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## Essays on International Reserve Accumulation and Cooperation in Latin America

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ESSAYS ON INTERNATIONAL RESERVE ACCUMULATION AND  
COOPERATION IN LATIN AMERICA

A Dissertation Presented

By

LUIS DANIEL ROSERO

Submitted to the Graduate School of the  
University of Massachusetts Amherst in partial fulfillment  
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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Department of Economics

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## **DEDICATION**

A mis padres, Carmen y Luis, quienes a pesar de no tener un doctorado, me han enseñado más de la vida de lo que pudiera aprender en cualquier universidad.

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The Economics Department at the University of Massachusetts exposed me to a valuable spectrum of approaches to the field of Economics, and proved to be fertile

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## **ABSTRACT**

### **ESSAYS ON INTERNATIONAL RESERVE ACCUMULATION AND COOPERATION IN LATIN AMERICA**

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One of the defining trends in international finance over the last two decades has been the unprecedented growth in the levels of international reserves accumulated by emerging nations. In a global financial system characterized by market failures and sudden stops, many developing countries have opted for the protection provided by individual accumulation of reserves as a second-best outcome. However, as suggested by Rodrik (2006), among others, the accumulation of reserves comes at a hefty opportunity cost to the nations that hold them. It is this particular aspect that brings into question—or at least merits a re-examination of—the validity and efficiency of reserve accumulation as a stabilization and development strategy, particularly in the context of some cash-strapped developing nations. This dissertation takes an in-depth look at this trend in Latin America



by investigating the extent of protection of these precautionary reserves, the role of contagion risk in the accumulation process, and the outlook of regional arrangements of cooperation, such as regional reserve pooling mechanisms.

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# **CHAPTER 1**

## **INTRODUCTION**

The concept of regional unification has been part of the Latin America dialogue since the foundation of its modern state republics. Bolivar, O'Higgins and Miranda all shared the same idealistic view that the successful future of the nascent American nations; tied by their common history of Spanish colonialism; lied entirely in their ability to unify under a federalist framework. Today, as the globalization movement advances and a few clear poles of influence prevail in the world dynamics, this discourse remains applicable. Small countries throughout the developing world struggle to find their niche in the globalized trade and capital markets of today, which arguably still resemble and propagate many of the remnants of colonialism. This dissertation is largely motivated by that same belief in the potentially significant gains from Latin American cooperation through regional financial integration, and in particular regional reserve pooling.

It is primarily aimed at continuing the discussion that surged soon after the Asian Financial Crisis in favor of an overhaul of the global financial structure and the revision of the role of developing nations within it. As such, it builds upon the valuable work done by other authors in highlighting the central role that regional cooperation in Latin America could have in counteracting the negative effects of globalization (and in particular capital account liberalization) as dictated by the Washington Consensus (Ocampo 2000, 2006, Agosin 2000, Mistry 1999, Machinea et al 2006 & 2007, Titelman 2006). The efforts of these economists and institutions like the Economic Commission for Latin America and the Caribbean (ECLAC), the Group of Twenty-Four (G-24), and

the United Nations' Financing for Development Office (FfDO) brought to the forefront the importance of regional financial coordination for the successful promotion of a development path guided by the principles of the Monterrey Consensus. However, given the recent nature of the topic and the lack of an extensive treatment in the literature, much work remains to be done. There is particularly a gap when it comes to the extensive treatment of the empirical analysis of the concepts and proposals for regional financial integration. Thus, this dissertation sets out to fill some of those gaps.

Regional financial integration provides an alternative to the prevailing methods used by LDCs in obtaining and allocating financial resources for their development process. Thus, this dissertation will explore how collective financial measures at the regional level (among Latin American countries) might provide improved access to credit and increased protection from international financial volatility. Improved access, at better terms, to financial resources allows national governments to channel resources in a more efficient manner in accordance with each country's development goals. Unlike the present system in which investment decisions are largely detached from the long-term performance of individual countries, regional financial integration—given the appropriate democratic institutions—has the potential to create a participatory system of national investment aimed at addressing the needs and hopes of a wider sector of the local population.

More specifically, this dissertation considers the particular case of foreign reserve pooling. The last few decades have been marked by an unprecedented accumulation of reserves by developing countries throughout the world, including those in Latin America. The analyses presented here build from the argument that this reserve accumulation in



developing countries is mainly held for precautionary motives, but costly to the holding countries. The following chapters will explore this phenomenon of individual reserve accumulation by Latin American countries against the prospects for protection under a mechanism of regional financial cooperation. Within this context, this dissertation looks at the particular case of reserve pooling—arguably the easiest, most urgent first-step in regional coordination. Each chapter will assess different aspects of the following overarching questions: *What role is there for regional mechanisms of cooperation like reserve pools in the precautionary reserve accumulation process? How do these mechanisms compare to individual accumulation of reserves in terms of their effectiveness?*

This research is particularly relevant in light of the latest global financial crisis, which has brought to the forefront the need for Latin American countries to protect against potential shocks emanating from the speculative capital flows that have recently flocked to the region. Moreover, the latest concerns about the reliability of US Dollar and Euro denominated assets cast serious doubts on the long-run wisdom of continued reliance on individual accumulation of reserves in the form of these assets. These concerns, in addition to the opportunity cost of holding such vast amounts of reserves, add urgency to the need to re-evaluate the precautionary accumulation of reserves via the individual hoarding and potential mechanisms of regional coordination.

## **1.1 Background**

The inherent contradictions that plague the existing global financial structure were most clearly exposed during the 1994 Mexican currency crisis and the financial crisis of East Asia in 1997. These two major finance-based crises made it clear how the current system

can undermine the economic well-being of developing countries. In the case of East Asia, the inability and unwillingness of financial institutions such as the International Monetary Fund (IMF) to respond immediately to the crisis, at best, contributed to a prolonged and deepened period of crisis. Furthermore, what began as a currency crisis from speculative attacks on the Thai Baht proved contagious to the economies of most countries in the region. Paradoxically, while most of the Southeast Asian countries were experiencing shortages of foreign currency and capital, both Japan and China, pressured by some international financial institutions (IFIs) and the US Treasury, found themselves unable to rescue their neighbors through the use of their extensive international reserves. Moreover, conditionality frameworks imposed by the IFIs as part of their aid packages and the inherently unstable character of the international capital markets made it very difficult—in some cases almost impossible—to promote auto-centric forms of development.

The financial crises of the last few decades made it clear that integration to global financial markets through financial liberalization—particularly by unregulated capital flows—will not only lead to an unstable growth path for developing countries, but will also lead to their growing dependency on capital flows from the North and the IFIs. Countries in the South have primarily responded to the failures in the global financial structure and the subsequent crises by accumulating unprecedented levels of foreign reserves. However, these reserves have come at a significant opportunity cost to these countries. In addition to individual accumulation of reserves, a growing number of countries in the South have turned their attention towards the creation of regional institutions that can serve as viable alternatives to the conventional IFIs.

Faced with fierce opposition from the traditional IFIs, some of these attempts have failed to materialize, as in the case of the Asian Monetary Fund (AMF), or the originally proposed balance of payments support branch of the Bank of the South. However, other regional integration institutions like the Latin American Reserve Fund (FLAR) have been able to partially overcome this pressure and to continue to expand their efforts in favor of improved financial conditions for countries in the South. Such institutions are uniquely positioned to foster the type of regional financial integration that would allow the incorporation of developing countries into the international financial markets, while mitigating some of the risks associated with this process. One of the most fertile grounds for regional cooperation, and a good precursor of this cooperation, is regional integration through the co-protection provided by mechanisms of regional reserve pooling.

## **1.2 Plan of the Dissertation**

Under this framework, this dissertation aims to fill some of the gaps in the literature by connecting two key aspects of crisis prevention and support: reserve accumulation and regional financial integration. Chapter 2 begins by exploring the presumed effectiveness of individual reserve accumulation in expanding the policy options available to policymakers. It has come to be widely accepted that the large stock of international reserves accumulated in recent years by emerging markets countries, including those in Latin America, minimized the negative impact that the latest global financial crisis had on these countries' economies, allowing them to promptly resume their previous growth path. Using a Vector Autoregressive analysis for the largest seven countries in the region,

this chapter tests the role that reserve accumulation has played in enhancing the policy tools available to the holding countries. It relies on the trilemma framework to assess the degree (if any) to which increases in reserves are associated with exchange rate stability, capital account openness, and monetary policy independence. It finds limited evidence for the benefits of reserves in escaping the trilemma. However, two key findings emerge as part of this chapter. First, in line with the traditional optimal reserve demand literature, it finds that increases in relative reserves are associated with higher levels of exchange rate stability only in instances of hard pegs. Second, the findings presented suggest that only countries with high levels of reserves obtain benefits in terms of their capital account openness and monetary policy independence as a result of increases in holdings of foreign reserves.

