	497	338	523	458	325	456	340	184
Number of groups	43	38	32	45	38	32	44	37	32

NOTES: t statistics in parenthesis; SMC: Stock market capitalization; FSD: Financial system deposits; DMB: Deposit money bank.
[a] Significant at 10%. [b] Significant at 5%. [c] Significant at 1%.

short term interest rate and FDI volatility is found, and with the IMF (2007b) which finds that, for total inflows, there is a negative relation between volatility and global liquidity. In our case this relation is found to be, at best, positive.

Finally, as regards the role of institutional and geopolitical factors, our results (presented in column 9) suggest the existence of a consistent and significant correlation between better developed institutional frameworks and FDI volatility. In line with the estimates in IMF (2007b) the coefficient on the quality of governance is found not to be significant. Additionally, it seems that countries whose legal origin is either English or French display a lower level of volatility. Among the geopolitical factors, results point to more stable flows of FDI in the countries that have a better developed structure to channel natural resources. It also appears that larger reserves of gas and oil are associated with a higher volatility.

6.2. Portfolio investment

Table 4 presents the results for the analysis on the volatility of portfolio flows. Domestic inflation, GDP pc, its growth rate and trade openness are the domestic macroeconomic factors which appear to have a closer relation to the observed patterns of volatility. While inflation can be associated with increased uncertainty and, hence, a higher volatility, the coefficients of GDP pc and GDP pc growth seem to reflect the fact that more developed economies have more stable flows, and that dynamic economies tend to experience more volatile portfolio flows. Finally, results indicate that the countries that are more open to trade tend to display lesser levels of portfolio flows volatility. These relations are, however, not very robust given that in other specifications they turn out to be insignificant (see columns 5 to 8 in Table 6). Only GDP pc growth and trade openness appear to be robustly related with volatility, as seen in the broader regression presented in column 8.

As shown in columns 2, 3, 5, 6 and 8, our results point at a very significant role of the domestic financial sector in shaping the volatility of portfolio flows. Similarly to our results for FDI, while a sounder banking sector (as measured by its level of assets) is significantly associated with less volatile portfolio flows, the less

competitive it is, the higher the volatility (see coefficients associated with the interest rate spread). We find somewhat surprising that both domestic credit and financial system deposits are associated with higher levels of volatility. A possible explanation may be that countries that have a bank-oriented funding rate are likely to experience more volatile portfolio flows as they rely less on stock market financing. Interestingly, and consistent with the view presented in Aghion et al. (2004), portfolio flows volatility has a nonlinear relation with the development of stock markets. While relatively small stock markets seem to go hand in hand with larger volatility, as the stock market develops (grows in size) it is associated with more stable portfolio flows.

Global factors are also strongly correlated with the volatility of portfolio flows. As shown in the fourth column, a strong performance in the USA economy, as measured by interest rate increases and growth of the S&P index, is associated with lower levels of volatility. This may be due to the fact that, despite the possible competition for funds that a strong American performance could trigger, it also reduces uncertainty and raises expectations of stronger domestic performance, which helps reducing the volatility of portfolio flows. On the other hand, strong world GDP growth and increased global liquidity seem to be associated with larger volatility. The first result may reflect the increased competition for funds while the second may proxy for speculative activity. A comparison between columns 4, 7, and 8 suggests that these results are stable and robust.

The last column presents results for the institutional and geopolitical variables. As for FDI, more stability and better governance seem to be associated with less volatile portfolio flows. We find, instead, that English legal origin is related to more volatile flows. The same can be said about the relation between the reserves of natural resources and volatility. Likewise, the availability of nuclear power seems to be associated with a higher volatility. This may be capturing the instability that can be associated with military nuclear activities. However, it is surprising that this result was not found when assessing the determinants of FDI volatility. All in all, the results for portfolio investment are in sharp contrast with those in Neumann et al. (2006), where no significant correlation is found with the exception of their indicator of financial openness.

