DIRETORIA DE ESTUDOS MACROECONÔMICOS

SEMINÁRIOS DIMAC Nº 19

Full Dollarization: The Case of Panama

Illan Goldfajn
(PUC-RJ)

Gino Olivares
(PUC-RJ)

28 de junho de 2000

INSTITUTO DE PESQUISA ECONÔMICA APLICADA

DIRETORIA DE ESTUDOS MACROECONÔMICOS

SEMINÁRIOS DIMAC Nº 19

Full Dollarization: The Case of Panama

Illan Goldfajn
(PUC-RJ)

Gino Olivares
(PUC-RJ)

28 de junho de 2000

MINISTÉRIO DO PLANEJAMENTO, ORÇAMENTO E GESTÃO
Martus Tavares - Ministro
Guilherme Dias - Secretário Executivo

Instituto de Pesquisa Econômica Aplicada

Presidente
Roberto Borges Martins

Diretores
Eustáquio José Reis
Gustavo Maia Gomes
Hubimaier Cantuária Santiago
Luís Fernando Tironi
Murilo Lôbo
Ricardo Paes de Barros

Coordenação de Seminários

Marcelo Lara Resende – Isis Carneiro Agarez
demolare@ipea.gov.br agarez@ipea.gov.br

Informações: Danielle de Lima Cortez (cortez@ipea.gov.br)

Os textos — trabalhos apresentados em seminários promovidos pela DIMAC/IPEA — são reproduzidos a partir de originais do(s) autor(es), sem qualquer revisão do Serviço Editorial do IPEA.

Tiragem: 50 exemplares

SERVIÇO EDITORIAL

Avenida Presidente Antônio Carlos, 51, 10º andar, Castelo
20020-010, Rio de Janeiro, RJ, Brasil
Tel.: (0xx21) 804-8121
Telfax: (0xx21) 240-1920
http://www.ipea.gov.br

Full Dollarization: The Case of Panama[1]

By

Ilan Goldfajn
and
Gino Olivares

Pontificia Universidade Católica – Rio de Janeiro

This paper is part of the regional study "The Choice of Currency Arrangements in Latin America and the Caribbean," LCSPR, Economic Management Group. The authors are solely responsible for the views and opinions expressed here.

Abstract

This paper analyzes the case of Panama, one of the largest countries currently adopting the dollar as its legal tender, and evaluates some of the predictions of the theory on the costs and benefits of full dollarization. The main conclusions drawn from the case of Panama are that on one hand, dollarization does not guarantee fiscal discipline, the elimination of currency risk does not preclude default risk or the high volatility of sovereign spreads, and that dollarization may increase slightly GDP growth volatility. On the other hand, a dollarized economy delivers an impressive inflation performance and may even reduce the impact of external confidence shocks, although not external real shocks. Finally, it is not clear whether the low interest rates in Panama are a consequence of the dollarization regime or the competitive internationalized banking system.

Address:
Pontificia Universidade Catolica
Departamento de Economia
Marques de Sao Vicente, 225
Rio de Janeiro, Brazil
Phone: (5521) 274-2797
Fax: (5521) 294-2095
e-mail: goldfajn@econ.puc-rio.br
olivares@econ.puc-rio.br

Keywords: Dollarization, Panama, Exchange Regime

[1] The authors would like to thank Eliana Cardoso for suggesting the theme of the paper and for her comments and support, to Leandro Rothmuller and Monica Cardoso for research assistance and to Taimur Baig and Andrew Berg for kindly sending requested data.

Table of Contents

I. INTRODUCTION

"Even the more resolute, on any occasion of disgust or disappointment hereafter, might falter in purpose, and, getting possession of the vessels, abandon the enterprise. The best chance of success was to cut off these means. He came to the daring resolution to destroy the fleet, without the knowledge of his army.....The destruction of his fleet by Cortés is, perhaps, the most remarkable passage in the life of this remarkable man. History, indeed, affords examples of a similar expedient in emergencies somewhat similar; but none where the chances of success were so precarious, and defeat would be so disastrous....The measure he adopted greatly increased the chance of success."

William H. Prescott, in History of the Conquest of Mexico.

Why should a country adopt a foreign currency as its legal tender? Leaving the trauma of loosing its national symbol aside, what are the disadvantages and advantages of using other country's money?

This paper attempt to answer this question analyzing the case of Panama, one of the largest countries currently adopting the dollar as its legal tender. The existence of a dollarized economy as Panama for more than 90 years allows us to test some of the predictions of the theory on the costs and benefits of full dollarization. The limits of this strategy are well known. It is difficult to separate the effect of full dollarization from the effect of other idiosyncratic differences in Panama. The paper attempts to control for some of the other differences comparing Panama with similar countries, first with the rest of Latin America and then, particularly, with Costa Rica and Argentina.

One can divide the theoretical debate on the benefits and costs of dollarization in three sequential blocks. The first block debates whether having a fixed parity to an international currency is relatively more advantageous than a more flexible regime. There is a vast literature on this issue, in particular in the context of the optimal currency area. Once the relative benefits and costs of a fixed exchange regime are laid down one can analyze which type of fixed regime is more appropriate, whether a simple parity or a more rigid regime, as for example a currency board. Finally, the third block analyzes the marginal benefits and costs that apply exclusively when a country decides to abandon currency and to adopt a hard currency. Here issues like renouncing completely the seignorage revenues are relevant.

The main issues are whether dollarization generates sufficient gains in credibility and reduces domestic interest rates and spreads on sovereign external bonds; whether the gains in inflation offset the cost of losing seignorage and the ability to use monetary policy to offset external and internal shocks; whether dollarization guarantees or at least promote fiscal discipline and; whether dollarization improves the efficiency of financial markets allocating resources better than in other exchange regimes.

The paper reviews the experience of Panama in several aspects. First, the paper performs a long run comparative analysis between the main macroeconomic variables of Panama and other Latin American countries with special focus on the exchange regime. Second, the paper reviews Panama's experience with low inflation, Panama's GDP growth performance and the real sector and its peculiar real exchange rate depreciation trend. Third, the paper evaluates the effect of full dollarization on domestic interest rates and sovereign spreads paid on external debt. Fourth, the paper analyzes whether the exchange regime has induced fiscal discipline in Panama and whether the absence of a lender of last resort has any

consequences. Fifth, the paper evaluates the performance of Panama during the Asian and Russian crises. Finally, the paper performs VAR analysis in Panama, Costa Rica and Argentina and compares, separately, the relative effect of an external confidence shock and a real shock in industrial countries.

The next section presents the theoretical section, section III carry out the empirical analysis and section IV performs the econometric exercise. In the appendix the paper leaves extensions of the econometric exercises, a list of fully dollarized countries in the world and a sketch of the model cited in the theoretical section.

II. Dollarization in Theory

A. Fixed versus Flexible

The first decision level on evaluating dollarization is whether a country should adopt a flexible or a fixed regime. The literature on this issue is vast. For example, the Optimal Currency Arrangement (OCA) literature has identified the pre-conditions for a country to join a monetary union.[2] In short, the OCA literature has argued that the more asymmetric the shocks are between the economies and the harder it is to an individual country to smooth the shock by other means that not the exchange rate, the more costly it is to adopt a fixed exchange rate. This general rule entails investigating the size, openness, and correlation of the shocks to evaluate the impact of a given external shock and examining the labor mobility, price flexibility, the fiscal cyclical stabilizers and the degree of financial opening to evaluate the ability of a country to smooth the shock in a pegged regime.

Adopting a fixed exchange regime without the necessary pre-conditions may entail large costs. For example, if fiscal policy is not very counter-cyclical, financial openness is such that monetary policy is not independent, and the labor market is not very flexible, a pegged regime must adjust to external shocks through large fluctuations in output. The costs therefore could be measured by the volatility of GDP and employment. The benefits of the pegged regime would be to reduce transactions' costs and risks associated with a floating regime that discourage trade and investment and to provide a nominal anchor for monetary policy. The latter benefit has been more relevant for developing countries since many pegs have been used to help stabilize high and medium inflation economies.

More modern arguments in the flexible versus fixed debate include on the cost side the large costs of the recent exchange rate and financial crises. These costs include not only the large GDP drops that were termed the "sudden stops" (Dornbusch et al. 1995, Calvo 1999) as well as the costs associated with the bailout of the banking and corporate sectors. The modern debate adds to the benefit side supposedly larger fiscal discipline by the reduction to the resort to inflationary finance. Recent experiences (e.g. Brazil) have show that this is not necessarily the case. Some argue that what is needed is a more credible peg, which is a debate regarding the optimal pegged regime (fixed versus currency board or dollarization), a theme we explore in the next subsection. In any case, it is accepted that a pegged regime is a step in the direction of increasing the credibility of the stabilization efforts and that one can summarize the existing trade-off in the debate as a choice between flexibility and credibility.

[2] See the volume edited by Blejer, Frenkel, Leiderman, Razin, Cheney (1997).

B. Which Type of Fixed Regime is Preferable?

The long list of speculative attacks and exchange rate crises in the last decade has led to the argument that simple fixed exchange rate regimes are no longer desirable, or even sustainable. The alternative to countries that would like to insist on fixed exchange parities would be to make more "credible" commitments, for example making the parity a constitutional amendment and defining the proportion of the domestic currency that would be covered by foreign exchange reserves, as in the currency board regime. Defenders of more "rigid" exchange regimes argue the origin of all the problems is the low credibility of simple fixed regimes where it is difficult to believe that a country will maintain its currency fixed relative to another country's currency for an undetermined period of time.

The reason for this lack of credibility is sometimes associated with the appreciation of the real exchange rate (RER) that often occurs in fixed exchange regimes. Several studies show that the probability of large nominal corrections is correlated with a more appreciated RER.[3] A typical example occurs in exchange-rate-based stabilizations where the RER tend to appreciate beyond justifiable movements in the fundamentals leading to a loss of competitiveness and a negative effect in the external accounts, leaving these countries extremely vulnerable to external shocks. In addition, growth falters after an initial boom and unemployment follows. It is at this point that the policy makers' credibility problems arise. What is the maximum unemployment rate that the society and the government are willing to tolerate to attain the objective of price stability? The answer depends on the cost of abandoning the regime.

It is the balance of costs and benefits of abandoning the peg in moments of distress that determines the credibility of the regime. The higher the cost the more credible the regime would seem. Therefore, the conclusion is that more "rigid" regimes, defined as the ones with higher exit costs, would tend to be more credible.[4] The irony is that for a given cost of abandoning the regime, sticking to the parity may not increase the credibility of the policy. In the words of Drazen and Masson (1994), "if there is persistence in unemployment, observing a tough policy in a given period may lower rather than raise the credibility of a no-devaluation pledge in subsequent periods".[5]

Governments would therefore try to "tie their hands" increasing ex-ante their exit cost by adopting a more rigid exchange regime. Of course, the cost of abandoning the regime is also partially determined by market forces and given by the history of the economy. An important example is the existence of an unofficial dollarized economy encouraged by the uncertainty caused by a history of high inflation rates. In this case the costs of abandoning the regime could be the return of the inflationary past. Another example is the currency mismatch

---

[3] Klein and Marion (1997), using logit analysis and a sample consisting of Latin American and Caribbean experiences with pegs during the period from the late 1950s through the early 1990s, found evidence that more appreciated real exchange rates are associated with a higher likelihood of devaluation. Goldfajn and Valdés (1999) using a broader sample show that overvaluation leads to a higher probability of sharp nominal corrections.

[4] In fact, if policy makers do not want to make such a binding commitment, the flexible regime could be revealed more appropriate. Edwards and Savastano (1999) argue that this is an important reason explaining the developing countries' shift toward more flexible regimes.

[5] In a nice analogy Drazen and Masson argue that the credibility of a fasting diet diminishes as time goes by.

in the balance sheets of banks and corporations encouraged by the implicit guarantee that a fixed exchange rate would last indefinitely. In these conditions, modifying the parity could generate a serious banking and corporate crisis.

One could think of actual fixed exchange regimes as having implicit escape clauses. Obstfeld (1997) argues that the existence of escape clauses of fixed regimes is destabilizing in the sense that it increases the uncertainty regarding the continuation of the fixed regime. Therefore, fixed pegs with wide exit options can be very destabilizing to a fixed exchange rate regime.

One could generalize the argument to include several types of fixed exchange regime, each with a different degree of escape clauses. Even currency boards and dollarized economies are in principle subject to regime changes and, therefore, have implicitly escape clauses. During the gold standard several countries had to reverse their currency boards and Liberia is at least one example were dollarization was reversed. The solution to the destabilizing feature of fixed regimes would be to reduce the escape clauses by adopting of a more "rigid" peg regime that reduces the exit options. Therefore, reducing the escape clauses is equivalent to increasing credibility, i.e., reducing the certainty that the regime would not be changed. Of course, the disadvantage of more credibility is losing the escape clauses or the ability to easily change regime if the costs are very high.

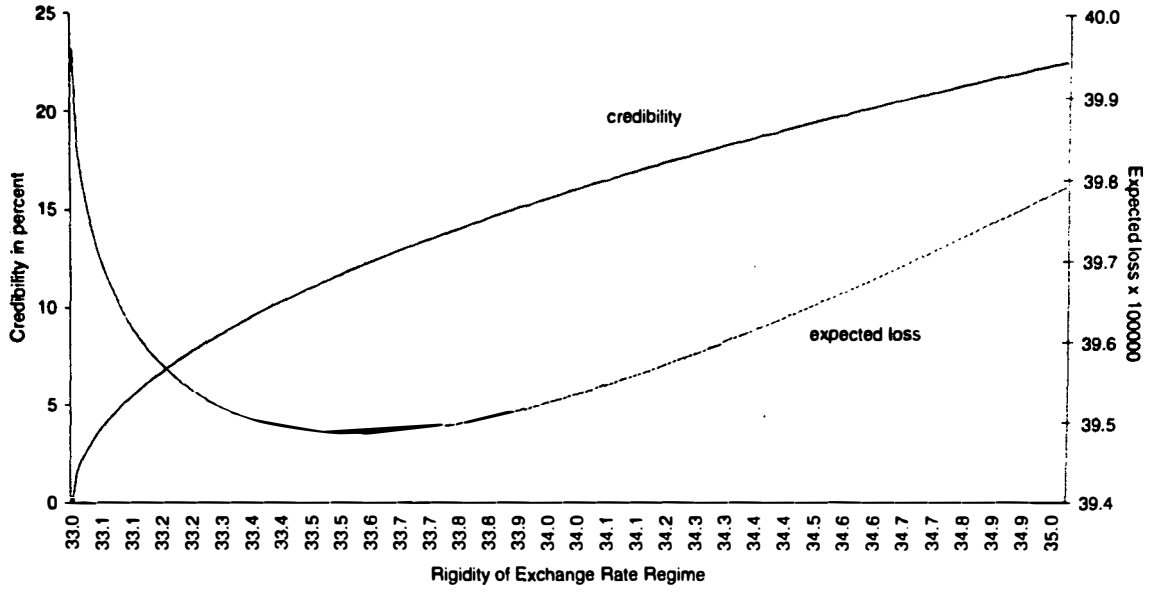
For example, Krugman (1999) argues that when one country adopts a currency board (and his argument is also valid in the case of full dollarization) it prevents itself from printing money to finance populist schemes, for example, but at the same time it is preventing itself from printing money when the costs of unemployment are very high.

This restatement of the credibility versus flexibility trade-off in the context of the optimal degree of peg rigidity is tentatively modeled in the appendix. Figure 1 shows a typical graph of the model. An increment in the degree of rigidity does increase the credibility of the exchange rate regime, but does not necessarily imply a gain in terms of welfare. We observe in the figure below that initially there are gains when we increase the degree of rigidity of the regime, but after some point there are net losses. The fixed cost maximizing credibility does not minimize the expected loss function. There is not a monotonic relationship between the degree of rigidity of an exchange-rate regime and its welfare effects. Therefore one should not conclude that a regime that maximizes credibility is not necessarily the best regime.

The absence of a central bank in a currency board or fully dollarized economy implies that there is no lender of last resort in the economy. This induces banks to seek for alternative contingent credits, particularly foreign funds, to replace partially the lender of last resort role. The necessity to seek for foreign funds gives a competitive edge to international banks over domestic banks, inducing a more international banking system.