Given the mixed evidence for the effectiveness of individual reserve accumulation, the third chapter explores an alternative method of insurance based on a regional approach. Recent contributions to the literature have suggested that regional mechanisms of coordination, as complements to the international financial structure, would provide valuable benefits to developing countries. This chapter highlights another reason why mechanisms of local coordination and support are desirable additions to the current structure. By investigating the so far neglected role of contagion risk in the accumulation of reserves, the empirical findings presented here suggest that countries take into consideration the volatility conditions of their neighbors when determining their optimal level of reserves. Moreover, given that countries in Latin America appear to purchase insurance against contagion risk, this chapter argues that a mechanism of reserve pooling that increases the protection of all members of the pool would thus

reduce the risk of contagion and thereby the opportunity cost faced by individual countries aiming to protect against it.

In light of the findings in the two previous chapters, Chapter 4 attempts to probe the effectiveness of reserve accumulation in the form of regional reserve pools by documenting the experience of the only institution of this kind in Latin America. Established in 1978 as the Andean Reserve Fund, the Latin American Reserve Fund (FLAR) continues to be a central component of the regional financial architecture in Latin America. As the only institution of its kind in the region, FLAR provides valuable insights into the feasibility of mechanisms of regional cooperation aimed at improving the efficiency of crisis prevention and management. This is especially important in the midst of the unprecedented unilateral accumulation of international reserves by countries in the region during past couple of decades. Moreover, it presents a framework for how these regional institutions can retain their own viability by dealing with endemic issues of both moral hazard and sovereignty concerns of member countries. Adopting a quantitative and qualitative approach, this chapter empirically assesses the effectiveness of FLAR's interventions, and provides an institutional analysis of its current and future viability. It contributes to the literature by developing an in-depth analysis of the outcomes of interventions of FLAR.

Overall, this dissertation contributes to the literature by revisiting the individual accumulation of reserves as a strategy for crisis prevention, and consequently development promotion. It proposes regional reserve pooling—as part of a process of regional cooperation—as an alternative, supplementary approach to the prevailing methods of crisis prevention and support. It argues that regional financial coordination in

Latin America, guided by the already successful experience of FLAR, has the potential to provide a cost-efficient alternative to precautionary reserve accumulation that would allow the countries in the region to better survive and thrive in a global system of open-economies, which is still characterized by undemocratic institutions and highly volatile financial markets.

## CHAPTER 2

### HAS RESERVE ACCUMULATION WORKED? A VECTOR AUTOREGRESSION ANALYSIS OF THE LATIN AMERICAN CASE

#### 2.1 Introduction

The repercussions of the Global Financial Crisis of 2008-10 were felt throughout the world, including in Latin America. However this last set of countries, along with other emerging economies, appears to have been uniquely positioned to weather the recession more effectively and experienced a milder and shortened version of it. After experiencing a short-lived real GDP contraction of -1.5% (only -0.1% if we consider only South America) in 2009, the region's GDP swiftly recovered to pre-crisis growth rates in 2010. This impressive performance from one of the traditionally most unstable regions in the world stands in sharp contrast to the much direr experiences of developed economies, particularly those of the United States and Europe, which experienced average GDP contractions of -2.4% and -4.1%, respectively during this same year<sup>1</sup>.

One prevailing explanation for this reversal of fortunes is the recent unprecedented accumulation of international reserves by most emerging market economies, including those in Latin America. This stands in direct contrast to the modest stocks of reserves held by developed nations. By 2009, Latin American countries held foreign reserves of nearly US\$594 billion, or 256% higher than those held a decade earlier. Arguments in favor of precautionary accumulation of reserves hold that access to liquid reserves allows countries to deter and deal with shocks to their currencies, thus avoiding the painful readjustment processes associated with currency and banking crises.

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<sup>1</sup> Data obtained from UNCTAD-Stat.

Based on this observation, some in the literature (e.g. Aizenman 2009) have concluded that enhanced reserve stocks have in fact fulfilled their mission, and more importantly that fears of excessive accumulations proved to be overblown.

While foreign reserves serve an undoubtedly important role as buffers in the event of a shock, and perhaps more importantly as deterring signals to potential speculators, they carry a significant opportunity cost (see Rodrik 2005, among others). Therefore, policy aimed at shielding the domestic economy should not simply follow Mrs. Machlup's hoarding approach to her wardrobe (Machlup 1966). Reserve accumulation should instead be informed by evidence of its effectiveness at improving the expected outcomes. Given the unprecedented accumulation of costly reserves by developing countries and the ambiguous evidence for their effectiveness, it is critical to evaluate whether reserves do in fact 'work'.

In this context, and within an empirical framework, this chapter directly tests the effectiveness of foreign reserves in enhancing the policy options at the disposal of policymakers. More specifically this chapter uses data for the largest seven Latin American countries in the last three decades to directly assess the degree to which reserves contribute to any of the three traditional goals associated with the impossible trilemma of international finance: Exchange rate stability, free flows of capital, and effective control over monetary policy. Using Vector Autoregression Analysis (VARs), this chapter finds mixed evidence for the presumed benefits of reserve accumulation. This analysis shows that, with a few exceptions, the effect of changes in the relative levels of reserves on any of the three trilemma goals is not statistically significant from zero, undermining some of the traditional expectations. However, the few exceptions



identified hint at two key conclusions: First, in line with the traditional optimal reserve demand literature, we find that increases in relative reserves are associated with higher levels of exchange rate stability only in instances of hard pegs. Second, our findings suggest that only countries with high levels of reserves obtain benefits in terms of their capital account openness and monetary policy independence as a result of increases in holdings of foreign reserves.

## **2.2 Literature Review**

### **2.2.1 Reserves Accumulation Motives**

In line with the majority of emerging market countries around the world, Latin American countries have accumulated unprecedented levels of international reserves. This growth in reserves was most pronounced in the period following the turmoil associated with the East Asian Financial Crisis, and has turned negative only once during a brief reprieve associated with the latest global financial crisis. Research into the motivations for this impressive accumulation of reserves is vast, and can be subdivided into two main views. First, the precautionary approach is based on a perceived necessity to self-insure against external shocks associated with greater exposure to international financial and trade markets (e.g. Heller 1966, Feldstein 1999, Aizenman et al. 2007). The second approach, known as the mercantilist approach, views reserve accumulation as a byproduct of the activities of monetary authorities engaged in currency manipulation to boost the comparative advantage of their countries' exports (Dooley et al. 2005). Despite the differences in motivations, both the precautionary and mercantilist roles of reserves presuppose high liquidity for the assets held, and an implicit inter-temporal investment

tradeoff. Therefore, this extensive accumulation of international reserves comes at a hefty social opportunity cost (Rodrik 2006).

### **2.2.2 Views on the Precautionary Efficacy of Reserves**

Given the context of high, growing and costly international reserves, it is sensible to assess the degree to which reserves are actually serving their intended precautionary purpose. Evidence from previous studies suggests a mixed conclusion. Among the works that are in line with the precautionary expectations of reserves, Obstfeld et al. (2009) find that while the level of reserves relative to GDP is not significantly associated (in statistical terms) with depreciations of the exchange rate, the level of “underinsurance”—defined as the ratio of actual reserves to those predicted by their model<sup>2</sup>—is significantly and negatively associated with such depreciations. This suggests that countries that accumulated sufficient reserves were more likely to have better weathered the recent crisis, while those that did not accumulate enough paid the consequences in the form of large currency depreciations. Similarly, in a review of the applicability of traditional leading (i.e. warning) indicators in explaining the latest global financial crisis, Frankel and Saravelos (2010) conclude that international reserves (through different specifications) is one of two consistently significant indicators of crisis vulnerability<sup>3</sup>. Moreover, their findings can be interpreted as suggestive of reserves serving a stabilizing role. For instance, they find that the level of reserves relative to GDP is positively and significantly associated with exchange rate appreciation and changes in industrial

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<sup>2</sup> Their model estimates expected reserve-to-GDP ratios by accounting for financial openness, the prevailing exchange rate regime, and monetary depth, as captured by M2.