TABLE 4. PORTFOLIO

	Macro (1)	*Financial* (2)	*Financial* (3)	*Global* (4)	*M-F* (5)	*M-F* (6)	*M-G* (7)	*M-F-G* (8)	*Institutional Geopolitical* (9)
GDP pc	-3.6E-06				-4.8E-06	-1.1E-05	-6.8E-07	-5.9E-06	
	(0.83)				(2.12)[b]	(2.90)[c]	(0.14)	(1.61)	
Squared (GDP pc)	2.4E-10				4.2E-11	4.0E-10	-2.0E-11	3.9E-10	
	(0.59)				(0.31)	(1.68)	(0.22)	(2.77)[c]	
GDP pc growth	0.0005				7.6E-04	9.0E-04	1.9E-04	3.5E-05	
	(3.09)[c]				(1.75)[a]	(1.65)	(1.37)	(0.22)	
Inflation	4.1E-06				4.1E-06	2.9E-06	1.7E-06	-2.1E-06	
	(3.61)[c]				(0.89)	(0.60)	(2.33)[b]	(0.85)	
Trade openess	2.3E-05				-7.7E-05	-1.5E-04	1.7E-04	9.0E-05	
	(0.24)				(0.89)	(1.37)	(1.99)[a]	(2.63)[b]	
Reserves to imports	0.001				-0.001	-0.002	4.36E-04	-4.13E-04	
	(1.47)				(1.39)	(1.43)	(1.16)	(1.55)	
Public deficit	0.027								
	(0.42)								
DMB Assets/GDP		-0.0459	-0.0717		-0.078	0.084		-0.078	
		(3.77)[c]	(2.93)[c]		(4.15)[c]	(1.95)[a]		(3.46)[c]	
Private credit (DMB)/GDP		0.0537	0.047		0.060	0.055		0.048	
		(3.20)[c]	(1.81)[a]		(2.13)[b]	(2.55)[b]		(1.82)[a]	
FSD/GDP		0.0068	0.0275		0.088	0.102		0.063	
		(0.36)	(1.91)[a]		(3.16)[c]	(3.85)[c]		(3.88)[c]	
Interest rate spread		-8.0E-07	1.2E-06		-1.1E-05	-7.0E-06		7.6E-06	
		(0.76)	(2.04)[a]		(0.71)	(0.45)		(0.86)	
SMC/GDP			0.0412			0.031		0.033	
			(2.99)[c]			(2.66)[b]		(5.65)[c]	
Squared (SMC/GDP)			-0.017			-0.010		-0.013	
			(3.82)[c]			(2.20)[b]		(8.62)[c]	
Stock market turnover ratio			-0.004						
			(1.29)						

USA 3 month T-Bill				-8.93E-04 (3.20)[c]			-1.16E-03 (3.73)[c]	-1.18E-03 (2.86)[c]	
S&P index				-1.36E-05 (5.59)[c]			-8.46E-06 (2.39)[b]	-1.97E-05 (9.33)[c]	
USA inflation rate				0.0004 (0.46)			9.20E-05 (0.14)	8.65E-04 (0.91)	
World GDP growth				0.0015 (2.30)[b]			9.49E-04 (1.92)[a]	0.003 (3.46)[c]	
Global liquidity				8.77E-05 (1.29)			-5.14E-05 (0.68)	-1.98E-04 (4.86)[c]	
Economic-political stability									-0.003 (2.72)[b]
Quality of governance									-0.0484 (2.45)[b]
English legal origin									0.013 (2.06)[b]
French legal origin									0.0098 (1.77)[a]
Pipelines (oil and gas)									-1.4E-07 (1.98)[a]
Reserves (oil and gas)									-6.3E-05 (2.96)[c]
Nuclear power									4.1E-07 (3.01)[c]
IMF quota									1.8E-09 (1.94)[a]
Constant	0.021 (1.91)[a]	0.020 (2.95)[c]	0.020 (2.88)[c]	0.020 (1.76)[a]	0.024 (3.53)[c]	0.038 (3.69)[c]	0.027 (1.52)	-0.003 (0.1)	0.047 (4.16)[c]
Observations	515	394	321	433	370	308	396	258	148
Number of groups	37	32	31	38	32	31	38	31	29

NOTES: t statistics in parenthesis; SMC: Stock market capitalization; FSD: Financial system deposits; DMB: Deposit money bank.
[a] Significant at 10%. [b] Significant at 5%. [c] Significant at 1%.