One of the favorite arguments in favor of the adoption of a more rigid regime as currency board or dollarization is the fiscal discipline that it may induce. Under this line of argument, the elimination of the possibility of printing money would limit the possibilities of financing fiscal deficits and would prompt more fiscal discipline. However, the resort to debt financing is available and governments may substitute fully money financing for higher public debts

Figure 1: Credibility and Expected Loss



C. The Limit of a Fixed Exchange Regime: Dollarization

Once a very rigid peg regime was chosen based on the credibility versus flexibility trade-off, what determines whether one should choose a currency board or a full dollarization regime?

First, one could think of full dollarization as a regime with even more credibility at the costs of even less flexibility. Then, the argument in favor of a more credible fixed exchange rate regimes could be taken to the extreme in favor of full dollarization. The idea would be that pegs that are less than absolute are perhaps not viable in modern, globalized financial markets, with high mobility of capital and, for this reason, for some countries the only defense would be to abandon their own money and to adopt the dollar as legal tender.

One of the costs of choosing a full dollarization regime over a currency board is the loss of the seignorage revenues. Although the currency board regime cannot resort to money printing to finance deficits, the existing inflation and the growth of GDP induce a natural growth in money demand that still generates revenues for the government.

One of the main arguments in favor of dollarization is that the elimination of currency risk will reduce both domestic interest rates and spreads on external bonds. Although it is plausible that the elimination of currency risk will somewhat reduce interest rates it is by no means certain. In principle, interest rates could be reflecting mostly default risks and the elimination of currency risk has little effect on the level of spreads and interest rates. Or it could be the case that, in the absence of exchange rate flexibility, the elimination of currency risk could actually increase the default risk (e.g. in a dollarized economy without price flexibility, a severe negative terms of trade shock could require such a large recession that policy makers may prefer to default on external obligations).

The identification of the effect of the elimination of currency risk is not trivial. Currency risk could be correlated with default risk. If the correlation is negative, the elimination of currency risk increases default risk. If the effect on the default risk is strong enough we could actually observe an overall increase in risk and an increase in interest rates, as we argued above. However, if the correlation is positive then the elimination of currency risk would have a beneficial indirect effect reducing also default risk (e.g. currency crises sometimes induce corporate and sovereign default).

The effect on the domestic interest rates can depend more on a higher degree of the liberalization of the financial system than on the full dollarization regime itself. However, it is difficult to separate the two effects, according to Berg and Borensztein (1999): "Another powerful but somewhat hypothetical argument for legal dollarization is that the change in monetary regime may contribute to raise the level of investor confidence and establish a firm basis for a sound financial sector, which would provide the basis for strong and steady economic growth".

D. Main Implications of the Theoretical Section:

1. The absence of monetary and exchange policy in a dollarized economy may induce more volatility of GDP, provided fiscal policy is not very counter-cyclical, relative to more flexible exchange regime but not relative to other fixed exchange regimes.
2. The credibility gains associated with dollarization induce lower average and variability of inflation.
3. Absence of currency risk should imply lower domestic interest rates but not necessarily lower spreads on foreign currency debt.
4. The absence of seignorage not necessarily induces more fiscal discipline.
5. The absence of a lender of last resort induces banks to seek for alternative contingent funds. This gives a competitive edge to international banks over domestic banks inducing a more international banking system.
6. The use of a hard currency may increase the efficiency of financial markets creating long run markets and allocating resources better than in other exchange regimes.
7. There is no presumption on the relative effect of external shocks on a dollarized economy. On one hand the flexibility to use exchange and monetary policy is limited. On the other hand, confidence shocks may have a smaller effect on dollarized economies.

III. Full Dollarization in Practice: The case of Panama

Not many large economies opt for a full dollarization regime. The Republic of Panama is a relatively small economy with an overall GDP of $ 6.9 billion dollars in 1998 and a population of 2.76 million people. According to official statistics, in 1998, Panama's labor force employed was only 945 thousand people. Notwithstanding its relatively small size, it represents the largest dollarized economy in the in the Western Hemisphere, as can be seen in Table I in the appendix. The U.S. dollar is legal tender in Panama since 1904, although there is a national currency, the balboa, used for small transactions and as a unit of account.

Panama's decision to dollarize the economy followed political and historical reasons rather than an economic choice for this exchange regime. Since colonial times, and because of its strategic location as a narrow strip of land connecting North and South America, Panama is a natural crossroad for trade and transit. This characteristic led, first, to the construction of the Panama Canal at the beginning of this century and, second, to the establishment of the Colon Free Zone in 1948. The Colon Free Zone is an international trade facility that allows businesses to operate without paying import duties or taxes, being the second largest in the world, just surpassed by Hong Kong. Dollarization came as a natural consequence of the international influence in the area and the importance of Panama.

A . Macroeconomic Performance and the Exchange Regime

There is not a large set of cross section empirical evidence on the subject. The reason is the absence of a good data set on exchange regimes. The available data set comes from the IMF's Exchange Arrangements and Restrictions publication which is known to report exchange regimes as defined by the reporting country, procedure that not always leads to a fair characterization of the regime. Notwithstanding this shortcoming, using this available dataset, Ghosh, Gulde, Ostry, and Wolf (1997) finds results that provide reasonable confirmation of the predictions of the theory. First, the paper finds that countries with fixed exchange rate regimes enjoy lower average and volatility of inflation rates, which it associateswith a higher degree of credibility of the authorities. Second, the paper finds that real volatility is higher under pegged regimes than under floating ones.

One would like to compare the results of the cross-section paper cited above with the case of Panama. Table 1, borrowed from Berg and Borensztein (1999), show that the case of Panama follows the pattern of other pegged regimes regarding inflation and GDP volatility. Panama's inflation and volatility is lower and GDP volatility higher than more flexible regimes. In addition, the table shows two interesting features. First, GDP growth volatility is higher in Panama than in other pegged regimes, suggesting that the degree of flexibility must be lower in Panama. This conclusion, however, contradicts the finding reported (in a footnote) by Ghosh, Gulde, and Wolf (1998) that the standard deviation of GDP growth under currency boards is about 0.7 percentage points lower than under other pegged exchange rate regimes. Second, average output growth is much lower in Panama than the average developing country. This would suggest that more rigid regimes have lower average growth rates. Again, this conclusion is not consistent with the evidence in Ghosh et al. (1998) where more rigid pegs (currency boards) have higher average growth rates (see Table 2). In fact, Table 3 shows that the average growth in Panama since 1970 is not atypical compared with other Latin American countries.

Ghosh, et al. (1998) found evidence of an inverse relationship between the degree of rigidity of the exchange rate regime and inflation rates (See Table 2). On average, the inflation in countries with currency boards was about 4 percentage points lower than under other pegged regimes. According to these authors, "this lower inflation was achieved by having lower money growth rates (a discipline effect). But the difference in money growth rates is not sufficient to explain the inflation differential, suggesting an additional confidence effect whereby higher money demand results in lower inflation. Numerically, this confident effect is substantially larger than the discipline effect, accounting for 3.5 percentage points out of the 4.0 percentage points differential".

In addition, as we can see from Table 2, Ghosh et al. found that currency board countries have fiscal deficits that are lower than deficits under any other exchange rate regime. This result would support the argument, frequently used by defenders of "more fixed" exchange rates regimes, that a higher degree of rigidity imposes more discipline in the fiscal authorities.

Panama's overall macroeconomic performance compares well with other Latin American countries in the last 28 years, but is not outstanding (see Table 3). On one hand, Panama's superb inflation performance is clearly an exception in Latin America, either measuring by the average or volatility of inflation. GDP growth average is not much lower than any other Latin American country and would have compared even better if we had restricted the sample to the last 18 years. On the other hand, GDP volatility is among the worst in Latin America, partly because of the large drop in GDP during the conflict with the U.S. in 1988-89. Fiscal performance is not overwhelming, only better than the worst Latin American performers as Mexico and Brazil.

This initial comparison already sheds light on important issues regarding full dollarization. We can summarize Panama's relative performance in four points. First, Panama's experience confirms that an exchange peg, with dollarization being the extreme example, generates low and stable inflation. In this regard, confirming the result on currency boards, it seems that the extreme pegs deliver even better inflation performance. Second, this gain in inflation performance is done without compromising average GDP growth. However, Panama's experience does not show any gain in average growth either (contrary to evidence on currency boards). Third, Panama has a bit higher volatility in GDP growth that could be attributed to the lack of flexibility in monetary and exchange policy. Fourth, the absence of monetary financing did not preclude Panama from having large and persistent fiscal deficits, not better than the typical Latin American country (again this is at odds with the evidence on currency boards).

In what follows, this section analyzes with more detail the macroeconomic performance of Panama concentrating on the behavior of inflation, the real sector, spreads and country risk, fiscal policy, domestic interest rates, the banking system, the absence of a lender of last resortand the reaction of Panama to the crises in the period 1997 to 1999.

Table 1: Panama and Developing Countries' Macroeconomic Performance, 1960-1995
(Deviations from average for all countries, in percent)
Berg and Borensztein (1999)

	Panama	Average for various exchange rate regimes		
		Pegged	Intermediate	Floating
Inflation				
Rate	-5.2	-2.90	-0.10	3.80
Volatility	-2.9	-1.74	0.53	1.67
Output				
GDP growth	-1.6	0.00	0.70	0.50
GDP volatility	0.6	0.08	-0.80	-0.52
Employment volatility	-0.2	0.05	0.01	-0.32

Sources: Berg and Borenstein (1999). For methodology and results for developing countries, see Ghosh et. al (1997).
Notes: Database is all developing countries with data from 1960 to 1995, classified by exchange rate regime.

Table 2: Macroeconomic performance across fixed exchange rate regimes

In percent, except Nobs	Nobs	Average π	Std. Dev. π	Average $\pi/(1+\pi)$	Average Money Growth	Average Gov. Bal./GDP	Average GDP Growth
Currency Boards	115	5.6	2.6	5.0	11.9	-2.8	3.2
Pegged. Excl. Currency Boards	1576	19.0	10.1	8.5	23.0	-4.2	1.3

Source: Ghosh, Gulde, and Wolf (1998).

Table 3: Panama and Latin America's Macroeconomic Performance, 1970 - 1998
(in percent)

Countries	Inflation		GDP Growth		Fiscal Deficit (% of GDP)
	Average	Volatility (s.d.)	Average	Volatility (s.d.)	
Argentina	46.79	31.50	2.3	5.1	3.7
Brazil	62.43	30.67	4.6	4.4	4.7
Chile	26.42	22.92	4.2	6.3	0.5
Costa Rica	14.20	9.06	4.2	3.5	3.0
Mexico	22.57	14.93	4.0	3.8	4.4
Panama	3.25	3.46	4.1	5.7	3.8
Peru	36.49	27.65	2.6	5.8	3.4

Source: IFS.
Notes: To avoid outliers, we calculated the average and volatility of the inflation using $\pi' = \pi / 1+\pi$.
Fiscal Deficit is the public sector borrowing requirement of the Central Governement.

B. Low Inflation, Real Depreciation and the Inverse of the Balassa-Samuelson Effect

Panama's economy shows an impressive performance in terms of price stability. The adoption of the U.S. dollar as legal tender should have implied that in the medium and long run Panama's inflation would approximate the United States, given Panama's relatively open economy (35-40% of GDP is exports and imports) and the fact that the U.S is the main trade partner (50% of exports and 34% of imports). In fact, Figure 2 shows that the inflation rate in Panama tracked closely the U.S inflation in the last 30 years. Notwithstanding the cyclical similarities, inflation trend in Panama seems to be lower than in the U.S.

This systematic lower inflation in Panama implies that its Real Exchange Rate (RER) is depreciating in the long run, given that Panama is fully dollarized and the U.S. is its main trade partner. Figure 3 shows this depreciation trend for the Real Exchange Rate in Panama, providing another example where one observes systematic deviations from the Law of One Price. As can be seen in the figure, this trend is robust to using different RER measures, as the CPI-based RER, the WPI-based RER or the IMF Real Effective Exchange Rate, where the latter is the only multilateral real exchange rate.

This RER depreciation trend is extremely interesting because it is at odds with the typical long run appreciation trend of developing countries. The common explanation for trends in the real exchange rate relies on different paths for the relative price of non-tradable goods between countries. The explanation for the typical appreciation trend rely on the so-called "Balassa-Samuelson Effect," the tendency for countries with higher productivity in tradables compared with non-tradables to have higher price levels. As developing countries catch up with productivity levels of developed countries in tradable goods, their general price level tend to rise and their real exchange rate to appreciate, provided that the catch up in non tradable goods is slower.

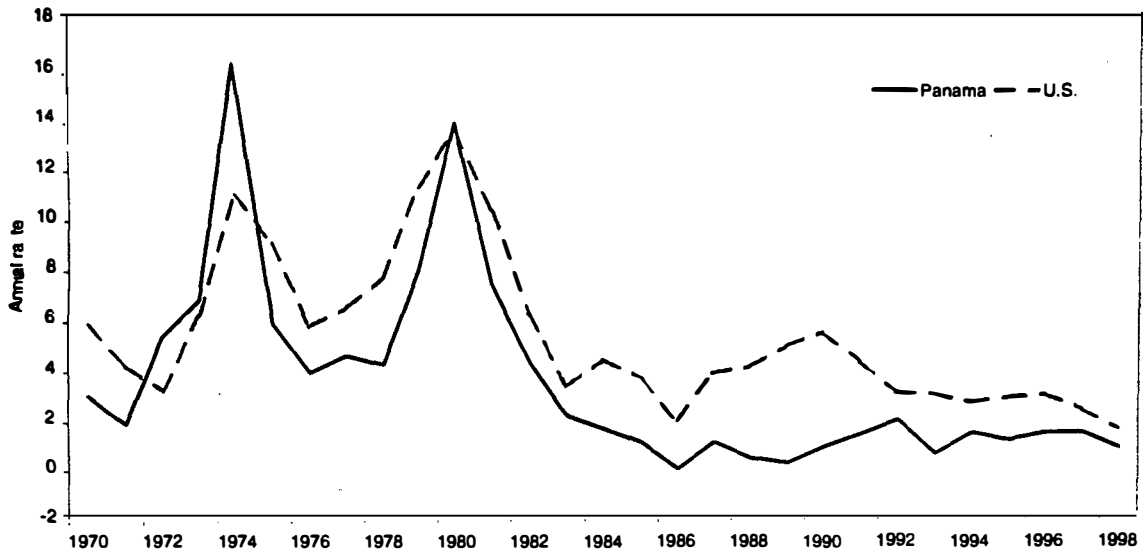
In the case of Panama, given the unusual high concentration of GDP in services (around 80%), most of the GDP per capita growth has to reflect increases in labor productivity in the non-tradable sector, which pressures down its relative price. Given the openness of Panama's economy, the law of one-price holds well for tradable goods and a reduction in the relative price of non tradables implies a depreciation of the RER. In other words, Panama's peculiar concentration of GDP on non tradable goods (services) leads to the inverse of the Balassa-Samuelson effect, the tendency of non tradable prices to become cheaper as Panama develops and the RER to depreciate.

In addition to the lower inflation of non tradable prices, low overall inflation and the real depreciation in Panama were partially caused by major trade liberalization reforms that reduce average import tariffs to around 9 per cent in 1998.