<sup>3</sup> Specifications of reserves include Reserves/GDP; Reserves as a percentage of external debt; Reserves in months of imports; M2/Reserves; and Short-term debt as a percentage of reserves.

production, and negatively and significantly associated with the likelihood of a country recurring to the IMF for help. Moghadam (2010), using cross sectional data for 57 emerging market countries for the 2008-2009 crisis, finds that higher pre-crisis levels of reserves (relative to external financing requirements) were positively and significantly associated with higher percentage changes in real output. Moreover, they conclude that while there are gains to reserve accumulation in terms of output growth, countries face diminishing returns to scale in accruing these gains. That is, countries with little relative reserves benefit more from the protection of reserves than do countries with reserve stocks exceeding 100% of short-term debt.<sup>4</sup>

In contrast, other studies point to less encouraging results with regards to the effectiveness of international reserve holdings in fulfilling their presumed precautionary role. Chief among this part of the literature is a strand that emphasizes the apparent shift by emerging market economies from the “fear of floating”<sup>5</sup> to the “fear of reserve loss” in recent years. Aizenman and Hutchison (2010) note that despite their unprecedented accumulation of foreign reserves, emerging market countries (including those in Latin America, with the exception of Venezuela) relied more heavily on exchange rate depreciation, rather than reserve draw downs to counter pressures associated with the latest global financial crisis. Table 2.1 reproduces this evidence for the seven emerging economies in Latin America. Aizenman (2009) suggests that Latin American countries might have been particularly prone to suffer from the “fear of reserve loss” due to their

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<sup>4</sup> These results are however at odds with the data that shows that many emerging markets did not rely on meaningful draw downs of their reserves during the last crisis, but rather responded by allowing their currencies to depreciate. Moreover, while the coefficient is lower for the high-reserve subsample, the significance of the other coefficient changes, which hints at the possibility of biased estimates. The size of the resulting coefficient of reserves is unrealistically high, and thus lacks economic significance.

<sup>5</sup> As presented in Calvo and Reinhart (2002).

relatively higher exposure to changes in the commodity markets and their lower levels of public and private savings.

**Table 2.1. Exchange Market Pressure Absorption**

Country	Exchange Rate Depreciation	Reserve Loss	Exchange Market Pressure
Argentina	17.55%	0.86%	18.41%
Brazil	51.59%	8.25%	59.84%
Chile	18.49%	-4.80%	13.69%
Colombia	42.56%	1.55%	44.11%
Mexico	48.41%	5.93%	54.34%
Peru	15.66%	16.29%	31.95%
Venezuela	0.00%	22.89%	22.89%

Source: Adapted from Aizenman and Hutchison (2010)

Similarly, Artus (2009) finds that emerging market economies opted for conserving their accumulated reserves at the expense of high depreciation of their currency. Moreover, since in some of these countries reserves stocks were built as a result of speculative capital inflows, these accumulated reserves are not seen as effective safeguards against capital flight during a reversal of fortunes. Blanchard et al. (2009) reach a similar conclusion, and suggest that the automatic response by emerging markets to further accumulate reserves might harm the prospects for economic recovery, and are likely to accentuate the problems associated with global imbalances.

Other arguments in the literature that question the precautionary benefits of reserve accumulation are based on the distortions caused by these stocks on the monetary base on the holding countries, as well as the implications for the rest of the world in the form of global imbalances. Kletzer (2000) concludes that the accumulation of international reserves may prove counterproductive. The expansion of the monetary base that is usually associated with rising reserves can lead to a change in the fundamentals and consequently lead to the currency depreciations that they are supposed to protect

against in the first place. Glick and Hutchison (2009) find that countries with high levels of reserves (e.g. China) face growing challenges in reining in inflationary pressures resulting from monetary base expansions associated with rising international reserve holdings. Attempts to sterilize these expansions in the monetary base not only grow costlier, but also more futile as reserve accumulation grows to some of the unprecedented levels seen in some emerging countries in recent years<sup>6</sup>. In this sense, the accumulation of reserves, rather than providing the expected countercyclical protection may actually lead to distortions in the exchange rate, and more importantly can undermine the country's monetary policy independence.

### **2.2.3 Reassessing the Benefits of Reserve Accumulation**

The unprecedented accumulation of costly international reserves by emerging market countries, along with the apparent ambiguity in terms of the ability of these reserves to serve their intended purposes makes it critical to reassess to what extent reserve accumulation has actually 'worked'. The remainder of this chapter will consider this question in the context of the past three decades in the seven largest economies in Latin America: Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. Most of these countries have experienced directly the havoc associated with global financial instability and have (with the exception of Venezuela) embraced a strategy of managed flexible exchange rates supported by large stocks of reserves. Moreover, the period considered captures the major periods of instability in the region (e.g. the Lost Decade,

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<sup>6</sup> With a fixed or quasi-fixed exchange rate regime, the rise of reserves leads to exchange rate appreciation, which can be combated with sterilization of these inflows. The net result is the growth of the money supply, as well as growing upward pressure on the price level. As inflation and M2 increase, it becomes more difficult to justify the tradeoff between inflation and a stable exchange rate.

contagion effects from the East Financial crisis, the Argentinean Crisis, as well as the effects of the most recent global financial crisis), and consequently provides a comprehensive view into the effects of varying levels of reserves on these countries policy instruments and economic outcomes.

In order to assess the benefits that reserve stocks provide in terms of expanding policy options, this chapter relies on the traditional Trilemma framework derived from the Mundell-Flemming Model (Mundell 1963, Fleming 1962) as a baseline approach. Under the Trilemma framework, countries in an open-economy are constrained in their ability to simultaneously accomplish the three traditional goals of macroeconomic policy-makers: exchange rate stability, monetary policy autonomy, and the free movement of capital flows. Open economies are faced with a choice of two of these goals, at the expense of the third. During the classical Gold Standard era countries opted for exchange rate stability—in the form of fixed exchange rates—and free movements of capital, while sacrificing monetary autonomy, and thus their ability to implement counter-cyclical monetary policy (Triffin 1963). As argued in Obstfeld et al. (2005), that strategy stands in contrast with the international infrastructure that prevailed during the Bretton Woods era when the choice of policy mix was characterized by a return of monetary policy autonomy and stable exchange rates—albeit at the expense of capital account liberalization.

Latin America's recent history in negotiating the policy mix shows that in the 1980s most of the region opted for overvalued exchange rates (mostly in the form of unofficial pegs) and control over its monetary policy. Capital controls—not always binding—were put in place to rein in some of the rising pressures of capital flight.

However, adverse conditions in the international financial markets, along with excessively expansionary monetary policy made capital flight and the eventual devaluation of the currency unavoidable. The liberalization process of the 1990s in the region brought with it a re-evaluation of the trilemma policy mix; leading to a new era of capital account liberalization, (mostly) flexible exchange rates, and consequently the rendering of countercyclical monetary policy ineffective. This choice proved particularly costly as integration into the international financial structure entailed further risk exposure to the vagaries of international markets.

In this context, this chapter considers whether international reserves allow countries to ‘ease the trilemma’ by fostering any of its three policy goals. Literature dealing with the direct effects of international reserves accumulation on the three components of the trilemma is limited. Aizenman (2009) claims that the large accumulation of international reserves by emerging market countries has made it possible for them to adopt a “middle-ground” configuration of the trilemma, under which they can afford to have managed exchange rate flexibility, and increasing integration into the world financial markets, while retaining a degree of monetary policy independence. This new prevalent arrangement is argued to have resulted in better outcomes in terms of adjusting to the shocks associated with the last global financial crisis. Similarly Aizenman et al. (2010) concludes that only in countries with reserves that exceed 21% of their GDP, do these reserves allow them to escape the trilemma. On the other hand, Glick and Hutchison (2009) through an analysis of the Chinese case, argue that reserve accumulation can compromise monetary control. This is of particular concern for instances in which sterilization becomes less feasible. Given some of the existing voids

and contradicting evidence, this chapter contributes to the literature by explicitly looking at the relationship of reserve accumulation and the policy goals under the trilemma.