6.3. Other flows

Finally, results for the volatility of other flows are collected in Table 5. Among the domestic variables, the one that seems to be consistently related to the volatility of other flows is GDP per capita, which indicates that richer countries tend to display more volatile flows. As one would expect, trade openness is also significantly and negatively correlated with volatility in many of the specifications. However, in the broader specification (column 8), trade openness turns out to be insignificant. In Neumann et al. (2006), where a much narrower representation of domestic conditions is presented, a significant relation between GDP pc growth and other flows volatility is found.

Surprisingly, we do not find any consistent evidence of a relation between the development of the domestic banking sector and the volatility of other flows. Only for the most comprehensive estimation some significant correlations are found. These suggest that a larger base of depositors may be associated with more stable flows, while a wealthier banking sector seems to imply a higher volatility. We have been unable to find a consistent interpretation for these findings.

Most of the global factors included in our specifications display a significant correlation with the volatility of other flows. As can be seen in columns 7 and 8, increases in global liquidity go hand in hand with a lower volatility of other flows. The same holds true for USA short term interest rates and inflation. On the other hand, increases in worldwide economic activity seem to be associated with a higher volatility of other flows. This contrasts with Neumann et al. (2006), where USA short term rates and World GDP growth are found to have no robust relation to the volatility of other flows.

Turning to institutional factors, as for portfolio flows, political stability and good governance are associated with a lower volatility. Converse to previous results, in this case we find that both an English and French legal origin seem to be correlated with higher volatility. In the case of other flows, only the reserves of oil and gas do present a significant (and negative) coefficient. This may be due to the fact that oil-rich countries have more stable ties with banks. Finally we find that IMF country quotas have a highly significant relation with the volatility of other flows.

7. CONCLUSIONS

In this paper we present evidence on the factors underlying the observed pattern of volatility for FDI, portfolio and other flows on total GDP. When compared with previous contributions such as Neumann et al. (2006), our study presents two technical innovations. First, instead of relying on the standard deviation of capital flows over a rolling window, we follow Bekaert and Harvey (1997) and fit a GARCH(1,1) model to infer our own measure of capital flows' volatility. This allows us to overcome some serious weighting problems associated with the rolling window approach. In addition, we apply the panel data version (Hoechle, 2006) of the Driscoll's and Kraay's (1998) correction of the standard errors, which addresses not only the usual problems of heteroskedasticity and serial correlation, but also the spatial correlation of standard errors that may arise from the presence of contagion effects.

A number of conclusions can be extracted from our empirical analysis. First, we find a differential impact of global conditions on the various types of flows analyzed. While global conditions appear to be especially relevant for the observed volatility of portfolio and other flows, we find a disconnection between FDI volatility and such factors. Second, although we do not quantify the importance of each factor, a clear pattern emerges showing that for all types of capital flows, countries' institutional framework has important implications for the observed pattern of volatility. Indeed, we find that political and economic stability goes hand in hand with more stable capital flows. Additionally, we observe that the quality of governance is associated with less volatile portfolio and other flows. As regards the determinants of FDI volatility, there is empirical evidence supporting the idea that economic development -measured by GDP pc- and volatility present an inverted-U relation. We also find stable evidence of a negative relation between volatility and competition in the domestic banking industry. When studying portfolio flows, consistent with Aghion et al. (2004), we find evidence of a non linear relation between volatility and stock market development. Finally, our study on the volatility of other flows reveals two main patterns. First, as already mentioned, global factors are of particular relevance. Second, there is a surprising lack of a significant relation between the structure