C. GDP Performance and the Real Sector

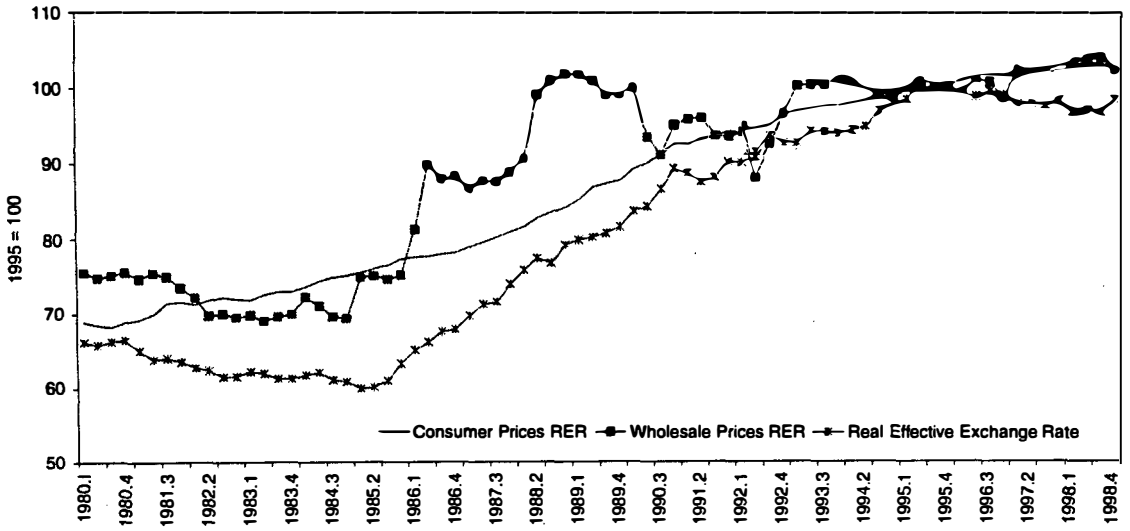
In the period 61-98, the average annual growth rate in Panama was 5.3 percent, with a standard deviation of 5.0 percent. This average was maintained in the period 90-98 – 5.3 percent --but with a lower variability, 2.7 percent. With the exception of 1983 (the debt crisis) and in the period 87- 88 (the result of sanctions imposed by the U.S.), Panama experienced positive growth rates. In fact, a good part of the overall variability of GDP growth during this period could be attributed to this few episodes.

Figure 2: CPI Inflation



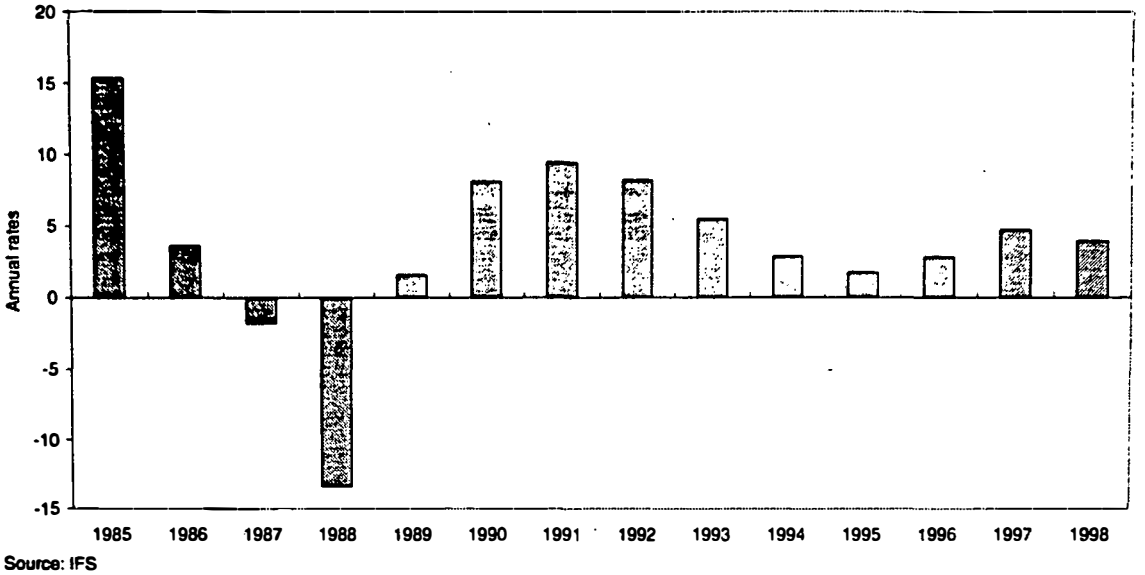
Source: IFS

Figure 3: Real Exchange Rates



Source: IFS

Figure 4: GDP Growth



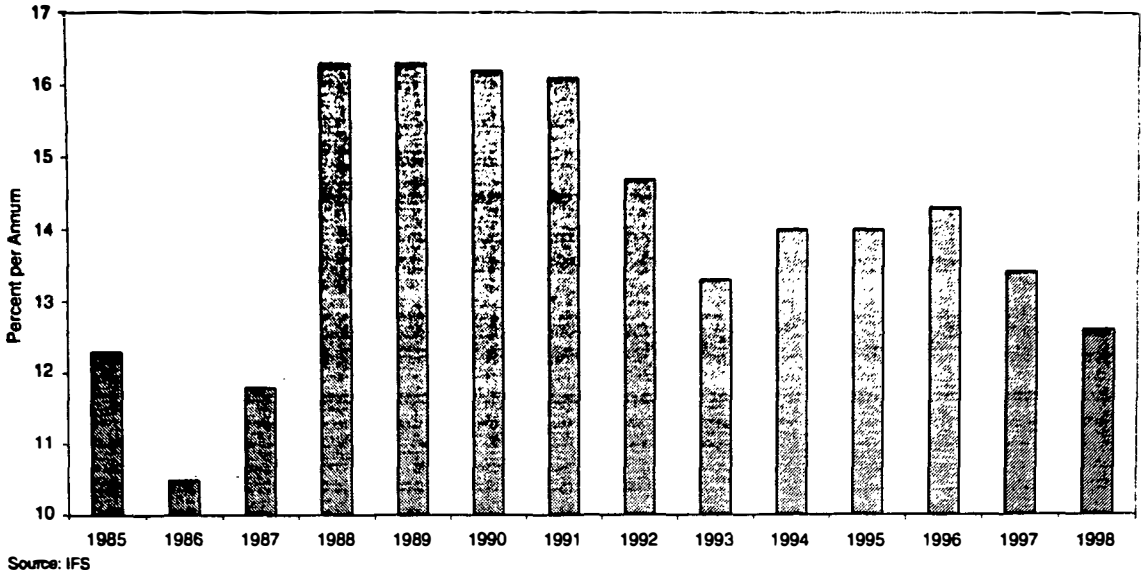
Source: IFS

Panama's GDP is highly concentrated in services. In 1998, 78.3 percent of GDP was produced in the services sector, being 20.8 percent in commerce, trade and restaurants; 12.3 in transport and communications, including Panama Canal Commission; 13.4 in financial intermediation; 13.4 in housing; and 15.3 in public utilities and administration. Only 13.6 percent of GDP is produced in secondary activities, of which 9.7 is in manufacturing and 3.9 in construction. This generates a service oriented GDP that has consequences for the RER and the effect of shocks in the economy.

The average annual rate of unemployment for the period 1985 - 1998 is 14.0 percent. If we consider just the period 93 - 98, this average is just a little bit lower (13.6 percent). The coexistence of high rates of growth and high unemployment is explained by the fact that more capital intensive sectors have led GDP growth in Panama. For example, in 1998, the sectors with growth rates above the average (3.9 percent) represented just the 24.9 percent of the labor force employed. It is also important to keep in mind that unemployment figures in Panama do not follow international standards and include people not actively seeking for jobs. If one would adjust for this difference, unemployment rates would fall to one digit.

Unemployment in Panama seems to have a hysteresis effect. Figure 5 shows that after the large recession of 1987-88, unemployment never returned to pre-crisis levels (perhaps only 11 years later, in 1999, unemployment will be close to pre-crisis level). This feature has a consequence on the effect and persistence of external shocks in Panama, naturally extending the costs over a long period of time.

Figure 5: Unemployment rate



D. Not Currency Risk but Default Risk

The presumption is that a dollarized economy would have more credibility by the absence of a currency risk. Figure 6 shows the J. P. Morgan' Emerging Markets Bond Index Plus (EMBI$^+$) for Argentina and Panama. Here we compare spreads paid by Argentina, a dollarized economy under a currency board and Panama under a fully dollarized regime. Observe that both are strongly influenced by the crises (Asian, Russian and Brazilian). The Russian crisis seems to be the most harmful, followed by the Asian crisis. The Russian crisis and its effect on Brazil seem to affect Argentina more than Panama. In general one cannot identify substantial difference in the behavior of Panama's and Argentina's spreads. This would indicate that most of the movement in spreads can be identified as movements in the perception of risk across Latin America, with the different currency regime having little influence on its behavior (other countries as Brazil and Mexico follow the same pattern).[6]

This does not mean that the perceived level of risk is similar across Latin America. Credit rating agencies give Panama a much better rating compared for example to Brazil or Peru (see Table 4). However, it is difficult to associate this exclusively to benefits of dollarization: Costa Rica with its floating exchange regime has similar ratings and Peru has a lower rating on foreign currency denominated bonds than in domestic bonds.[7]

It currency risk was an important component of default risk, one would expect Panama to pay lower spreads on external bonds than other comparable Latin American countries. However, during most of 1998 Panama paid a higher spread on dollar denominated external bonds relative to Costa Rica. This difference increased as the Russian crisis spilled over into a

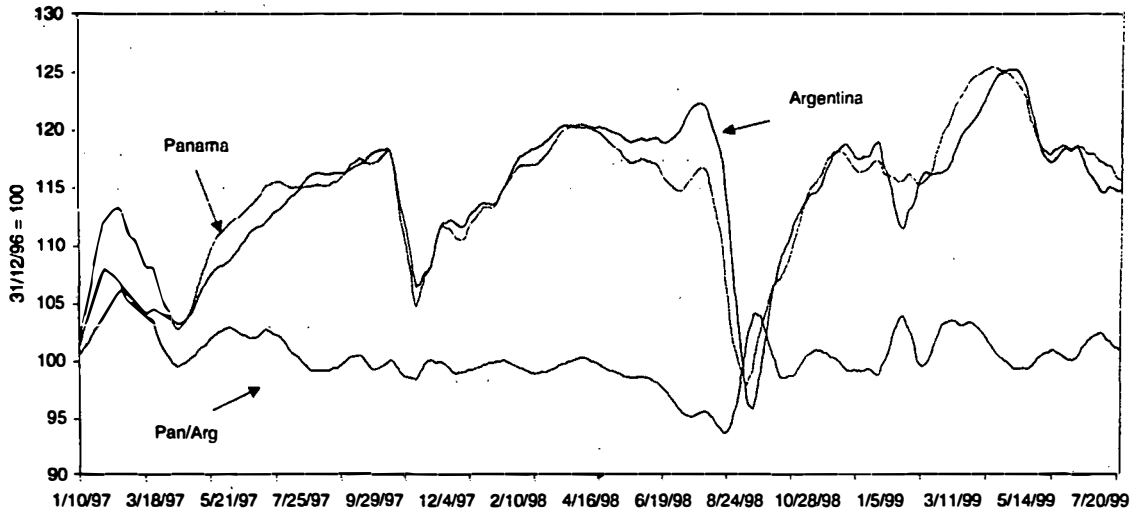
[6] Berg, Andrew and Eduardo Borensztein (1999) compare Argentine and Panamanian Brady Bonds spreads and conclude that much of the Argentina's spread cannot be attributed to currency risk. The evolution of the EMBI$^+$ series seems to reinforce this argument.

[7] Of course, this does not imply that the perceived currency risk in Peru is zero (or negative) but that the probability of default is higher on external debt bonds.

Brazilian crisis. In October 1998, Panama was paying around 700 basis points more than the equivalent U.S. Treasury bond and 340 basis points more than Costa Rica. Therefore one would not necessarily conclude that overall dollarization in Latin America would necessarily reduce spreads across the board.

If adopting a full dollarization regime does not necessarily reduce spreads on foreign debt bonds neither it guarantees automatic access to international markets. At the beginning of last March, the government of Panama tried to obtain funds through a bond issue in international markets but the operation was suspended because of the poor market conditions existing at that time (nonetheless, later on Panama obtained success with a US$500 millions 30-year bond issue at a premium of "only" 405 basis points).

Figure 6: Panama and Argentina JPMorgan EMBI+ 1997-99
(15-days centered moving average)



Source:

Table 4: Long Term Debt Ratings

	Foreign Currency		Local Currency	
	Moody's	S&P	Moody's	S&P
Argentina	Ba3	BB	Ba3	BBB-
Brazil	B2	B+	Caa1	BB-
Chile	Baa1	A-	NR	AA
Costa Rica	Ba1	BB	Ba1	BB+
Panama	Ba1	BB+	NR	BB+
Peru	Ba3	BB	Baa3	BBB-

Source: Bloomberg.
Notes:
Moody's: Baa1 > Baa3 > Ba1 > Ba3 > B2 > Caa1.
S&P: AA > A- > BBB- > BB+ > BB > BB- > B+.
NR: No rating.

Table 5: External Bond Spread
(basis points)

Countries	05/22/98	07/02/98	08/13/98	10/08/98
Panamá	236.4	296.3	341.9	699.8
Costa Rica	212.5	228,5	260.1	422.6

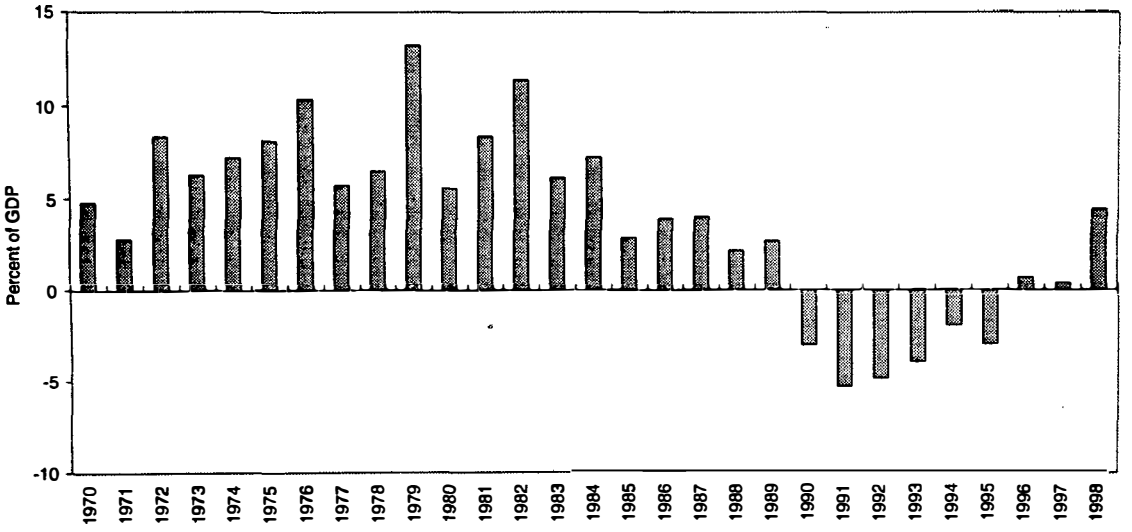
Source: Bloomberg.
Notes: For both countries we used a foreign bond issued in US dollars. The panamanian bond maturity is 2002 and the Costarican bond maturity is 2003.

E. Fiscal Discipline? Not Panama

One of the favorite arguments in favor of the adoption of "full dollarization" is the fiscal discipline that it may induce. Under this line of argument, the elimination of the possibility of printing money and the absence of seignorage revenues would limit the possibilities of financing fiscal deficits and would prompt more fiscal discipline. Does the case of Panama provide evidence that supports this presumption?

Figure 7 shows Panama's government deficit in percent of GDP. We can conclude that discipline was not a virtue of the Panamanian authorities despite the absence of seignorage revenues. This trend was reversed in the period 1990-95 thanks to an effort to improve the quality of the fiscal management.

Figure 7: Fiscal deficit



Source: IFS

Of course, fiscal deficits can be financed by increasing public debt. Statistics published by the *Ministerio de Economía y Finanzas* of Panama show that in 1995 the total public debt reached almost 100 percent of GDP, with 75 percent of the total being foreign debt. The

reduction in foreign debt observed since 1996 is the outcome of a process, started in 1994 and concluded in July 1996, that included an external bond exchange and a debt reduction operation.

Panama's reputation is not solid. The suspension of external debt payments in the period 1987 - 1988 affected its creditworthiness. Moreover in the last 25 years Panama has had 13 IMF programs, more than any Latin American country since 1963, more than fiscal troubled countries like Argentina, Peru, Brazil, or Haiti. Therefore, it is hard to conclude that dollarization in Panama has induced more fiscal discipline.