## 2.3 Methodology

### 2.3.1 Measuring the Trilemma

This analysis makes use of the indices developed in Aizenman et al. (2008) for the three policy choices that countries face under the traditional trilemma approach. Whether in the form of an explicit fixed exchange rate regime (e.g. Argentina's currency board period), or through a managed float, stability of the exchange rate is highly valued by open economies<sup>7</sup>. The index used to capture a country's exchange rate stability is calculated as follows,

$$ERS = \frac{0.01}{0.01 + stdev(\Delta \log(exchrate))}$$

Where the exchange rate is expressed as the price of a unit of US currency in terms of the domestic currency, and the standard deviation measure is based on a yearly calculation of monthly data.<sup>8</sup> An ERS index of one is characteristic of a country with a perfectly fixed exchange rate, while a value of zero corresponds to a country with a pure float of its currency.

While more nuanced, the argument in favor of capital account openness as a policy goal derives from the assumption that free flow of capital allows for interest rate parity, and thus access to more and cheaper access to financial capital to finance domestic

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<sup>7</sup> While a small number of emerging market countries do opt for complete exchange rate flexibility, free floats by their own nature imply instability through exchange rate risk. This is particularly of concern in the context of relative small emerging economies like those of Latin America (see Devlin et al. 2001)

<sup>8</sup> Further descriptions of this and the remaining indices are available from Aizenman et al. (2010)



projects in capital-deprived regions.<sup>9</sup> In order to capture the second policy goal of the trilemma,—capital account openness—this chapter relies on the Chinn-Ito index (KAO). This index accounts for *de jure* capital account liberalization, based on reported restrictions on current and capital account transactions, the presence of multiple exchange rates, and the requirement of the surrender of export proceeds. Possible values of this index range from zero to one, with higher values representing instances of countries with a more open capital account.

The third policy goal under the trilemma is that of monetary policy independence. The monetary policy independence index (MPI) is captured by comparing the behavior of domestic short-term interest rates to those of a base country, such that,

$$MPI = \frac{1 - corr(i_i, i_j)}{2}$$

Where  $i_i$  accounts for the monthly money market interest rate in the Latin American country under consideration, and  $i_j$  corresponds to the US monthly money market rate. As the previous two indices, the MPI index ranges from zero to one, with higher values associated with countries with more control over their monetary policy—as expressed by the divergence of and variation of their interest rate relative to that of the base country.

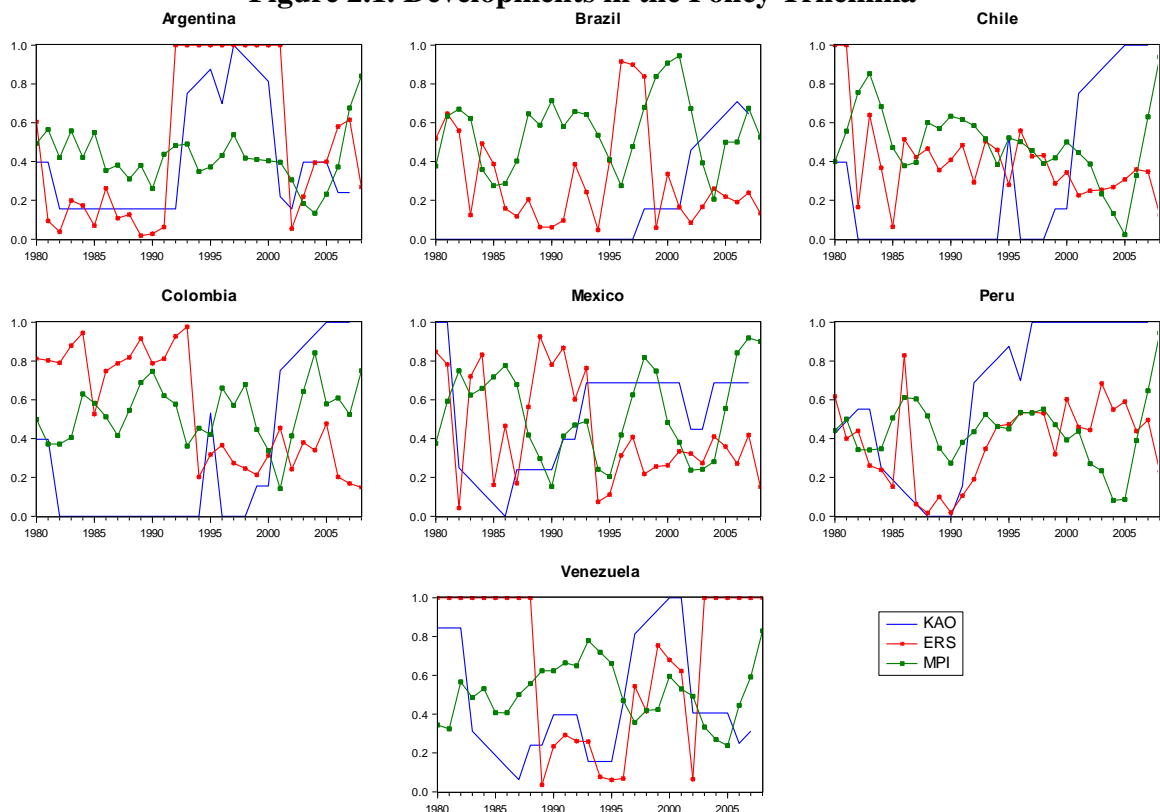
Historical representations of the three indices under consideration confirm the trade-offs faced under the trilemma approach. Moreover, Figure 2.1 below shows the changes in the policy choices adopted in the region. In recent years, most of the largest Latin American countries appear poised to favoring monetary policy autonomy and

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<sup>9</sup> Edison et al. (2004) provides a comprehensive survey of the literature in this regard. However, it is important to note that while a component of the traditional trilemma framework, complete capital account openness should not necessarily be a desirable goal under all conditions. For instance, Lee and Jayadev (2005) address the potential negative effects of it in terms of economic growth, and income distribution.

capital account liberalization, at the expense of exchange rate stability. Argentina and Venezuela, by contrast, have opted for maintaining relatively more control over their currency by restraining capital flows into their economies. After 2002, Argentina's and Venezuela's ERS index values increased in a mostly consistent fashion. Concurrently their MPI index values were proportionally decreasing. For other Latin American countries like Chile, Colombia, and Peru, the KAO index increased to one in recent years, as they disbanded any remaining capital controls and embraced full capital account liberalization. Exchange rate stability, however, was sacrificed during this time, and has settled around a value of 0.2 in these countries.

**Figure 2.1. Developments in the Policy Trilemma**



As will be discussed later, these differences in the trilemma mix selection provide an insight into the differing effectiveness of reserve accumulation in easing a country's

trilemma constraints. On the whole, there appears to be preliminary evidence for an attempt in the region to adopt moderated policy choices, while shying away from policy extremes in either direction. For instance, most countries in the region rely on managed flexible exchange rates, some—albeit more lenient—capital controls, and monetary independence within a context of inflation targeting.

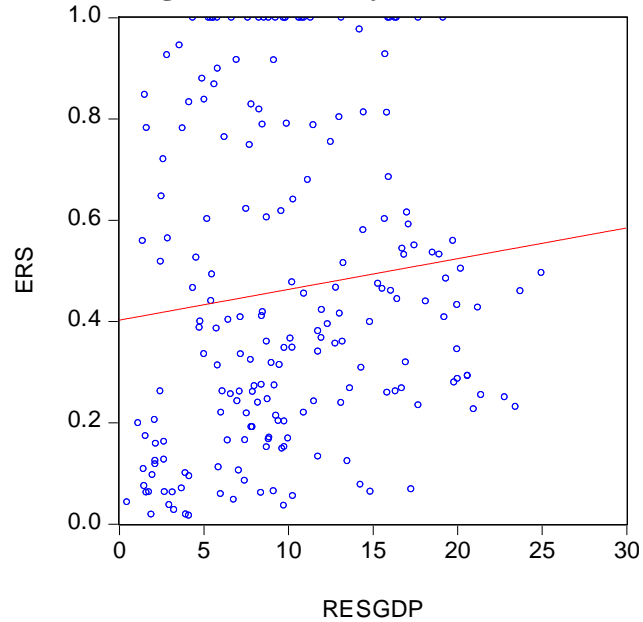
### **2.3.2 The Role of Reserve Accumulation: Easing the Trilemma?**

In order to assess the effectiveness of international reserve accumulation, this chapter seeks to explore the relationship between each of the indices described above and the relative level of reserves. Before delving into a more formal analysis, this section formalizes the hypothetical expectations and explores underlying trends in the data.