TABLE 5. OTHER FLOWS

	Macro (1)	*Financial* (2)	*Financial* (3)	*Global* (4)	*M-F* (5)	*M-F* (6)	*M-G* (7)	*M-F-G* (8)	*Institutional Geopolitical* (9)
GDP pc	2.82E-05				2.40E-05	-4.72E.07	-2.29E-07	5.27E-06	
	(1.84)[a]				(1.91)[a]	(0.23)	(0.12)	(2.72)[c]	
GDP pc growth	4.73E-04				-0.0011	0.0011	3.93E-04	9.50E-05	
	(1.13)				(1.44)	(2.42)[b]	(2.86)[c]	(0.76)	
Inflation	2.11E-06				1.56E-06	1.11E-06	1.25E-06	1.43E-06	
	(2.61)[b]				(1.12)	(0.74)	(2.50)[b]	(2.07)[b]	
Trade openess	-6.19E-04				-5.79E-04	-1.91E-04	-3.91E-05	1.38E-05	
	(2.98)[c]				(2.17)[b]	(2.16)[b]	(0.44)	(0.25)	
Reserves to imports	-0.00143				0.003	-0.003	-0.002	-7.80E-04	
	(2.38)[b]				(2.00)[a]	(1.46)	(5.23)[c]	(0.98)	
Public deficit	-0.006								
	(0.26)								
DMB Assets/GDP		0.3663	-0.0631		0.033	0.004		0.073	
		(1.34)	(1.30)		(0.89)	(0.12)		(5.14)[c]	
Private credit (DMB)/GDP		0.1436	0.0793		0.009	0.053		-0.030	
		(1.07)	(2.94)[c]		(0.49)	(2.05)[b]		(1.38)	
FSD/GDP		-0.1377	-0.0282		-0.055	-0.032		-0.116	
		(0.92)	(0.65)		(1.02)	(1.14)		(4.16)[c]	
Interest rate spread		3.41E-05	-9.79E-07		-4.25E-06	3.71E-06		-7.04E-06	
		(1.83)[a]	(0.78)		(0.80)	(0.71)		(1.61)	
SMC/GDP			0.0014			3.71E-03			
			(0.06)			(0.21)			
Squared (SMC/GDP)			-0.0008			-3.61E-03			
			(0.13)			(0.79)			
Stock market turnover ratio			-0.0041						
			(0.85)						

USA 3 month T-Bill				0.016			-5.84E-04	-0.001	
				(3.10)[c]			(1.18)	(2.54)[c]	
S&P index				8.19E-05			-6.04E-06	-2.94E-06	
				(14.71)[c]			(4.09)[c]	(1.44)	
USA inflation rate				-0.036			-0.004	-0.005	
				(5.22)[c]			(15.86)[c]	(12.24)[c]	
World GDP growth				-0.0098			0.001	0.001	
				(2.08)[b]			(3.69)[c]	(3.94)[c]	
Global liquidity				-0.002			-2.35E-04	-1.78E-04	
				(6.79)[c]			(5.68)[c]	(3.80)[c]	
Economic-political stability									-0.0137
									(1.98)[a]
Quality of governance									-0.4672
									(2.11)[b]
English legal origin									0.0707
									(3.47)[c]
French legal origin									0.0611
									(4.08)[c]
Pipelines (oil and gas)									-2.15E-06
									(1.35)
Reserves (oil and gas)									-5.74E-04
									(1.99)[a]
Nuclear power									-4.13E-07
									(3.61)
IMF quota									8.10E-08
									(2.61)[b]
Constant	0.021	-0.014	0.053	0.329	0.042	0.053	0.092	0.086	0.3837
	(0.83)	(0.26)	(9.12)[c]	(8.25)[c]	(2.21)[b]	(11.08)[c]	(17.44)[c]	(11.07)[c]	(3.14)[c]
Observations	690	536	343	550	497	330	480	356	198
Number of groups	45	40	33	47	40	33	46	39	34

NOTES: t statistics in parenthesis; SMC: Stock market capitalization; FSD: Financial system deposits; DMB: Deposit money bank.
[a] Significant at 10%. [b] Significant at 5%. [c] Significant at 1%.

and development the domestic banking system and the volatility of other flows.

In this paper we have restricted our attention to four sets of factors; we have not addressed issues like exchange rate regimes, processes of financial liberalization, crises or multilateral intervention. Further research within this framework should be directed along those lines.