Table 6: Panama's Public Debt

	1994	1995	1996	1997	1998
(in millions of balboas)					
Domestic	1922,6	1786,0	1893,5	1878,7	1835,3
Foreign	5505,5	5891,0	5069,6	5051,0	5179,7
Total	**7428,1**	**7677,0**	**6963,1**	**6929,7**	**7015,0**
(in percent of GDP)					
Domestic	24,9	22,6	23,2	21,6	19,9
Foreign	71,2	74,5	62,2	58,1	56,2
Total	**96,0**	**97,1**	**85,4**	**79,7**	**76,1**

Source: *Informe Económico 1998, Ministerio de Economía y Finanzas de Panama*

F. Domestic Interest Rates and the Banking Sector

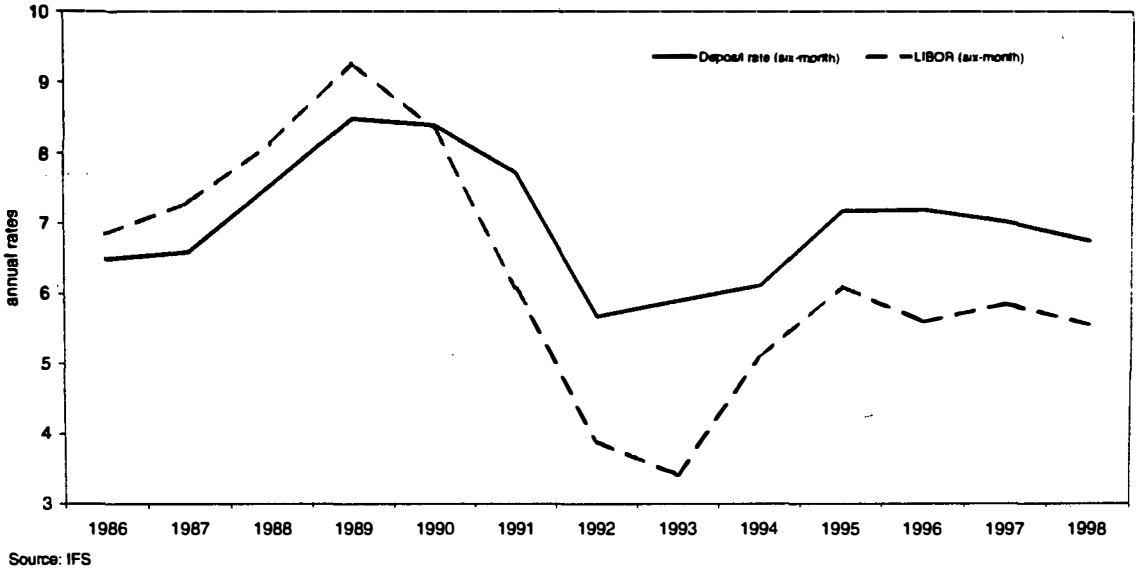
Dollarization is also assumed to reduce domestic interest rates by eliminating currency risks. Interest rates in Panama relative to international rates are shown in Figure 8 that exhibits the six-month deposit rate offered by domestic banks in Panama jointly with the six-month LIBOR. Panama's deposit rate follows closely the Libor rate, with the spread between them being approximately 100 basis points since 1995. Similarly, the lending rates in Panama followed the Prime Rate. Figure 9 shows the evolution of the lending rate for long run credits (1-5 years) for the commercial sector. In the period 1990 - 98 the spread was, on average, 289 basis points, with a maximum of 406 basis points in 1993 and falling to 247 basis points in 1998. Interest rates in Panama are probably one of the lowest in Latin America. But is it due to the elimination of currency risk?

The low interest rates are at least partially determined by Panama's financial openness. As Moreno-Villalaz (1999) asserts, Panama is "a dollar economy with financial integration". He defines four characteristics that jointly define the Panama's monetary system: First, the use of U.S. dollar as a legal tender; second, free capital markets; third, an internationalized banking system and; fourth, the absence of a central bank.

Panama liberalized its banking system and freed interest rates in 1970 allowing the modernization of this sector and its integration with world financial markets. The reform implemented in Panama allowed banks to operate in offshore and local markets simultaneously and removed restrictions on the allocation of funds by the banks between domestic and foreign market. In addition, the government opened the banking industry to foreign participants with the desire to improve the efficiency in the allocation of resources and

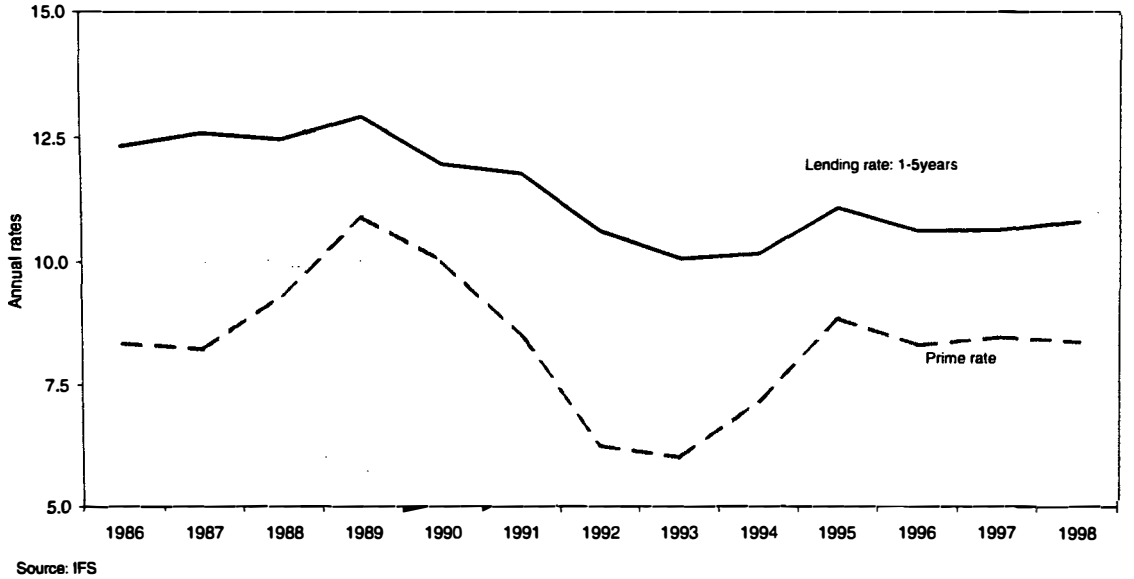
foster economic growth. With an efficient capital allocation the funds would be allocated in the projects with the highest rates of return to the economy. The result was a substantial reduction in interest rates. Figures 10 and 11 show that to date interest rates charged by foreign banks are lower than those charged by local banks.

Figure 8: Deposit rates



Source: IFS

Figure 9: Lending rates



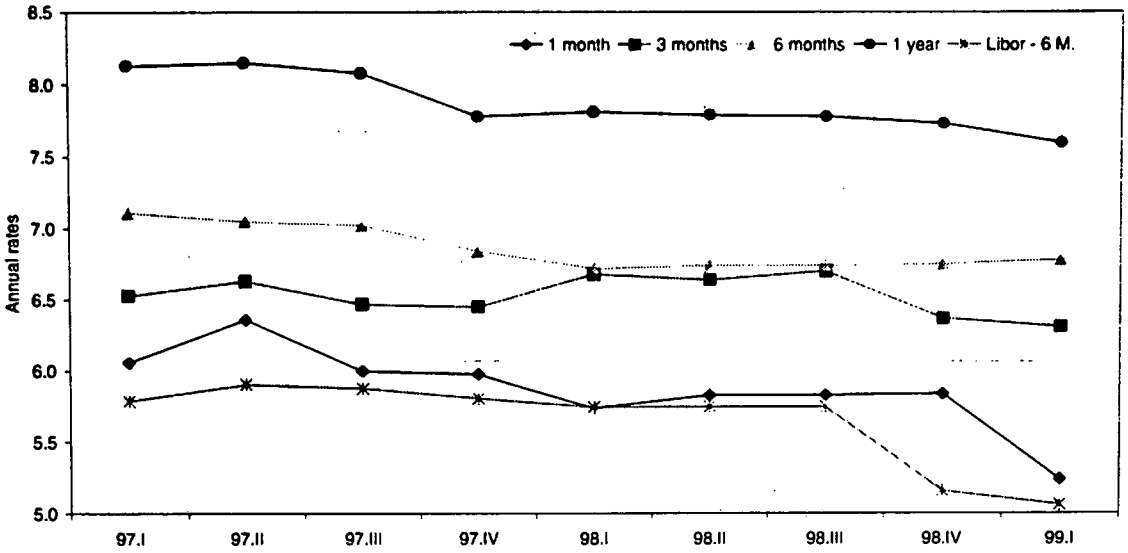
Source: IFS

The figures show the evolution of the short run (less than 1 year) deposit rates offered by both domestic and foreign banks in the period 97.I - 99.I. Foreign banks offer smaller interest rates than local banks do, probably because they offer more security and better

services than local banks. In addition, the term structure in foreign banks is flatter than in local banks reflecting lower risk premium.

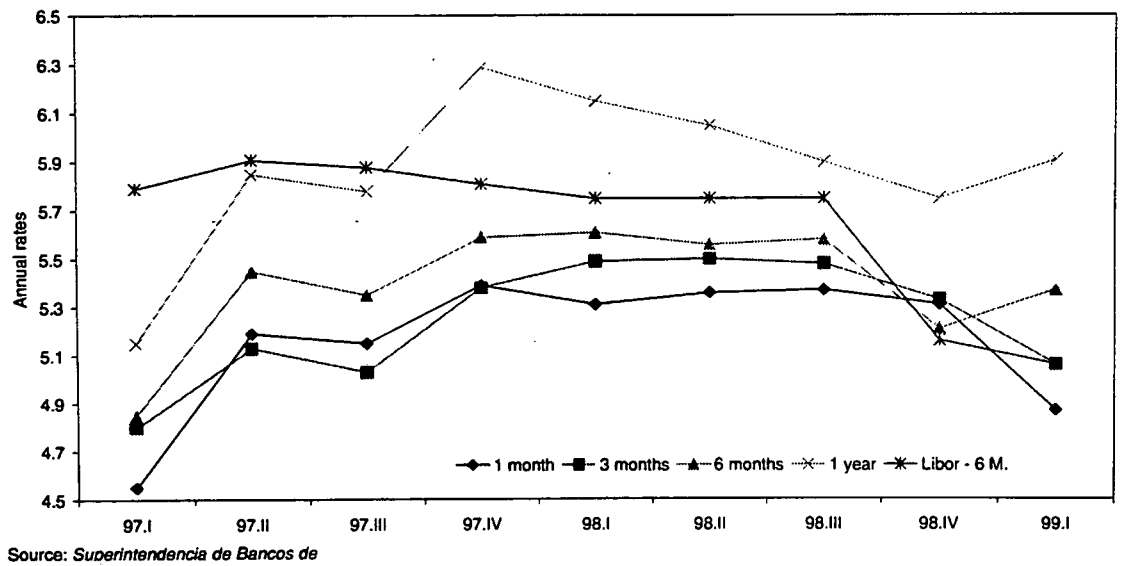
It is interesting to observe that foreign banks follow the LIBOR closer than domestic banks do. This implies that the increasing financial opening of Panama leads not only to lower interest rates but also to a higher correlation with international interest rates.

Figure 10: Local banks deposit interest rates



Source: *Superintendencia de Bancos de*

Figure 11: Foreign banks deposit interest rates



Source: *Superintendencia de Bancos de*

The benefits of the adjustment mechanism of the financial system in Panama are probably overstated Moreno-Villalaz (1999). If banks have an excess of liquidity, they allocate this resources abroad, clearing the money market. In the same way, if the problem is

lack of liquidity, banks can take resources in the international markets to eliminate the excess of money demand. In the words of Moreno-Villalaz, "access to international capital increases the availability of resources, which allows the level of investment to be independent of, and not limited by, local savings".

However, it is hard to say that investment and savings are independent. Local savings have financed 91,6 percent of investment, on average, in the period 93 – 97 (Table 7). In essence this is a restatement of the Feldstein-Horioka saving-investment puzzle for the case of Panama.

Table 7: Panama: Saving and Investment

	1993	1994	1995	1996	1997
(in percent of GDP)					
Gross Domestic investment	**24,1**	**24,5**	**26,2**	**23,6**	**25,4**
Fixed capital formation	23,8	24,2	25,0	25,1	25,9
Public sector	4,0	3,4	3,4	3,8	4,4
Private sector	19,8	20,8	21,5	21,3	21,5
Changes in inventories	0,3	0,3	1,3	-1,5	-0,5
Gross national saving	**22,0**	**24,1**	**22,8**	**22,0**	**22,4**
Public sector saving	2,6	3,8	3,5	4,2	3,3
Private sector saving	19,4	20,4	19,3	17,8	19,1
Foreign saving	**2,2**	**0,4**	**3,4**	**1,6**	**3,0**

Source: IMF Country Report No. 99/7.

G. The absence of a Lender of Last Resort and the internationalized banking system

The absence of a central bank in a fully dollarized economy implies that there is no lender of last resort in the economy. This induces banks to seek for alternative contingent credits, particularly foreign funds, to replace partially the lender of last resort role. The necessity to seek for foreign funds gives a competitive edge to international banks over domestic banks, inducing a more international banking system.

In fact, Table 8 and Figure 12 show the extent of the foreign participation in the Panamanian banking system that itself represents approximately 90 percent of the financial sector of Panama, measured in terms of assets and net worth. The overall participation of foreign banks amounts to approximately 55 percent.

H. The performance of Panama during the Asian and Russian Crises

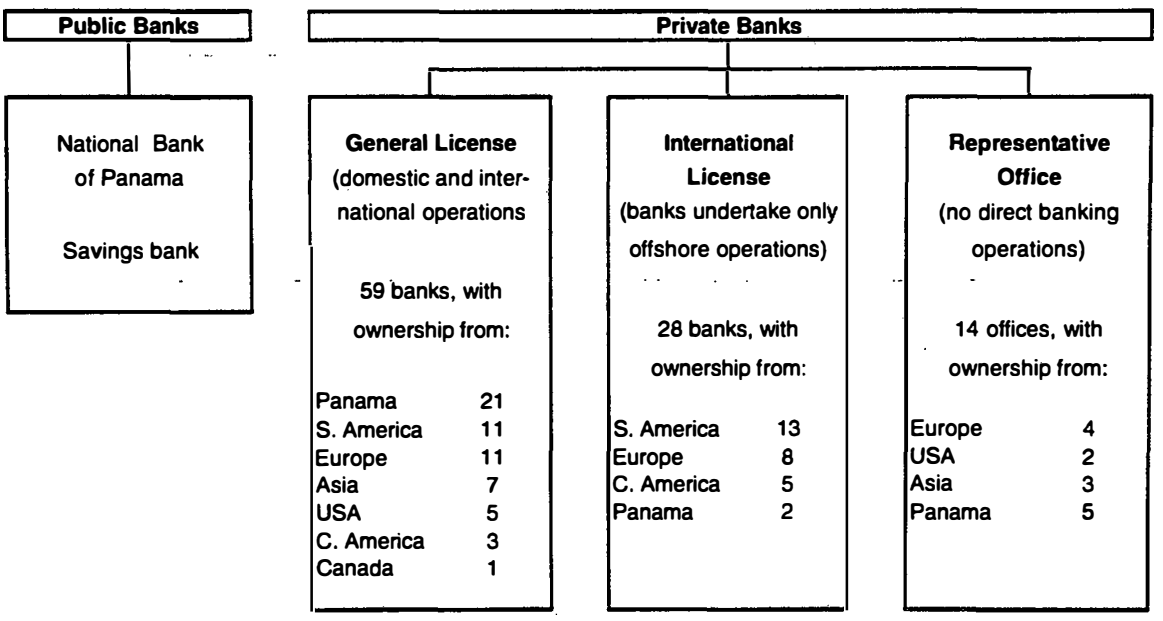
The reaction of Panama to the crisis in 1997 and 1998 was relatively mild, although not better than other countries in the region. Table 9 compares the growth performance of Panama with the rest of the region. In 1997, Panama grew at a rate lower than the average of the region, but in 1998 its growth rate was higher than the growth rate of Latin America. Also it is interesting to note that GDP performance by Panama was worst than in Argentina, where the regime is a currency board, and Mexico and the Dominican Republic, with flexible regimes.