A preliminary look at the relationship between international reserves and the Exchange Rate Stability index suggests that reserves as a share of GDP (RESGDP) have been positively associated with higher levels of this index (Figure 2.2) in Latin America. High levels of international reserves allow countries facing devaluation pressures to sustain a given target exchange rate by drawing down these reserves, or more importantly by signaling the ability of the central monetary authority to respond to these pressures. For instance, Obstfeld et al. (2009) find that in the context of the 2008 financial crisis, a country's relative level of international reserves was a good predictor of exchange rate movements. Countries with insufficient levels of reserves were more likely to experience currency depreciation following the crisis. An alternative view of international reserves accumulation suggests that high levels of reserves are a byproduct of stable—purposely

undervalued—exchange rates. Countries are seen to rely on these undervalued exchange rates aimed at gaining mercantilist advantage for their exports (Dooley et al., 2005).

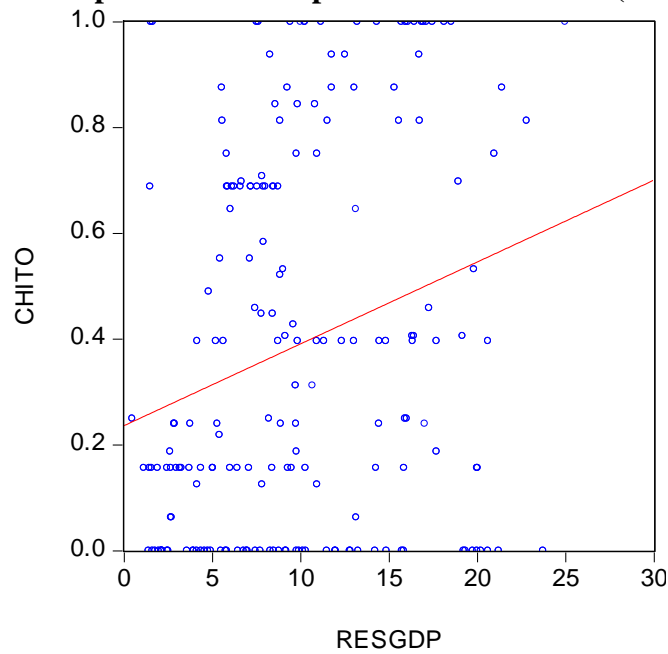
**Figure 2.2. Exchange Rate Stability and Reserves (1980-2008)**



Traditional arguments in favor of capital account openness suggest that in the context of emerging nations like those of Latin America, the elimination of barriers to capital should lead to capital flowing into these countries in search of better returns. Positive net inflows of capital would thus be associated with capital account surpluses, which could finance deficits in the current account or add to existing surpluses in the latter. Consequently, based on the simple accounting of the balance of payments accounts, capital account liberalization should result in additions to a country's stock of international reserves, with other things being held constant. Capital account surpluses are assumed to arise primarily from a combination of pull factors (e.g. inherently higher rates of return on capital) and structural conditions (e.g. lack of capital controls and predictable monetary policy). Conversely, higher levels of international reserves can arguably foster capital account openness by providing a buffer against adverse shocks

related to the exposure of more mobile capital flows. In either case, the relationship between reserves and the extent of capital account liberalization would be expected to be positive. A scatter plot of the KAO index and the level of reserves adjusted by the level of gross domestic product (Figure 2.3) provides *prima facie* evidence in support of this positive relationship. Thus, higher relative levels of reserves seem to be associated with instances of more liberalized capital accounts.

**Figure 2.3. Capital Account Openness and Reserves (1980-2008)**

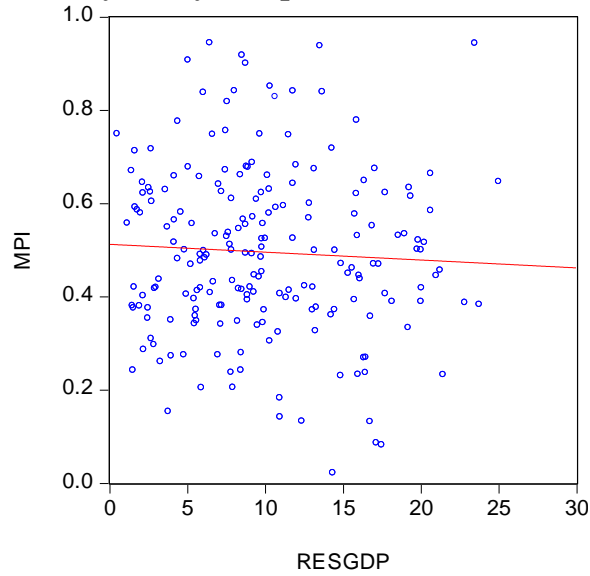


Higher liquidity in the form of international reserves also provides flexibility in adjusting to shocks, and thus reduces the need to modify monetary policy outcomes. International reserves, when sufficiently available, make the sterilization process associated with defending against exchange rate depreciation credible. In an open economy, a balance of payments deficit introduces depreciation tendencies to the domestic currency, which can be offset by the monetary authority through the sale of foreign assets in exchange for domestic currency. Given the procyclical nature of international capital flows, the resulting decrease in the domestic money supply can be

devastating to an already ailing economy. A process of sterilization (through the purchase of domestic financial assets by the central bank), along with the original intervention through the use of foreign reserves, makes it possible to respond to deflationary pressures on the exchange rate, while retaining monetary autonomy by leaving the interest rate target unaffected.

Conversely, when faced with an undesirably appreciated domestic currency, an active central bank has the option of counteracting the resulting upward pressure on the money supply through the sale of domestic financial assets to match increasing foreign reserves acquired in the currency stabilization process. An alternative view of the relationship between international reserves and monetary policy independence emphasizes causality running from the latter to the former. That is, countries that enjoy monetary policy independence can engage in countercyclical monetary policy to address shocks to the internal economy, and thus ensure more stability in the current and financial accounts. Figure 2.4 below shows the relationship between the relative level of reserves and the monetary independence index (MPI). Contrary to expectations, this plot suggests that a negative—albeit small—relationship between these two variables may prevail.

**Figure 2.4. Monetary Policy Independence and Reserves (1980-2008)**



### **2.3.3 Modeling the Relationship**

In sum, higher levels of reserves, through the channels outlined above, are assumed to contribute to the easing of the trilemma by promoting higher levels of each of its components. Using quarterly data for the seven largest countries in the region for the period between the first quarter of 1980 and the third quarter of 2009, this chapter empirically analyzes these potential relationships. Descriptive statistics of the variables employed in the analysis are presented in Appendix A. Augmented Dickey Fuller (ADF) tests were conducted to assess the stationarity properties of each individual variable, while lags for these tests were selected using the Schwarz Information Criterion (SIC). Stationarity results are presented in Appendix B.

As presented in the literature review section of this chapter, previous studies have only addressed the relationship between international reserves and the components of the trilemma indirectly. Moreover, most of these studies have relied on pooled panel data least square regressions for their analysis. While useful in providing some insights, the underlying tradeoff implied by the trilemma as well as the possibility for

contemporaneous determination suggested by the hypothesized relationship among the variables present us with a clear potential for simultaneity, and consequently biased estimators. To avoid this issue, and to benefit from the richness in the analysis from recursive effects, the empirical analysis used here is based on a Vector Autoregressive (VAR) model of the form:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + c_i + \epsilon_t,$$

Where  $y_t$  accounts for the vector of the respective endogenous variables considered,  $A_1, \dots, A_p$  represent the matrices of coefficients to be calculated,  $c_i$  is the intercept to be estimated, and  $\epsilon_t$  corresponds to a vector of innovations that are uncorrelated with their own lagged values and those of the right-hand side variables.

Moreover, in order to determine the appropriate number of lags to be included in the analysis, a sequential modified likelihood ratio (LR) test is conducted, such that:

$$LR = (T - m) \{ \log |\Omega_{l-1}| - \log |\Omega_l| \} \sim \chi^2(k^2)$$

Results for these tests are also reported in Appendix B.

Indices are estimated for the quarterly data using the methodology outlined above and in Aizenman et al. (2008). All data, with the exception of the MPI values, was obtained from the IMF's International Financial Statistics database.<sup>10</sup> For ERS, the United States is considered the center country, and thus the exchange rate values used are based on the domestic currency value of a US Dollar. Similarly, in the case of KAO, the US money market interest rate is used as a point of comparison relative to the domestic money market interest rate. In line with previous works in the literature, data for

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<sup>10</sup> Data for MPI is available yearly from [http://web.pdx.edu/~ito/trilemma\\_indexes.htm](http://web.pdx.edu/~ito/trilemma_indexes.htm). Quarterly values were imputed from these dataset by assigning the annual value to the quarters of the respective year. This appears to be a valid assumption, given the relative stability of this index.



countries with limited money market interest rate data is supplemented with values for the lending rate. RESGDP is calculated as the ratio of total international reserves minus gold and the seasonally-adjusted quarterly gross domestic product for each country.