Appendix A

Sample countries

Albania	Hong Kong	Pakistan
Argentina	Hungary	Peru
Bahamas	India	Philipinnes
Bangladesh	Indonesia	Poland
Bolivia	Korea	Czech Republic
Brazil	Lao PDR	Romania
Bulgaria	Latvia	Russian Federation
Cambodia	Lesotho	Singapore
Chile	Lithuania	South Africa
China	Malaysia	Sri Lanka
Colombia	Mexico	Sudan
Croatia	Moldova	Thailand
Ecuador	Morocco	Turkey
Estonia	Myanmar	Ukraine
Ethiopia	Nepal	Uruguay
Guatemala	Nicaragua	Venezuela

Appendix B

Data sources

Variable	*Source*
Capital flows	IFS
GDP	IFS
GDP per capita	WDI
Inflation	WDI
Trade openess	WDI
Reserves in months of imports	WDI
Public deficit	IFS
Deposit money bank assets	FSD[a]

Variable	*Source*
Private credit by deposit money banks	FSD
Financial system deposits	FSD
Interest rate spread[b]	WDI
Stock market capitalization	FSD
Stock market turnover ratio	FSD
Quality of governance	ICRG[c]
Legal origin	LLSV[d]
Economic and political stability index	Freedom house
Oil and gas: Pipelines	Reynaud and Vauday (2006)
Oil and gas : Reserves	Reynaud and Vauday (2006)
Nuclear power	Reynaud and Vauday (2006)
IMF quota	Reynaud and Vauday (2006)
3 months USA T-Bill rate	Datastream
S&P 500 price index	Datastream
USA inflation rate	WDI
World GDP growth	WDI
Global liquidity	Erce (2006)

[a] Financial Structure Database (Wrold Bank). [b] Lending rate minus deposit rate. [c] International Country Risk Guide. [d] La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998).

Appendix C

Correction on the standard errors

For expositional clarity we use expression (1) to determine the measure of volatility based on a rolling window:

$$vol_{it} = \left(\frac{1}{4} \sum_{j=t-3}^{t} (flow_{ij} - \mu)^2 \right)^{\frac{1}{2}}$$

It is immediate to see the source of serial correlation in the estimation errors, ε_{it}, of the regression $vol_{it}=\Gamma X_t+\varepsilon_{it}$. Given that $\text{corr}(vol_{it}, \varepsilon_{it})\neq 0$ and, by construction, $\text{corr}(vol_{it}, vol_{it-j})\neq 0$ for $j\in (0,3)$, it is straightforward that:

$$Corr(\varepsilon_{it}, \varepsilon_{it-j}) \neq 0 \qquad \forall j \in (0,3)$$

In order to correct for this problem we use Driscoll and Kraay (1998) standard errors, which allow for heteroskedasticity and various forms of correlation in the error terms. The method, implemented using STATA following the work by Hoechle (2006),

provides standard errors which are the square root of the diagonal elements of the asymptotic robust covariance matrix:

$$Var(\hat{\Gamma}) = (X'X)^{-1}\hat{S}_T(X'X)^{-1}$$

with $\hat{S}_T$ obtained as in Newey and West (1987) using a non-parametric kernel-based estimator:

$$\hat{S}_t = \hat{\Omega}_0 + \sum_{j=1}^{r(T)} w(j,r)\left[\hat{\Omega}_j + \hat{\Omega}_j'\right]$$

where $r(T)$ denotes the length of the autocorrelation of the residuals. The Barlett weights, $w(j,m)=1-(j/(r(T)+1))$, are used to guarantee that $\hat{S}_T$ is positive semidefinite, and are set such that underweighting of high order autocorrelations is avoided.[15] Finally, $\hat{\Omega}_j$ matrices are defined as:

$$\hat{\Omega}_j = \sum_{t=j+1}^{T} h_t(\hat{\Gamma})h_{t-j}(\hat{\Gamma})'$$

where $h_t(\hat{\Gamma}) = \sum_{i=1}^{N(t)} x_{it}(y_{it} - x_{it}'\hat{\Gamma})$. Allowing $N(t)$ to vary with time is enough to make the estimator ready for use with unbalanced panels (Hoechle, (2006)).

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[15] That amounts to introduce lag size bigger than strictly necessary, which given the structure of the rolling window implies four lags.

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