Table 8: Panama: Foreign Banks and the National Banking System
(December 1998, in millions of US dollars)

	Foreign Banks (A)	National Banking System (B)	(A) + (B) (in percent)
Liquid Assets	2807	7000	40.1
Loans	11329	17898	63.3
Investments	791	2303	34.3
Other Assets	779	1294	60.2
Total Assets	**15706**	**28495**	**55.1**
Deposits	10013	19668	50.9
Liabilities	3614	4818	75.0
Other liabilities	685	1237	55.4
Capital	1394	2772	50.3
Total Liabilities plus Capital	**15706**	**28495**	**55.1**

Source: Superintendencia de Bancos de Panamá.

Figure 12: Structure of the International Banking Center



Source: IMF Country Report No. 99/7

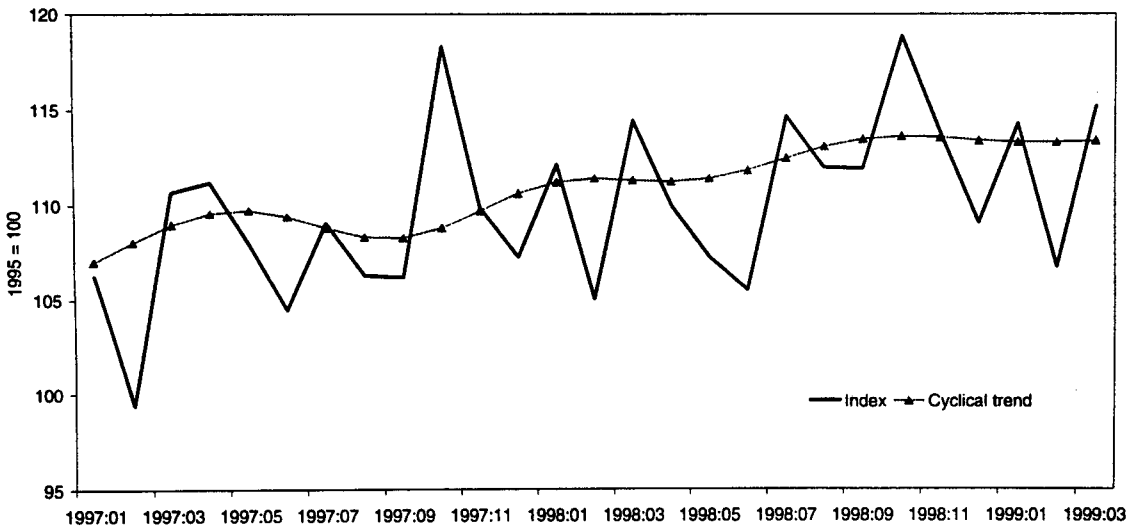
Table 9: GDP Growth 1997-98
(Annual rates)

	1997	1998
Latin America	**5,2**	**2,3**
Argentina	8,4	4,0
Brazil	3,0	0,5
Colombia	3,0	2,0
Costa Rica	3,7	5,5
Dominican Republic	5,2	7,0
Mexico	7,0	4,5
Nicaragua	5,0	3,5
Peru	7,4	1,0
Venezuela	5,1	-1,0
Caribbean	**2,0**	**1,2**
Panama	**4,7**	**3,9**

Source: *Informe Econômico 1998, Min. de Economía y Finanzas, Panama*

The effect of the crisis on Panama can be gauged looking at higher frequency data. The Monthly Index of Economic Activity tracks the evolution of the level of activity in Panama and is calculated by the *Contraloria General de la República* of Panama. In Figure 13 we plot two series: the Index itself and a seasonally adjusted series. The two observed peaks in 1997:10 and 1998:10 are actually explained by seasonal arguments. The two valleys in the adjusted series occur exactly during the crises, indicating that Panama was affected by both crises although mildly.

Figure 13: Economic Activity Index



Source: *Ministério de Economía y Finanzas de Panamá*

As we saw in the previous subsection, inflation in Panama is correlated to the inflation in the U.S., usually with a downward bias that depreciates the real exchange rate. In 1997 and 1998 the CPI inflation rates in Panama were -0,5 percent and 0,6 percent, respectively. Figure 14 shows the evolution of the CPI inflation in Panama and the U.S. Observe that the

Panamanian inflation has a higher volatility than the U.S. inflation, including some months with deflation. In particular, during the Asian crisis, Panama had a strong deflation, due to the reduction in oil prices and to the low prices of the Asian products, caused by the devaluation of the currencies in the region.

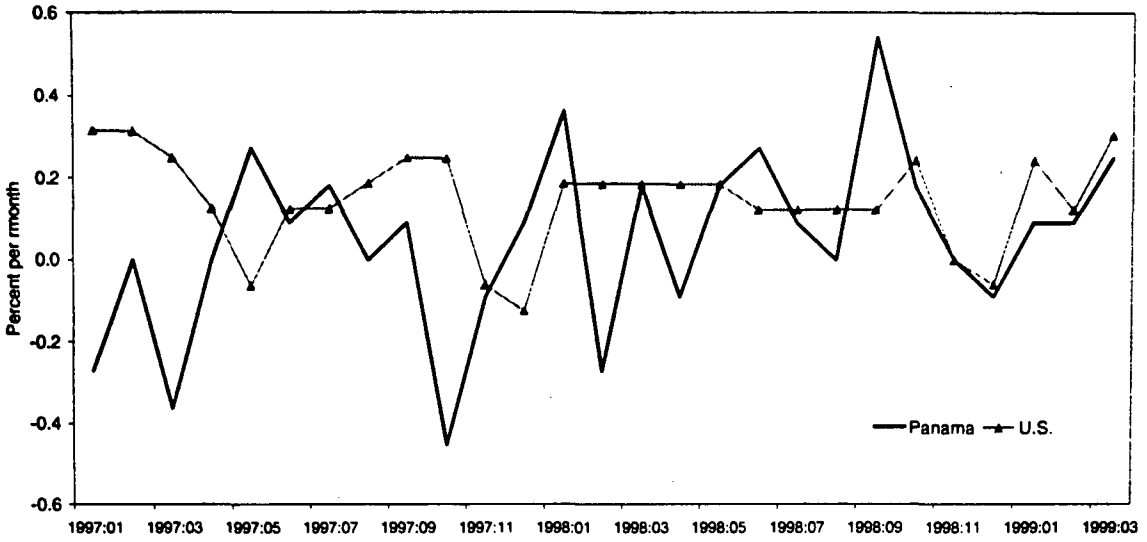
The most likely transmission mechanism of the crises to Panama is through interest rates offered by the Panamanian banking system. Depending on whether one concentrates on interest rates charged by local banks or foreign banks the effect of the Asian or Russian crisis was stronger. On one hand, the relative high rates in local banks remained stable during both crisis which implied that the spread relative to the LIBOR increased during the Russian crisis (see Figure 10). On the other hand, deposit rates on foreign banks followed closely the deposit rates in international markets, which increased substantially during the Asian crisis but not during the Russian crisis (Figure 11).

In short, the overall effect of the crises on Panama was an increase in deposit rates in foreign banks during the Asian crisis, as a consequence of the increase in international interest rates, combined with a relative increase in interest rates by local banks during the Russian crisis.

The dynamics of the lending rates in Panama confirm that the Asian and Russian crises had an important effect on the economy. The short run lending rates --consumer credit with maturity less than 1 year -- shows two peaks that coincide with the Asian (97.IV) and the Russian (98.III) crises. The long run rates – credit with maturity greater than 5 years-- shows just one peak, in 98.III. This fact is consistent with a perception of the Asian crisis as a temporary event, and the Russian crisis as a more permanent one, perhaps as a consequence of the spillover to Brazil and Latin America.

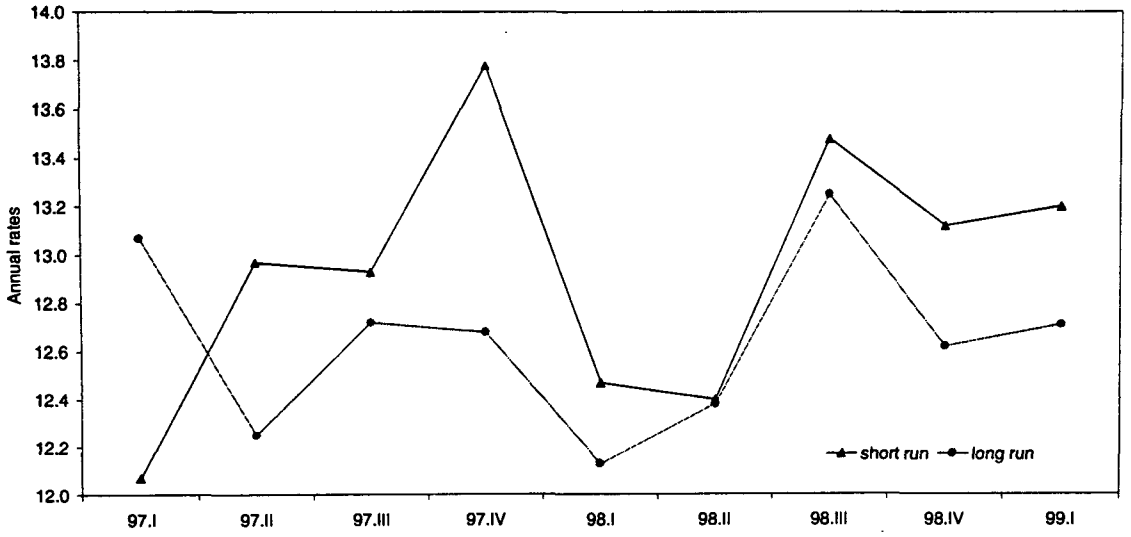
Therefore, the effect of the Asian crisis was seen as temporary, mostly concentrated in a large fall in prices rather than quantities, while the Russian crisis and its contagion to Latin America was seen as permanent shock, increasing long term lending rates and reducing GDP growth rates.

Figure 14: CPI Inflation



Source: IFS

Figure 15: Lending Rates



Source: *Superintendencia de Bancos de Panamá*

IV. Econometric Exercise: The Effect of External Shocks

In this section we analyze the effects of external shocks on growth, interest rates and the RER in Panama. It is interesting to carry on the analysis on a comparative basis, in order to gauge the relative effects of an external shock on a dollarized economy. We have chosen Costa Rica and Argentina as the control countries because the former is a small Latin American economy with a floating exchange regime and the later has a currency board regime, the closest to a full-dollarization regime.

Formally, the paper estimates a Vector Autoregression (VAR) model for each country and analyzes the effect of an external shock on domestic variables and the resulting dynamics. The domestic variables include the real exchange rate, domestic interest rate, and the level of activity. To represent the external factors we have used alternatively the J. P. Morgan' Latin Emerging Market Bond Index Plus (EMBI$^+$), representing the confidence in Latin American countries and the costs of external funds,[8] and an index of industrial production of the industrial countries, representing the world's level of activity. Because of data limitations the exercise covers the period 1994 to 1999 in a monthly frequency.

The ordering of the variables include always the external variable (the J. P. Morgan' Latin Emerging Market Bond Index Plus - EMBI$^+$ - or the industrial countries' industrial production index) as preceding both the RER and the activity level. The RER was assumed preceding the activity level variable but the results were robust to changes in the ordering (the figures and tables shown below use the following order: external variable, RER and then activity level).

The real exchange rate series used here are the Real Effective Exchange Rates (REER) from the International Monetary Fund (Information Notice System database). The industrial countries' industrial production index was taken from the IMF's International Financial Statistics. The level of activity series are the monthly series of industrial production for Argentina, the Monthly Economic Activity Index published by the *Dirección de Estadística y Censo* of Panama, and a monthly series based in quarterly GDP series for Costa Rica.[9] All variables are expressed in logs except interest rates.

A. The Effect of a Negative External Confidence Shock

The figures below show the response of the level of activity and the real exchange rate to a negative shock in the Latin EMBI+ index, representing a negative confidence shock on Latin American countries.

Panama

[8] The exercise was replicated using the federal funds rate as the external variable. It is available from the authors on request.

[9] The series for Panama starts in January 1995. For Costa Rica we used the *distrib.src* procedure of RATS to obtain the monthly series from quarterly data.

A negative confidence shock has a negative and significant effect on the real exchange rate (real depreciation). The effect on the level of activity is initially positive and insignificant, but five months after the shock we observe a negative and significant effect. In other words, a negative confidence shock generates a recession in Panama (see Figure 16)

The variance decomposition of the forecast errors of the estimated VAR shows that after 24 months thirty-four percent of the variance of the real exchange rate is explained by the external confidence variable. In the case of the level of activity, the external confidence variable explains only 17 percent of the variance (Table 10).[10]

Costa Rica:

In this case we have used data from the period 1994:01-1999:06. The results for Costa Rica show that a negative confidence shock has a strong effect on the real exchange rate. Figure 17 shows that the shock generates a strong real depreciation. The effect of the shock on the level of activity is negative and becomes statistically significant after six months, attaining its lower value nine months after the shock. One year later the effect becomes insignificant.

The variance decomposition of the forecast errors of the real effective exchange rate and the estimated monthly GDP series show that, in the first case, the Latin EMBI+ series explains more than fifty-eight percent of the variance in a 24-months horizon. In the case of the level of activity, the series Latin EMBI+ series explains more than 30 percent of the variance in a 24-months horizon (Table 11). These variances are larger than in Panama.

To check the robustness of our results we ran an alternative VAR including the Latin EMBI+, the domestic discount rate and the real exchange rate for the same period. The results are equivalent and appear in the appendix.

Argentina:

Figure 18 show the impulse-response graphs for Argentina estimated with a VAR including the Latin EMBI+, the real exchange rate and an index of industrial production in the period 1994:01-1999:06. Observe that a negative confidence shock has a significant impact on both real exchange rate and level of activity series. In other words, the negative confidence shocks generates a real depreciation and a recession. Both results were as expected.

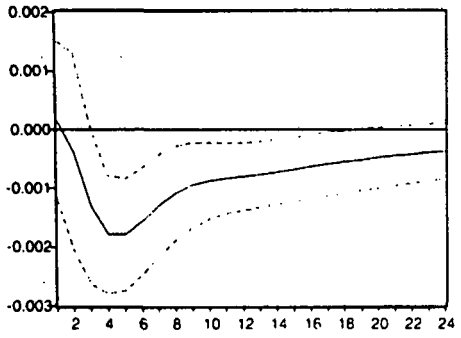
The variance decomposition of the forecast error of the real exchange rate series shows that, after 24 months, thirty-eight percent of the variance is explained by the Latin EMBI+ series. In the case of the level of activity series the Latin EMBI+ series explains thirty-two percent and the real exchange rate series explains twenty-five percent of the variance (Table 12).

For Argentina, we replicated the same exercise using the domestic money market rate in dollars (MMDAR) instead of the real exchange rate. Results are shown in the appendix.