A useful alternative to interpret the VAR estimates is through the use of impulse response functions. The following section of this chapter presents accumulated impulse-response function tables based on shocks of one unit of the residuals. Based on these findings, it is possible to narrow down our analysis to account for the effects of shocks to the indices of interest as a result of changes in the relative level of reserves.

## **2.4 Results**

The preliminary evidence presented in the previous section suggests a role for international reserve accumulation in advancing the main goals of the traditional Triffin trilemma. This section presents the results from the more exhaustive, disaggregated VAR analysis outlined above. Data availability differed across countries, and is reflected in the respective figures.

### **2.4.1 Exchange Rate Stability and Reserves**

Figure 2.5 presents the accumulated impulse responses of the Exchange Rate Stability index to a one-unit shock to  $\Delta$ RESGDP for each of the individual countries. Contrary to expectations, our VAR analysis provides limited empirical support for the presumed positive relationship between international reserves and the stability of a country's exchange rate. Based on these findings, it appears that countries that see reserve accumulation as a way out of the trilemma by trying to sustain stable exchange rates—

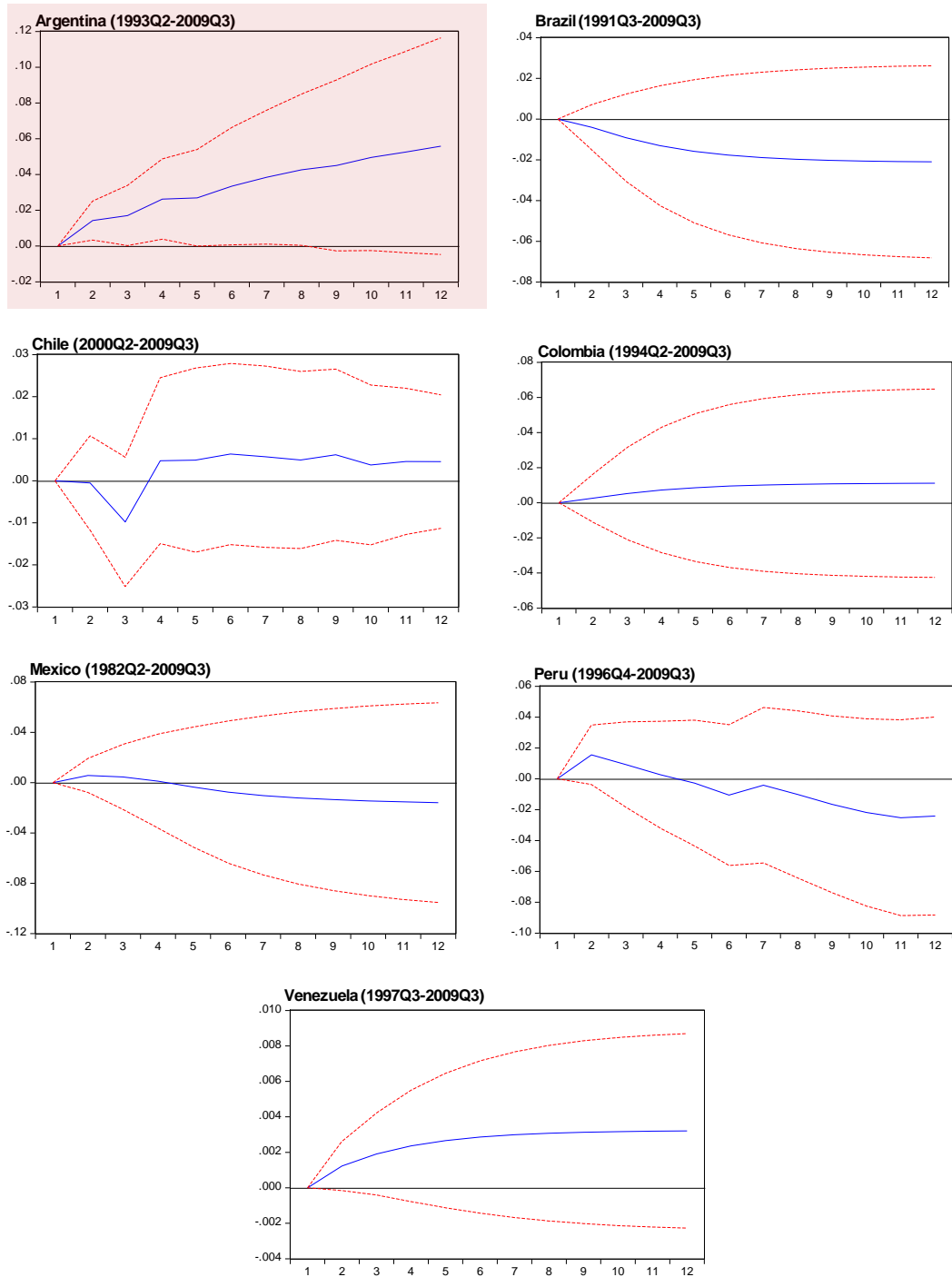
while simultaneously being committed to liberalized capital accounts and independent monetary policy—are bound to see their attempts fail. This finding is in line with the recent literature on “the fear of reserve loss”, under which most emerging countries (including those in Latin America) despite having unprecedented levels of reserves during the 2007-2009 global financial crisis, experienced significant depreciations of their currencies (Aizenman and Hutchison 2010).

Despite the limited evidence for the benefits of reserve accumulation with regards to exchange rate stability, it is important to note another important finding from the above results. Of the seven Latin American countries considered in the analysis, only Argentina’s (and to a lesser degree Venezuela’s<sup>11</sup>) exchange rate stability appears to benefit from increases in relative reserves. This is of particular interest given the prominent role that fixed exchange rate regimes have played in these two countries during parts of the period used in our analysis. The impulse response of ERS to a shock in  $\Delta$ RESGDP is especially large and statistically significant in Argentina. A closer look at the Argentinean case is merited.

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<sup>11</sup> Venezuela is the only country in the sample which maintained a pegged exchange rate during the last financial crisis. It was also the only country that relied entirely on foreign reserve reductions to absorb the exchange market pressure associated with this crisis (see Table 1).

**Figure 2.5. Accumulated Impulse Responses of Exchange Rate Stability to Shocks in International Reserves**



Note: The solid line represents the accumulated impulse response to a one-unit shock in  $\Delta$ RESGDP. The dashed lines show  $\pm 2$  S.E. confidence intervals.

## 2.4.2 Argentina's Currency Board

In an attempt to rein in the hyperinflation that prevailed at the end of the 1980s, Argentina opted for the establishment of a currency board on April 1, 1991. Under this arrangement the Argentinean Peso was tied to the US dollar at a 1-to-1 rate until its collapse in January 6, 2002. As discussed in Spiegel (2002), traditional currency boards must meet three criteria: maintain a fixed exchange rate with the anchor currency, provide for full convertibility between the domestic and the anchor currency, and fully back its monetary liabilities with foreign reserves. While Argentina's currency board did not always meet these criteria in their entirety (see Hanke and Schuler (2002)), it undoubtedly represented the only long-term binding hard peg in the region in recent history. The traditional theory on reserve accumulation holds that countries with fixed exchange rate regimes require higher levels of reserves relative to flexible exchange rate arrangements (Haberler (1977)). Thus, it follows that of all the Latin American countries considered, Argentina presents the only consistently significant evidence in favor of the role of reserves in supporting exchange rate stability.

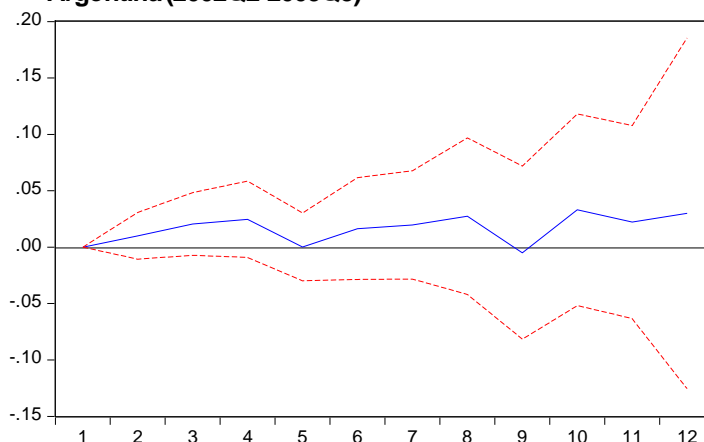
This effect is further illustrated by the fact that this relationship becomes statistically insignificant when we conduct a VAR analysis of the subsample of the period following the disbanding of the currency board<sup>12</sup>. Figure 2.5a shows the accumulated response of ERS to a one-unit shock to  $\Delta$ RESGDP for the post-currency board period (2002Q-2009Q3). As can be seen from this graph, once Argentina allowed its exchange rate to float, the relationship between changes in reserves and the stability of the

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<sup>12</sup> At the  $\alpha=0.1$  level of significance.

exchange rate is no longer statistically significant, and therefore appears to reflect the experience of the other countries in the region.

**Figure 2.5a. Argentina Post-Currency Board: Accumulated Impulse Responses of Exchange Rate Stability to Shocks in International Reserves**  
**Argentina (2002Q2-2009Q3)**



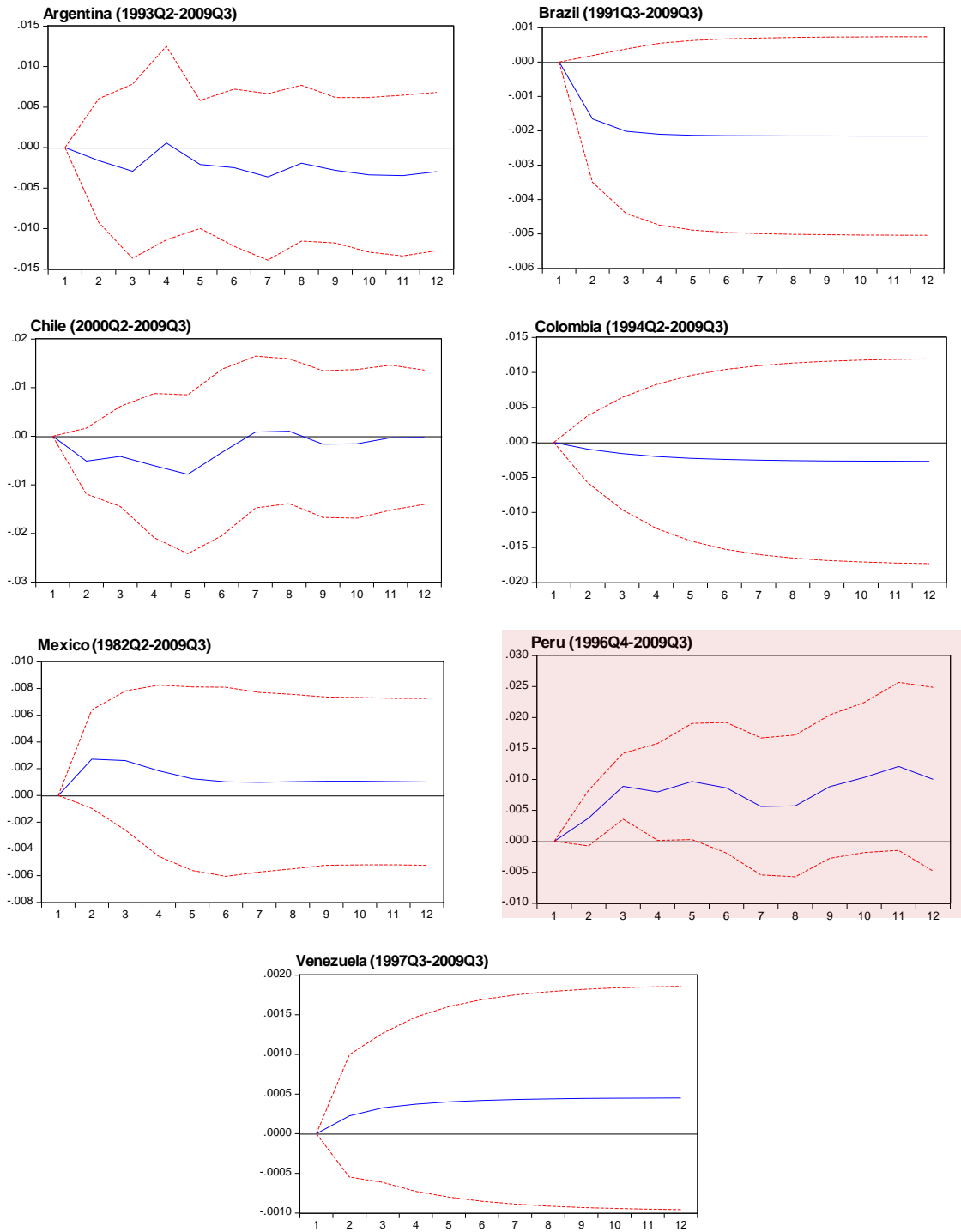
Note: The solid line represents the accumulated impulse response to a one-unit shock in  $\Delta$ RESGDP. The dashed lines show  $\pm 2$  S.E. confidence intervals.

Taken together, this evidence suggests the foreign reserves play a role in promoting exchange rate stability only in instances of fixed exchange rate regimes—such as that of Argentina’s currency board in the 1990s and early 2000s. For other countries with managed flexible exchange rates, or even softer pegs (e.g. Brazil 1994-1998) there is no evidence of higher exchange rate stability associated with larger changes in the level of relative reserves.

### 2.4.3 Capital Account Openness, Monetary Independence and Reserves

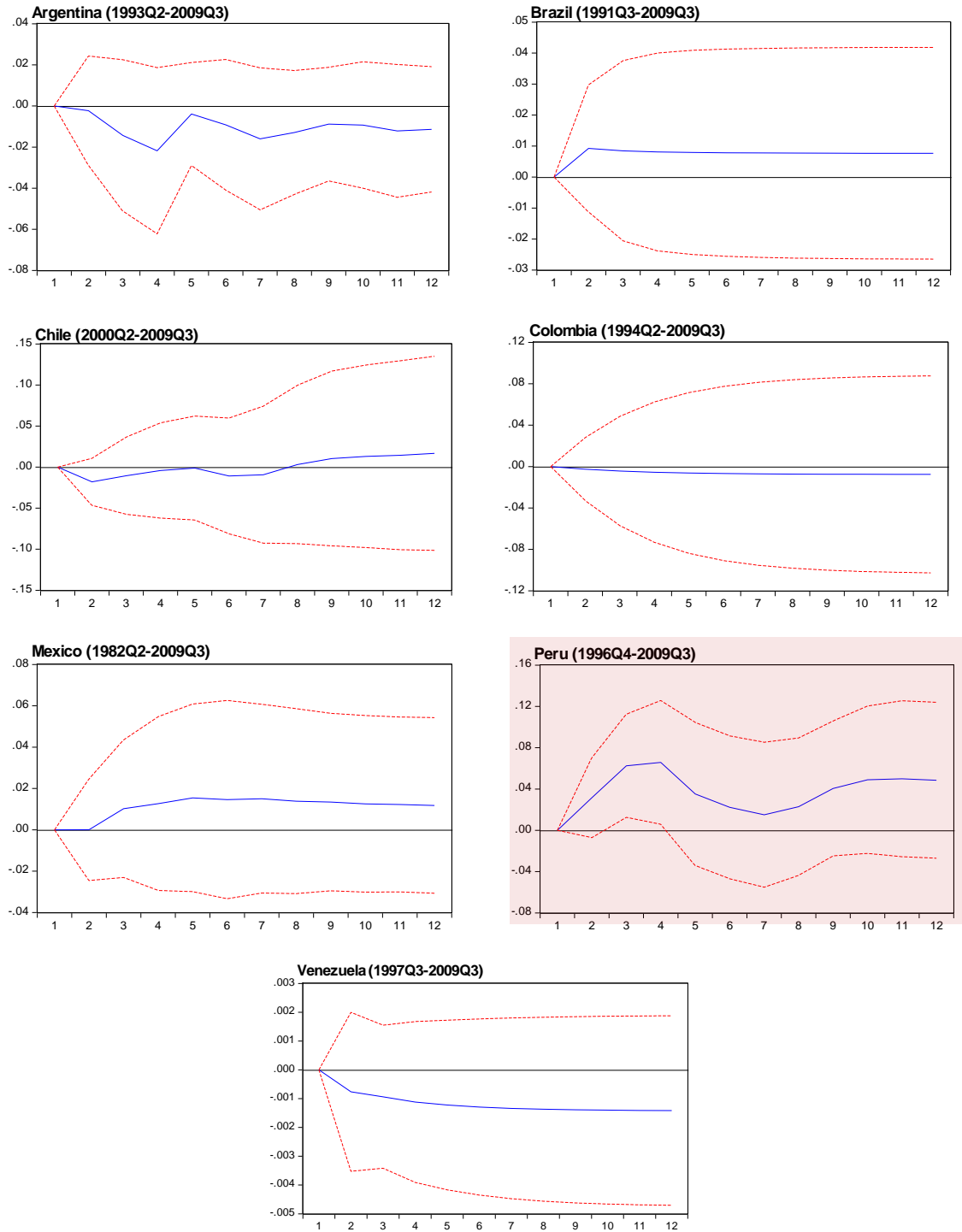
Similar to the findings for the relationship of reserves and ERS, the impulse-response analyses for the effect of changes in relative reserves on capital account liberalization and monetary policy independence provide little support for the expected positive relationships. Figures 2.6 and 2.7 present the accumulated responses of  $\Delta$ KAO and MPI