[10] One could argue that a shock in the EMBI+ does not represent an external confidence shock for Panama. The appendix shows an equivalent exercise using instead the Federal Funds Rate with similar results, although less significant

Figure 16: Response of Panama to a negative Latin EMBI+ shock

Real effective exchange rate



Level of activity

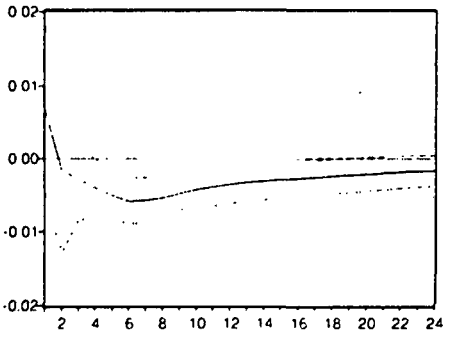
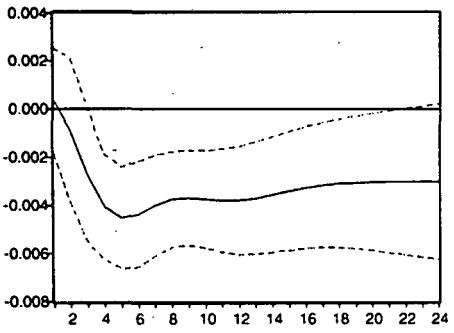


Figure 17: Response of Costa Rica to a negative Latin EMBI+ shock

Real effective exchange rate



Level of activity

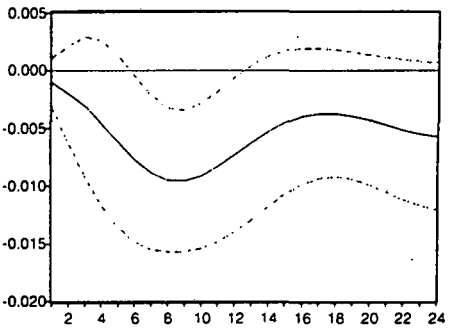
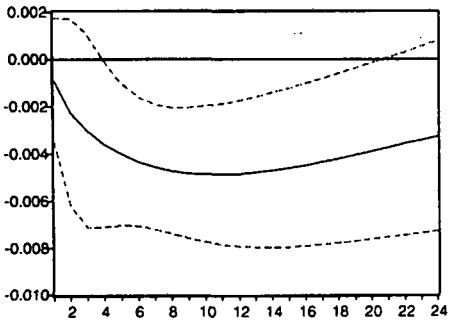


Figure 18: Response of Argentina to a negative Latin EMBI+ shock

Real effective exchange rate



Level of activity

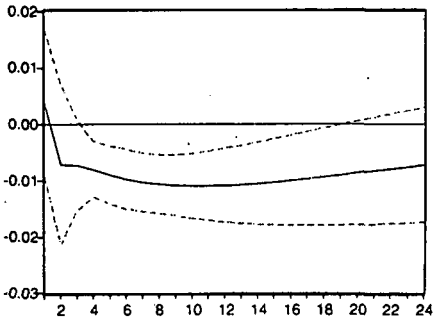


Table10: Variance Decomposition, Panama

Real Exchange Rate:

Period	Standard Error	EMBI+	Real Exchange Rate	Economic Activity
1	0.043721	0.121416	99.87858	0.000000
6	0.095298	22.34655	73.20348	4.449969
12	0.112384	29.85842	63.88347	6.258112
18	0.119382	32.80853	60.62932	6.562143
24	0.122386	34.01723	59.27944	6.703323

Economic Activity

Period	Standard Error	EMBI+	Real Exchange Rate	Economic Activity
1	0.004563	3.072169	0.148170	96.77966
6	0.006930	7.652978	5.226561	87.12046
12	0.007450	13.96428	4.965100	81.07062
18	0.007648	16.17047	4.821566	79.00796
24	0.007735	17.13086	4.760561	78.10858

Table 11: Variance Decomposition, Costa Rica

Real Exchange Rate:

Period	Standard Error	EMBI+	Real Exchange Rate	Economic Activity
1	0.047318	0.160730	99.83927	0.000000
6	0.122291	26.36421	71.06209	2.573701
12	0.160113	44.47961	52.58600	2.934384
18	0.187989	53.39919	43.67360	2.927217
24	0.209052	58.58272	38.70104	2.716238

Economic Activity

Period	Standard Error	EMBI+	Real Exchange Rate	Economic Activity
1	0.008662	1.506547	0.040876	98.45258
6	0.015621	8.447155	8.229046	83.32380
12	0.018425	25.81713	6.976569	67.20630
18	0.020255	27.86489	6.458307	65.67680
24	0.021634	30.45789	6.648489	62.89363

Table12: Variance Decomposition, Argentina

Real Exchange Rate:

Period	Standard Error	EMBI+	Real Exchange Rate	Economic Activity
1	0.045105	0.792458	99.20754	0.000000
6	0.130612	13.22874	86.27524	0.496012
12	0.190385	31.45689	67.71139	0.831719
18	0.223148	37.50190	61.77723	0.720874
24	0.240270	38.04168	61.34600	0.612316

Economic Activity:

Period	Standard Error	EMBI+	Real Exchange Rate	Economic Activity
1	0.009940	0.560508	5.307466	94.13203
6	0.021770	10.05138	11.39081	78.55781
12	0.025185	24.03217	11.88120	64.08663
18	0.029304	30.10064	18.95965	50.93971
24	0.032526	31.59138	25.19599	43.21263

B. The Effect of a Negative External Real Shock

This section estimates the VAR models replacing the EMBI+ series for the industrial countries' production index. The idea is to analyze the effect of a negative real shock (instead of a financial shock) on Panama, Costa Rica and Argentina. Figures 19-21 below show the responses of both the real exchange rate and the level of activity for each country.

Panama:

A negative real shock on industrial countries generates, as expected, a real depreciation and a recession in Panama. The depreciation becomes statistically significant after the third month and remains significant for seventeen months. The recession also becomes significant after three months and lasts nineteen months (See Figure 19)

The variance decomposition shows that after 24 months thirty-one percent of the variance of the real exchange rate and twenty-nine percent of the variance of the level of activity are explained by the external variable (Table 13)

Costa Rica:

A negative real shock in the industrial countries also provokes both a real depreciation and a recession in Costa Rica. The effects on Costa Rica seem to last longer than on Panama. Both real depreciation and recession remain significant after 24 months.

The variance decomposition shows that after 24 months the external variable explains twenty-nine percent of the variance of the real exchange rate and thirty-four percent of the level of activity variance. For the real exchange rate the proportion that is explained by the external variable is smaller in the case of Costa Rica than in the case of Panama. For the level of activity the proportion of the variance that is explained by the external variable is larger in Costa Rica than in Panama.

Argentina:

In the case of Argentina the negative real shock in the industrial countries has also negatives effects on both Argentine real exchange rate and level of activity, but these effects seem to be shorter than in the cases of Panama and Costa Rica. The real depreciation becomes significant after three months and remains in this way during nine months. The recession begins to be statistically significant three months after the shock and lasts fourteen months.

The variance decomposition shows that after 24 months the external variable explains twenty-one percent of the variance of the real exchange rate and twenty percent of the variance of the level of activity. For both variables (real exchange rate and level of activity) the proportion of the variance explained by the real external variable is lower in Argentina than in Costa Rica and Panama.

Figure 19: Response of Panama to a negative real shock in Industrial Countries

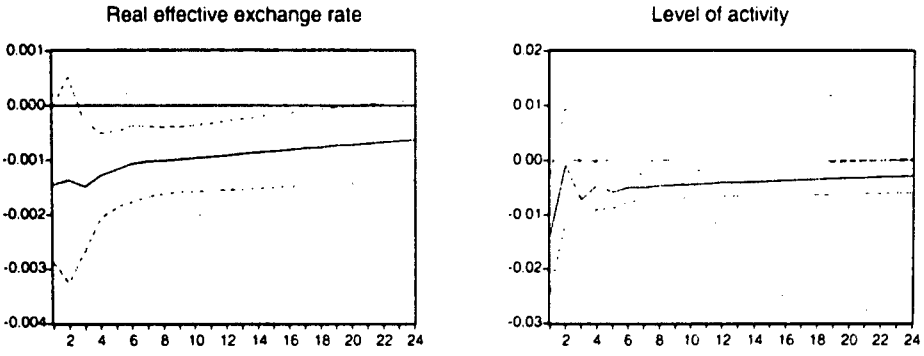


Figure 20: Response of Costa Rica to a negative real shock in Industrial Countries

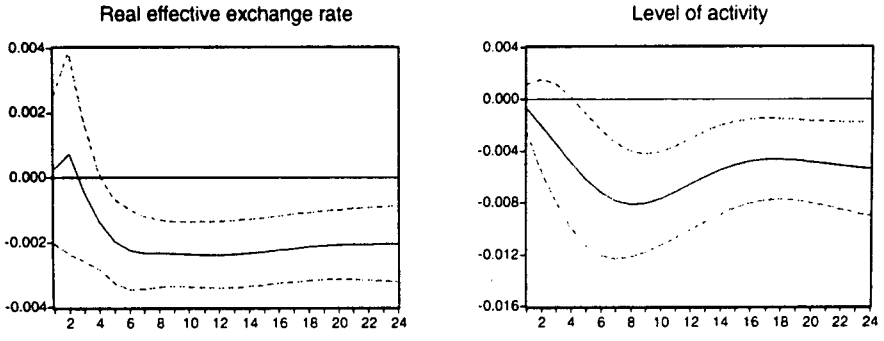


Figure 21: Response of Argentina to a negative real shock in Industrial Countries

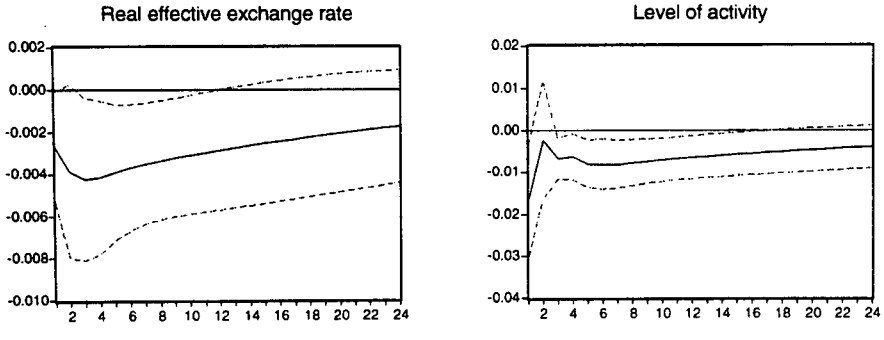


Table 13: Variance Decomposition, Panama

Real Exchange Rate

Period	Standard Error	Industrial Countries	Real Exchange Rate	Economic Activity
1	0.005577	8.706003	91.29400	0.000000
6	0.010401	17.61085	76.94175	5.447402
12	0.013228	24.56638	69.58477	5.848851
18	0.014875	28.73996	65.06955	6.190491
24	0.015916	31.32330	62.27634	6.400361

Economic Activity

Period	Standard Error	Industrial Countries	Real Exchange Rate	Economic Activity
1	0.004932	13.03384	0.171464	86.79469
6	0.007690	19.05990	3.295870	77.64423
12	0.008113	24.26642	3.190026	72.54355
18	0.008393	27.43776	3.056819	69.50542
24	0.008580	29.45332	2.974488	67.57220

Table 14: Variance Decomposition, Costa Rica

Real Exchange Rate

Period	Standard Error	Industrial Countries	Real Exchange Rate	Economic Activity
1	0.006766	0.055044	99.94496	0.000000
6	0.013908	4.230179	94.86453	0.905293
12	0.019594	14.24593	82.42421	3.329864
18	0.023615	21.76496	75.17314	3.061902
24	0.026775	27.06418	69.94662	2.989199

Economic Activity

Period	Standard Error	Industrial Countries	Real Exchange Rate	Economic Activity
1	0.010693	0.617590	0.053107	99.32930
6	0.016514	9.125956	0.847742	90.02630
12	0.017753	24.72531	1.333429	73.94126
18	0.018611	29.51954	1.499522	68.98094
24	0.019306	33.73024	1.402571	64.86719

Table 15: Variance Decomposition, Argentina

Real Exchange Rate

Period	Standard Error	Industrial Countries	Real Exchange Rate	Economic Activity
1	0.005826	6.999612	93.00039	0.000000
6	0.010098	12.74856	84.91073	2.340703
12	0.012457	16.83459	79.59655	3.568865
18	0.013699	19.47201	76.65064	3.877346
24	0.014403	21.11278	74.89653	3.990697

Economic Activity

Period	Standard Error	Industrial Countries	Real Exchange Rate	Economic Activity
1	0.010299	10.38105	5.006202	84.61275
6	0.026085	11.86123	17.59437	70.54440
12	0.029570	15.92782	24.81283	59.25936
18	0.030775	18.40577	25.55210	56.04213
24	0.031316	19.91565	25.46791	54.61643

C. Summary of Econometric Results and Comparative Analysis

Under the hypothesis that a negative shock in the JP Morgan Latin EMBI+ in fact represents an external negative confidence shock, the paper has analyzed the effects of a confidence shock on the real exchange rate, the domestic interest rates and the level of activity for Panama, Costa Rica and Argentina. There are two main results. First, as expected, a negative external confidence shock affects significantly the level of activity generating recessions in all the three countries. Since these countries maintain different exchange-rates regimes, one may conclude that an "external confidence shock" has significant effects on Latin American countries' level of activity **independently** of the exchange-rate regime.

There are, however, differences in the extent of the shocks. The variance decomposition analysis provides evidence that the external shocks in Panama explain a much smaller proportion of the overall variance in the activity level, about half of the proportion explained in Argentina and Costa Rica. This result occurs despite the fact that Panama is a very open economy and foreign interest rates translate fast into domestic interest rates. One explanation is, of course, that the credibility gained in a dollarized economy may contribute to insulate the economy from adverse shocks. The problem is that we have seen that domestic interest rates react strongly to the external environment. Another explanation is the fact that Panama's activities are concentrated in services, which may fluctuate less with external factors or may have more automatic stabilizers.

Second, negative external confidence shocks provoke real depreciations in all the countries and, therefore, it seems that the direction and significance of the effect is independent of the exchange-rate regime. However, as expected, the intensity of the shock differs across the countries. Costa Rica has a larger effect on the RER than both Argentina and Panama basically due to the floating exchange regime. Fixed exchange regimes minimize the effect the variability of the RER's. This does not mean that the price effects are negligible in Panama but that they are smaller than the exchange variations in Costa Rica. In fact, quite to the contrary, price movements could be substantial in Panama, as was Panama's deflation during the Asian crisis.

In our second exercise we have analyzed the effects of a negative real shock affecting the industrial countries on the real exchange rate and the level of activity in Panama, Costa Rica and Argentina. In contrast to the previous exercise, the external shocks seem to affect more the activity level in Panama and Costa Rica than in Argentina. This result contradicts the hypothesis that Panama's service economy is generally less affected by external shocks than the other economies and suggests that it is particularly financial shocks that have mild effects. Indeed, real shocks have strong effects on both real exchange rate and the level of activity in Panama.

V. Conclusions

This paper analyzed the case of Panama focusing on the consequences of its extreme exchange regime for the rest of the economy. The objective was to provide some empirical evidence for the debate on the benefits and costs of full dollarization from the experience of one the largest dollarized economy in the world. The limits of this strategy are well known. It is difficult to separate the effect of full dollarization from the effect of other idiosyncratic differences in Panama. The paper has tried to control for some of the other effects comparing Panama with similar countries, first with the rest of Latin America and then, particularly, with Costa Rica and Argentina.

Notwithstanding this intrinsic difficulty, the paper offers a few conclusions regarding the effect of full dollarization. First, inflation performance is impressive both in terms of its average and volatility in the last 30 years. Panama's record is helped by the fact that non-tradable relative price has a long run downward trend.

Second, domestic interest rates are indeed lower in Panama than in other Latin American countries. This fact, however, must be attributed partly to the reform of the financial system that both freed and opened completely the markets to foreign participation.

Third, full dollarization does not necessarily reduce spreads on foreign debt bonds neither it guarantees automatic access to international markets. Although Panama's spreads are relatively low compared to the average in Latin America, they are not lower than in Costa Rica. Moreover, Panama's external debt spreads are extremely correlated to other spreads, as for example, the Argentine. In essence dollarization reduces currency risk but not necessarily default risk.

Fourth, the absence of inflationary finance does not necessarily induce more fiscal discipline. The fiscal performance of Panama has been poor and had led to very high public debt and even default on external obligations. Moreover in the last 25 years Panama has had 13 IMF programs, more than any Latin American country since 1963.

Fifth, Panama has experienced a high volatility of GDP. This conclusion is reversed somewhat if one considers as outliers the extreme cases as the debt crisis in 1982-83 and Noriega's political crisis in 1987-88 (see Moreno-Villalaz, 1999). However, one could argue that the suspension of the lines of credit and the obstruction of the clearing of Panama's payments by the U.S. during the political crisis that led to a severe recession must be accounted as part of the costs of full dollarization.

In the empirical exercises, the external confidence shock in Panama explains a much smaller proportion of the overall variance of the activity level than in Argentina or Costa Rica. This could be interpreted as evidence that overall confidence shocks may have a smaller effect on more credible currency regimes. This interpretation is further supported by the fact that once confidence variables are replaced by real shocks, the level of activity of Panama reacts as strongly as in Costa Rica and stronger than in Argentina. These two results would suggest that adopting a more rigid regime could be useful to minimize the effects of confidence shocks, but not necessarily to reduce the effect of real shocks.

Sixth, the absence of a lender of last resort has induced banks to seek for alternative contingent funds. This gave a competitive edge to international banks over domestic banks inducing a more international banking system in Panama.

References

Barro, Robert, and David Gordon (1983). "A positive theory of monetary policy in a natural rate model". *Journal of Political Economy*, 91, pages 589-610.

Berg, Andrew, and Eduardo Borensztein (1999). "Full Dollarization". IMF Policy Discussion Paper (in preparation). Washington.

Blejer, Frenkel, Leiderman, Razin, Cheney (1997).

Calvo, Guillermo (1998). *Capital Flows and Capital-Market Crises: The Simple Economics of Sudden Stops*. Journal of Applied Economics (CEMA), 1.1, November, pp. 35-54.

Calvo, Guillermo (1999a). *Argentina's Dollarization Project: A Primer*. Available from http://www.bsos.umd.edu/econ/ciecalvo.

---------- (1999b). *On Dollarization*. Available from http://www.bsos.umd.edu/econ/ciecalvo.

---------- (1999c). *Testimony on Full Dollarization*. Available from http://www.bsos.umd/econ/ciecalvo.

---------- (1999d). *Fixed versus Flexible Exchange Rates: Preliminaries of a Turn-of-Millenium Rematch*. Available from http://www.bsos.umd.edu/econ/ciecalvo.

Dornbusch, R. Goldfajn, I. and Valdés, R. O. "Currency Crises and Collapses." BPEA, 1995.

Drazen, Allan, and Paul Masson (1994). "Credibility of Policies versus Credibility of Policymakers". *Quarterly Journal of Economics*, 109, 3. Page 735.

Edwards, Sebastian, and Miguel Savastano (1999). "Exchange rates in emerging economies: What do we know? What do we need to know? ". NBER Working Paper No. 7228.

Feldstein, Martin, and Charles Horioka (1980). "Domestic savings and international capital flows". *Economic Journal*. 90, June.

Fischer, Stanley (1999). *The Financial Crisis in Emerging Markets: Some lessons*. Available from http://www.imf.org.

Ghosh, Atish, Anne-Marie Gulde, Jonathan Ostry and Holger Wolf (1997). "Does nominal exchange rates regime matters?" NBER Working Paper No. 5874.

Ghosh, Atish, Anne-Marie Gulde and Wolger Wolf (1998). "Currency boards: The ultimate fix?" IMF Working Paper No. 98/8.

Hanke, Steve H. and Kurt Schuler (1999). *A Dollarization Blueprint for Argentina*. Foreign Policy Briefling No. 52. The Cato Institute. Washington D.C.

International Monetary Fund (1999). *Panama: Recent Economic Developments*. Staff Country Report No. 99/7. Washington D.C.

Ize, Alain and Eduardo Levy-Yeyati (1998). *Dollarization of Financial Intermediation: Causes and Policy Implications*. Working Paper No. 98/28. International Monetary Fund. Washington D.C.

Krugman, Paul (1999). *Monomoney mania*. Available from http://www.slate.com.

Krugman, Paul (1999). Don't Laugh at Me, Argentina . Available at the site www.slate.com.

Liviatan, Nissan, (ed.) (1993). *Proceedings of a Conference on Currency Substitution and Currency Boards*. Discussion Paper No. 207. The World Bank. Washington D.C.

Ministerio de Econom a y Finanzas de PanamÆ (1999)*Informe Econ mico 1998* . PanamÆ.

Mishkin, Frederic (1999). International experiences with different monetary policy regimes . Journal of Monetary Economics, 43, pages. 579-605.

Moreno-Villalaz, Juan Luis (1999). "Lessons from the Monetary Experience of Panama: A Dollar Economy with Financial Integration". *Cato Journal*, Vol. 18, No. 3 (Winter).

Obstfeld, M (1994). "The logic of currency crises", NBER working paper No. 4640, February 1994;

Obstfeld, M (1997). "Destabilizing effects of exchange-rate escape clauses", *Journal of International Economics*, 43, pages 61-77.

Rogoff, Kenneth (1998). *The Risks of Unilateral Exchange Rates Pegs*. Paper presented in the 1998 Bank of Korea conference on "Implications of Globalization for Macroeconomic Policy".

Schuler, Kurt (1998). *Dollarizing Indonesia*. Available from http://www.erols.com/kurrency.

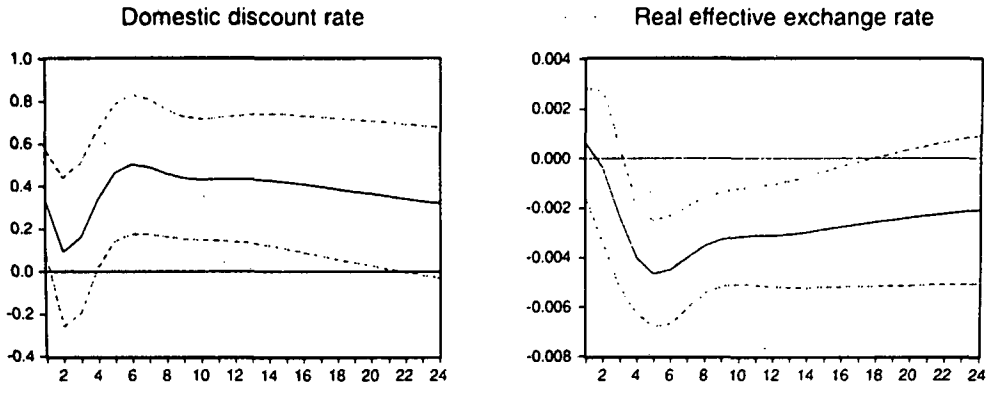
Wagner, Helmut, (ed.) (1998). ***Current Issues in Monetary Economics***. Physica Verlag, Heidelberg.

Appendix I: Robustness Checks for the Econometric Exercise

Costa Rica

To check the robustness of our results we ran an alternative VAR including the Latin EMBI+, the domestic discount rate and the real exchange rate for the same period. The results appear below.

Figure A1: Responses of Costa Rica to a negative Latin EMBI+ shock



Observe that a negative confidence shock generates, as expected, a significant rise in the domestic discount rate and, on the other size, it impacts significantly on the real exchange rate; the same result that we obtained in the first VAR. The fall in the domestic discount rate is compatible with the response of our estimated monthly GDP series in the first VAR too. In fact, in a VAR including the Latin EMBI+, the domestic discount rate, and the estimated monthly GDP (whose results are not reported here), we found that a negative confidence shock has a positive and significant effect on the domestic discount rate and a negative and significant effect on the level of activity, as expected.

The results of the variance decomposition in our second VAR show that the Latin EMBI+ series explains forty-five percent of each the domestic discount rate and the real exchange rate in a 24-month horizon.

Variance Decomposition

Discount Rate:

Period	Standard Error	EMBI+	Discount Rate	Real Exchange Rate
1	0.046301	10.48636	89.51364	0.000000
6	0.117557	16.08615	67.44465	16.46921
12	0.161630	32.26448	51.43597	16.29955
18	0.190659	41.03516	44.35566	14.60918
24	0.208999	44.57994	40.84389	14.57618

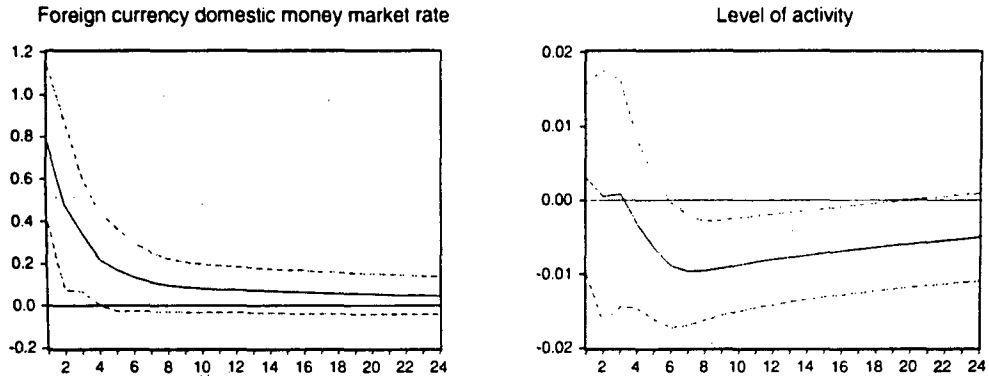
Real Exchange Rate:

Period	Standard Error	EMBI+	Discount Rate	Real Exchange Rate
1	1.003604	0.481595	3.219275	96.29913
6	2.123572	25.54785	3.095166	71.35698
12	2.454586	38.79801	5.755333	55.44665
18	2.694124	43.51540	8.061586	48.42301
24	2.887880	45.37475	9.490765	45.13449

Argentina

For Argentina, we did the same exercise using the domestic money market rate in dollars (MMDAR) instead of the real exchange rate. We found that a positive confidence shock has, as expected, a temporarily significant decrease in MMDAR and a statistically significant increase in the level of activity. [11]

Figure A2: Responses of Argentina to a negative Latin EMBI+ shock



Variance Decomposition

Domestic Rate:

Period	Standard Error	EMBI+	Domestic rate	Economic activity
1	0.046313	26.86912	73.13088	0.000000
6	0.112388	37.33098	60.12886	2.540164
12	0.142088	38.25743	59.20288	2.539693
18	0.157649	38.71350	58.75781	2.528689
24	0.166621	38.99262	58.48558	2.521792

Economic Activity:

Period	Standard Error	EMBI+	Domestic rate	Economic activity
1	1.484510	0.380491	7.290141	92.32937
6	1.663503	2.901571	9.319610	87.77882
12	1.681245	11.27500	10.66474	78.06026
18	1.691006	15.62388	11.31196	73.06416
24	1.697059	18.06257	11.67289	70.26454

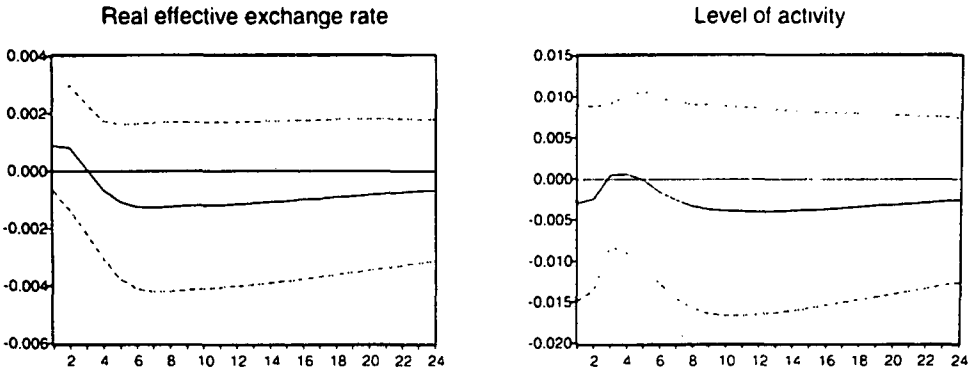
The variance decomposition shows that MMDAR explains more than fifty-eight percent of its own variance in a 24-month horizon and that EMBI+ index contributes with almost thirty-nine percent. In the case of industrial production, the own series explains more than seventy percent in the same horizon.

[11] The results are similar if we use the domestic currency money market interest rate.

Panama:

Figure A3 below shows our main results for Panama using a VAR including the Federal Funds Rate (FFR), the real exchange rate and the economic activity index for the period 1995:01-1999:03. A positive Federal Funds Rate shock (representing a tight U.S. monetary policy) generates a recession and a depreciation, although these effects are not statistically significant.

Figure A3: Response of Panama to a positive Federal Funds Rate shock



Variance Decomposition

Real Exchange Rate:

Period	Standard Error	Federal Funds Rate	Real Exchange Rate	Economic Activity
1	0.110633	2.708065	97.29193	0.000000
6	0.266693	4.736536	88.39042	6.873047
12	0.314043	11.66755	79.18429	9.148154
18	0.334016	15.80471	74.43492	9.760377
24	0.343859	17.97125	72.03201	9.996747

Economic Activity:

Period	Standard Error	Federal Funds Rate	Real Exchange Rate	Economic Activity
1	0.005322	0.518876	4.454170	95.02695
6	0.009837	0.696024	28.45759	70.84639
12	0.010713	3.414312	31.05125	65.53444
18	0.011147	6.060028	30.65321	63.28676
24	0.011373	7.636968	30.25525	62.10778

The analysis of the variance decomposition show that, after 24 months, the real exchange rate series continues to be the main cause (more than seventy-two percent) of its own forecast errors, with FFR explaining eighteen percent. The same thing occurs in the case of the level of activity. The series itself explain more then sixty-two percent of its own variance 24 months later while the real exchange rate series contributes thirty percent and FFR almost eight percent.

Appendix II : Dollarized Countries. Based in Schuler (1998) and Rogoff (1998).

Country	Population	Political Status	Currency used	Since
Andorra	63,000	Independent	French franc and Spanish peseta	1278
Bhutan	1.5 mn.	Independent	Indian rupeee	1948
Channel Islands	140,000	British dependencies	pound sterling	1797
Cocos Islands	600	Australian external territory	Australian dollar	1955
Cyprus, Northern	180,000	de facto independent	Turkish lira	1974
Greenland	56,000	Danish self-governing region	Danish krone	Before 1800
Guam	150,000	U.S. territory	U.S. dollar	1898
Kiribati	80,000	Independent	Australian dollar	1943
Liechstenstein	31,000	Independent	Swiss franc	1921
Marshall Islands	60,000	Independent	U.S. dollar	1944
Micronesia	120,000	Independent	U.S. dollar	1944
Monaco	30,000	Independent	French franc	1865
Nauru	8,000	Independent	Australian dollar	1914
Niue	2,000	New Zealand self-governing Territory	New Zealand dollar	1901
Norfolk Island	2,000	Australian external territory	Australian dollar	Before 1900
Northern Mariana Islands	48,000	U.S. commonwealth	U.S. dollar	1944
Palau	18,000	Independent	U.S. dollar	1944
Panama	2.5 mn.	Independent	1 balboa = US$ 1; uses dollar notes	1904
Pitcairn Island	56	British dependency	New Zealand and US. dollars	1800s
Puerto Rico	3.5 mn.	U.S. commonwealth	U.S. dollar	1899
Saint Helena	6,000	British colony	pound sterling	1834
Samoa, American	60,000	U.S. territory	U.S. dollar	1899
San Marino	24,000	Independent	Italian lira	1897
Tokelau	1,600	New Zealand territory	New Zealand dollar	1926
Turks and Caicos Islands	14,000	British colony	U.S. dollar	1973
Tuvalu	10,000	Independent	Australian dollar	1892
Vatican City	1,000	Independent	Italian lira	1929
Virgin Islands, British	17,000	British dependency	U.S. dollar	1973
Virgin Islands, U.S.	100,000	U.S. territory	U.S. dollar	1917

Appendix III: The Model

This is an application of Obstfeld (1994, 1997). All the variables are expressed in natural logarithms and we will assume that PPP holds. Assuming PPP allow us to set e_t, the home-currency price of foreign exchange, as being equal to p_t, the money price of domestic output.[12]

As in Obstfeld (1994), we define y_t, the domestic output, in the following way:

$$y_t = \alpha(e_t - w_t) - u_t \tag{1}$$

where w_t is the money wage and u_t is a mean-zero, serially independent shock. We interpreted u_t as been simply an aggregate demand shock.

As usual in this type of models, wages are determined based in expectations at t-1. Thus, w_t does not respond to u_t. In other words, there is no possibility to workers to contract u_t.

$$w_t = E_{t-1}\{e_t\} \tag{2}$$

The workers cannot adjust their wages according with realizations of u_t, but the government can because it "plays" after u_t is known. How can the government respond? It responds through changes in the contemporaneous exchange rate. In this way the government has the possibility to stabilize the economy.

The government problem is minimize the following loss function

$$L_t = \frac{\theta}{2}(e_t - e_{t-1})^2 + \frac{1}{2}[\alpha(e_t - w_t) - u_t - y^*]^2 + cZ_t \tag{3}$$

This loss function penalizes deviation of inflation rates from a target of zero and also penalizes deviations of output from a target y^*. This target y*--different of zero--is, of course, the source of the policymaker's credibility problem. We include a fixed cost c multiplied by a variable Z that will be 1 if the government abandon the regime and zero otherwise. In our model, the fixed cost c represents the cost of abandon the regime or, in other words, the degree of rigidity of the regime. Intuitively, more rigid regimes are characterized as regimes with higher costs of abandon. Thus, for example, a currency board is more rigid than a simple peg and a full dollarization regime is more rigid than a currency board. It is easy to rationalize the same relationship in terms of costs of abandon these regimes. In consequence, the higher the cost of abandon the regime, the more rigid it is.

The government faces a nominal wage w_t defined before to its decision about the exchange rate for period t. Thus, there is a predetermined expected rate of inflation $\pi_t = w_t - e_{t-1} = E_{t-1}\{e_t\} - e_{t-1}$. Then, if the government maintains the regime the loss function will be:

$$L_t^M = \frac{1}{2}(\alpha\pi_t + u_t + y^*)^2 \tag{4}$$

Otherwise, the loss function will be:

[12] Of course, setting p_t^*, the foreign currency price level, as constant and equal to zero.

$$L_t^A = \frac{1}{2}(1-\lambda)(\alpha\pi_t + u_t + y^*)^2 + c \tag{5}$$

where

$$\lambda = \frac{\alpha^2}{\alpha^2 + \theta} \tag{6}$$

In this situation, and for a given fixed cost c, the government will abandon the regime whenever

$$L_t^M - L_t^A = \frac{1}{2}\lambda(\alpha\pi_t + u_t + y^*)^2 - c > 0 \tag{7}$$

that is, when

$$\frac{1}{2}\lambda(\alpha\pi_t + u_t + y^*)^2 > c \tag{8}$$

To illustrate our point, we need to define a probability distribution for u. We will assume that the disturbance u_t follows a uniform distribution in the interval $[-\mu,\mu]$. If we considering Equation 8 as being an equality and solve for u, we will find two roots determining upper and lower values, $\bar{u} > \underline{u}$, such that the government devalues whenever $u_t > \bar{u}$ and revalues whenever $u_t < \underline{u}$. This would provide some rationality for the existence of "escape clauses", as described by Obstfeld (1997). Observe that the trigger points $\underline{u}$ and $\bar{u}$ depend on prior expectations of depreciation $\pi_t = e_t - e_{t-1}$, and these, in turn, depend on market perceptions of where the realignment trigger point lie.

As Obstfeld did, we will assume temporarily that devaluation requires policymakers to pay the cost c, but that revaluations are not possible at all. Following Obstfeld, we will assume that agents believe the domestic currency will be devalued whenever a shock more severe than a threshold level $\bar{u}$ occurs. Identification of equilibria in this model requires two steps: (1) the calculation of market depreciation expectations given an anticipated devaluation threshold $\bar{u}$, and (2) calculation of the actual threshold given market expectations.

The expected exchange rate at date t will be:

$$\pi_t = \text{Prob}(u_t \le \bar{u}).0 + \text{Prob}(u_t > \bar{u}).E\{e_t - e_{t-1} \mid u_t > \bar{u}\} \tag{9}$$

Using our hypotheses about the probability distribution of the disturbance u_t it is easy to identify the equilibrium π_t as a function of the disturbance and the parameters of the model

$$\pi = \delta(u) = \frac{\lambda\left(\frac{\mu-u}{2\mu}\right)\left(\frac{\mu+u}{2\alpha} + \frac{y^*}{\alpha}\right)}{1-\lambda\left(\frac{\mu-u}{2\mu}\right)} \tag{10}$$

Using Eq. 11 and solving the following equation for u[13]

$$\sqrt{\lambda}(\alpha\delta(u)+u+y^*)=\sqrt{2c} \tag{11}$$

we obtain the solutions:

$$\bar{u}_1=\frac{-2\mu+\lambda\mu+\sqrt{2\lambda c}+\sqrt{4\mu^2-4\lambda\mu^2+2\lambda c-4\mu y^*\lambda}}{\lambda} \tag{12a}$$

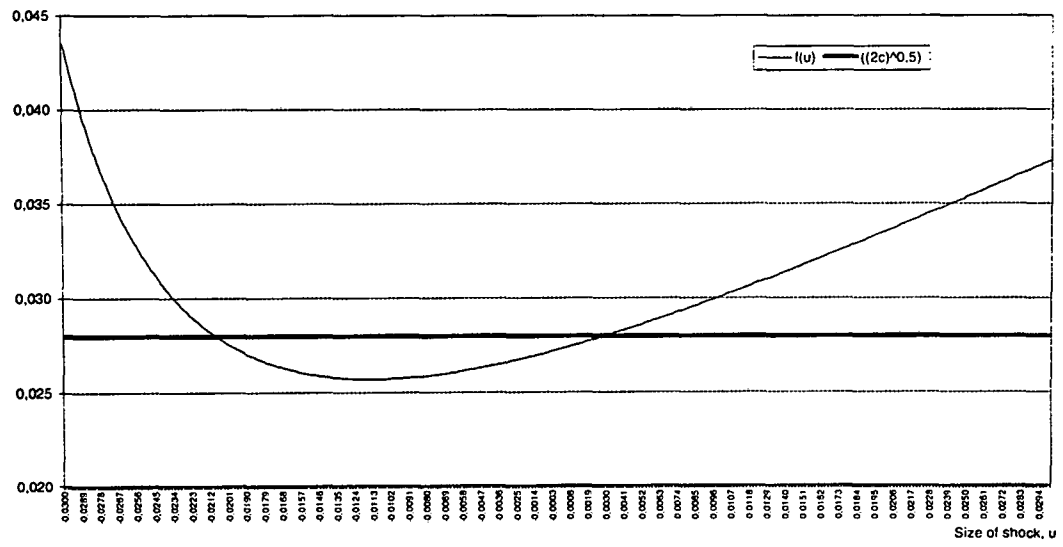
$$\bar{u}_2=\frac{-2\mu+\lambda\mu+\sqrt{2\lambda c}-\sqrt{4\mu^2-4\lambda\mu^2+2\lambda c-4\mu y^*\lambda}}{\lambda} \tag{12b}$$

Observe that for any u_t into the interval $[\bar{u}_2, \bar{u}_1]$ we have that $\frac{1}{2}\lambda(\alpha\pi_t+u_t+y^*)^2<c$ and there is no realignment. Using this fact and the probability distribution of the disturbance u_t, we can define the credibility of this regime as the probability of no realignment. Thus, our measure of credibility will be:

$$\text{Cred}=\text{Prob}(\bar{u}_2\le u\le\bar{u}_1)=\frac{\bar{u}_1-\bar{u}_2}{2\mu}=\frac{\sqrt{4\mu^2-4\lambda\mu^2+2\lambda c-4\mu y^*\lambda}}{\lambda\mu} \tag{13}$$

constrained to u_1 and u_2 be in the interval $[-\mu,\mu]$.

The figure below helps us to illustrate the problem we are facing. The thin line f(u) is the LHS of Equation 11 and the line labeled $(2c)^{1/2}$ is the corresponding RHS. The two intersections of both lines define the points $\bar{u}_2$ and $\bar{u}_1$. Our measure of credibility is the ratio between the areas of two rectangles: The rectangle delimited by the two intersections $\bar{u}_2$ and $\bar{u}_1$, and the rectangle delimited by $-\mu$ and μ.



[13] When the $\alpha\delta(u)+u+y^*<0$ devaluation is never optimal but revaluation (which has been excluded) is.

It is interesting to analyze the properties of our measure of credibility. As expected, credibility increases when the fixed cost c increases, when the propensity to accommodate λ decreases, when the distortion y^* decreases, or when the volatility of shocks decreases.[14]

The probability we are calling "Credibility" will be equal to zero when $\bar{u}_1 = \bar{u}_2$. This condition defines the lower bound of the fixed cost:

$$\underline{c} = \frac{2\mu(-\mu + \lambda\mu + y^*\lambda)}{\lambda} \tag{14}$$

Observe that below this point the fixed cost is irrelevant. We could say that $c > \underline{c}$ defines, in a broad sense, the entire class of fixed exchange-rate regimes.

On the other hand, credibility will be maximized (Cred = 1) when $\bar{u}_2 = -\mu$ and $\bar{u}_1 = \mu$. These conditions define the fixed cost maximizing credibility:

$$\bar{c} = \sqrt{\lambda}\left(\frac{y^*}{1-\lambda} - \mu\right) \tag{15}$$

It is clear that for whatever $c > \bar{c}$ there are no more gains in terms of credibility.

Now we are ready to show our main result. Remember that our objective here is to analyze the implications, in terms of welfare, of increasing the degree of rigidity of a determined exchange rate regime. We have defined above the fixed cost c as our measure of rigidity. Then, we would like to express a measure of welfare as a function of this fixed cost c. The criterion we will use to measure welfare will be the unconditional expected policy loss. Thus, we define the following expected loss as a function of the fixed cost c:

$$EL(c) = Cred(c) * E\{L^F(c) \mid u \in [\bar{u}_2, \bar{u}_1]\} + (1 - Cred(c)) * E\{L^R(c) \mid u \notin [\bar{u}_2, \bar{u}_1]\} \tag{17}$$

where

$$E\{L^F(c) \mid u \in [\bar{u}_2, \bar{u}_1]\} = \int_{\bar{u}_2}^{\bar{u}_1} [\frac{1}{2}(\alpha\delta(u) + u + y^*)^2] f(u \mid u \in [\bar{u}_2, \bar{u}_1]) du \tag{18}$$

and

$$E\{L^R(c) \mid u \notin [u_2, u_1]\} = A + B \tag{19a}$$

$$A = \int_{-\mu}^{\bar{u}_2} [\frac{1}{2}(1-\lambda)(\alpha\delta(u) + u + y^*)^2 + c] f(u \mid u \notin [\bar{u}_2, \bar{u}_1]) du \tag{19b}$$

[14] In mathematical terms, $\frac{\partial(Cred)}{\partial c} > 0$, $\frac{\partial^2(Cred)}{\partial c^2} < 0$, $\frac{\partial(Cred)}{\partial \lambda} < 0$, $\frac{\partial(Cred)}{\partial y^*} < 0$, and $\frac{\partial(Cred)}{\partial \mu} < 0$.

$$B = \int_{u_2}^{u_1} [\frac{1}{2}(1-\lambda)((\alpha\delta(u) + u + y^*)^2 + c]f(u \mid u \in [u_2, u_1])du \qquad (19c)$$

Intuitively, the expected loss is a weighted average of the expected losses in both, maintaining and abandoning, situations. The weights are the probabilities that the shock u_t lies in and out the interval $[u_2, u_1]$, that in this case are exactly our measures of credibility. All the terms are expressed as functions of the fixed cost c and the other parameters of our model.

Of course, this unconditional expected loss depends crucially on the parameters of the model and on the probability distribution of the disturbance u_t. In this case we have used for the parameters the values used in Obstfeld (1994): $\alpha = 1$, $\mu = 0.03$, $\theta = 0.15$, $y^* = 0.01$, and $\lambda = 0.87$. In this work Obstfeld says that $\lambda = 0.87$ corresponds to a rather than accommodative government, but here we are not interested in classify the governments in categories. Our exercise is just for illustration purposes. The figures in the text show credibility and the unconditional expected loss as functions of the fixed cost c in the interval $[c, \bar{c}]$ using for the parameters the values described above.

SEMINÁRIOS DIMAC
(2000)

Nº 1 (**23 de fevereiro**) - *Política Fiscal dos Estados Brasileiros*, Fernando Andrés Blanco Cossío, Rio de Janeiro, 24 p.

Nº 2 (**01 de março**) - *Um Cenário para a Economia Brasileira: 2000/2006*, Fabio Giambiagi, Rio de Janeiro, 38 p.

Nº 3 (**15 de março**) - *A Small Quarterly Macroeconometric Model for the Brazilian Economy: an Interim Report*, Mamoru Obayashi, Rio de Janeiro, 19 p.

Nº 4 (**17 de março**) - *Switching the Japanese Social System from Pay as You Go to Actuarially Fair: A Simulation Analysis*, Noriyoshi Oguchi e Tatsuo Hatta, Rio de Janeiro, 18 p.

Nº 5 (**22 de março**) - *Medidas da Tendência (Núcleo) da Inflação*, Ajax Reynaldo Bello Moreira, Rio de Janeiro, 7 p.

Nº 6 (**27 de março**) - *Regimes Cambiais e Monetários* (transcrição), Armínio Fraga Neto, Rio de Janeiro, p.

Nº 7 (**29 de março**) - *MAPS: Uma Versão Amigável do Modelo Demográfico-Atuarial de Projeções e Simulações de Reformas Previdenciárias IPEA/IBGE*, Kaizô Iwakami Beltrão, Francisco Eduardo Barreto de Oliveira, Mirian Carvalho de Souza, João Luís de Oliveira Mendonça e Luiz Paulo Costa da Silva Gomes, Rio de Janeiro, 54 p.

Nº 8 (**05 de abril**) - *Reformas Económicas e Inversión: América Latina en los Noventa*, Ricardo Alberto Bielschowsky, Rio de Janeiro, 23 p.

Nº 9 (**12 de abril**) - *A Cunha Fiscal sobre o* Spread *Bancário no Brasil*, Renato Fragelli Cardoso, Rio de Janeiro, 30 p.

Nº 10 (**19 de abril**) - *A Distribuição Mundial da Renda nos Anos 90: O Que Vem Acontecendo no Auge da Globalização?* Regis Bonelli, Rio de Janeiro, 24 p.

Nº 11 (**26 de abril**) - *The Pass-through from Depreciation to Inflation: A Panel Study*, Ilan Goldfajn e Sérgio R. C. Werlang, Rio de Janeiro, 42 p.

Nº 12 (**03 de maio**) - *Debt Management in Brazil: Evaluation of the Real Plan and Challenges Ahead*, Afonso S. Bevilaqua e Márcio G. P. Garcia, Rio de Janeiro, 34 p.

Nº 13 (**15 de maio**) - *The Real Plan and the Exchange Rate*, Gustavo Henrique de Barroso Franco, Rio de Janeiro, 96 p.

Nº 14 (**24 de maio**) - *Elections and Exchange Rate Policy Cycles*, Marco Antonio Cesar Bonomo e Maria Cristina Trindade Terra, Rio de Janeiro, 19 p.

Nº 15 (**31 de maio**) - *Ciclos Reais para a Indústria Brasileira?* Fabio Kanczuk e Francisco Carlos Pessoa Faria, Rio de Janeiro, 13 p.

Nº 16 (**07 de junho**) - *Um Modelo Macroeconométrico Trimestral para o Brasil: Possibilidades, Limitações e Resultados Preliminares*, Marco Antônio Freitas de Hollanda Cavalcanti, Rio de Janeiro, 16 p.

Nº 17 (**14 de junho**) - *A Disciplina Constitucional do Sistema Financeiro Nacional e o Banco Central do Brasil*, Jairo Sampaio Saddi, Rio de Janeiro, 22 p.

Nº 18 (**21 de junho**) - *Monopoly Power, Trade Protection and Growth: Cross Industry Evidence*, Pedro Cavalcanti Gomes Ferreira, Rio de Janeiro, 22 p.

Nº 19 (**28 de junho**) - *Full Dollarization: the Case of Panama*, Illan Goldfajn e Gino Olivares, Rio de Janeiro, 46 p.