**Figure 2.6. Accumulated Impulse Responses of Capital Account Openness  
to Shocks in International Reserves**



Note: The solid line represents the accumulated impulse response to a one-unit shock in  $\Delta RES_{GDP}$ . The dashed lines show  $\pm 2$  S.E. confidence intervals.

**Figure 2.7. Accumulated Impulse Responses of Monetary Policy Independence to Shocks in International Reserves**



Note: The solid line represents the accumulated impulse response to a one-unit shock in  $\Delta$ RESGDP. The dashed lines show  $\pm 2$  S.E. confidence intervals.

to a one-unit shock to  $\Delta\text{RESGDP}$ . Here again, all countries, with the exception of Peru (and to a lesser degree Brazil in the case of  $\Delta\text{KAO}$ ), show no evidence of experiencing gains in either capital account openness and/or monetary policy independence due to rising changes in the relative level of reserves.

#### **2.4.4 Peru: An Exception to the Rule?**

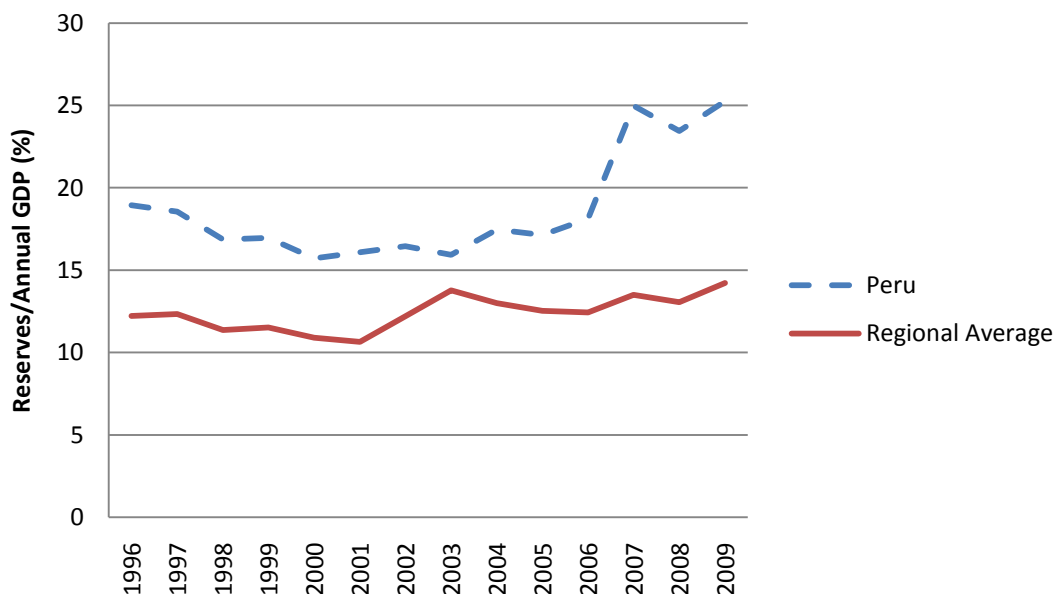
In addition to showing little evidence for the expected gains in capital account openness and monetary policy independence associated with reserve accumulation, Figure 2.6 and 2.7 highlight the stark difference between the responses by  $\Delta\text{KAO}$  and MPI in Peru and those in the other countries considered. Based on these results it appears that reserve accumulation ‘works’ for Peru in terms of encouraging higher levels of capital account openness and monetary policy independence, and thus easing the trilemma. This raises an interesting question: why does reserve accumulation benefit Peru, but not other countries?

Further analysis shows that Peru is an exception to the rule only in the sense that it is uniquely positioned (in the region) to benefit from reserve accumulation. That is, unlike its neighbors Peru has maintained exceptionally high levels of international reserves relative to their GDP. Figure 2.8 shows Peru’s reserve position relative to the rest of the region. For the period under consideration, Peru has maintained consistently higher levels of relative reserves. Indeed in recent years that level has exceeded 20% of its GDP, and by 2009, the country’s relative reserves were almost twice as large as the regional average. This observation is significant when put in the context of previous findings by others in the literature, who have argued that only at high levels of relative reserves are countries able to escape the trilemma. For instance Aizenman et al. (2010)



finds that high levels of relative reserves (exceeding a 21% of GDP threshold) allow countries “...to pursue a higher weighted average of MI and KAOPEN, i.e. relax the trilemma.” Once this observation is taken into account, it appears that the evidence found in this chapter supports their assertion that reserve accumulation ‘works’ only for those countries with already high pre-existing levels of relative reserves. As of today, of all the large emerging Latin American countries, only Peru meets this threshold.

**Figure 2.8. Peru's Foreign Reserve Accumulation in Perspective (1996-2008)**



## 2.5 Conclusion

Latin American countries, like the majority of emerging markets across the globe, have embarked in an unprecedented process of international reserve accumulation. These reserves, however, do not come free. Therefore, it is critical to assess the degree to which reserves are actually serving their desired purpose, and to what degree could these purposes be achieved in a more cost-efficient manner. This chapter builds on the limited

(and somewhat ambiguous) existing evidence by directly delving into the question of the effectiveness of international reserves in enhancing any of the policy goals considered under the traditional trilemma of international finance.

Contrary to most traditional expectations, the VAR analysis carried out in this chapter finds little evidence in support of the effectiveness of reserves in helping the holding countries ease the trilemma. With a few exceptions, increases in the level of reserves relative to GDP do not appear to be associated with changes in any of the three trilemma goals at a reasonable level of statistical significance. In other words, reserve accumulation does not appear to be working—at least in terms of helping the holding countries escape the trilemma.

However, two notable exceptions to this general conclusion reinforce some of the previous findings in the literature. First, only the two countries with a recent history of fixed exchange rate regimes in the area (Argentina and Venezuela) showed evidence of gains in exchange rate stability associated with increases in relative reserves. A closer look at the Argentinean case suggested that in line with the traditional optimal reserve demand literature, gains in exchange stability from accumulating reserves accrue mostly in instances of hard pegs. Second, our findings suggest that only countries with high levels of reserves obtain benefits in terms of their capital account openness and monetary policy independence as a result of increases in holdings of foreign reserves. For instance, Peru—the only country in the region with reserves in excess of 21% of its GDP—is also the only country in our sample that appears to experience statistically significant increases in capital account openness and monetary policy independence as a result of an increase in relative reserves. This finding is in line with the evidence presented in

Aizenman et al. (2010) which claims that only in countries with reserves exceeding 21% of GDP do these reserves ease the trilemma.

Rather than definitively answering the question of whether reserves ‘work’ or not, the findings presented in this chapter raise important questions for policymakers in terms of the appropriateness of reserve hoarding. While not conclusive, these findings do provide some evidence in support of the idea that reserve accumulation contributes to easing the trilemma *only* in instances when reserves are significantly large. For countries holding a more moderate level, reserves appear to provide little to no benefit, except in cases of hard pegs of their exchange rate. Policymakers must consider the opportunity cost as well as their country’s ability and willingness to accumulate the high levels of reserves necessary to escape the trilemma. Moreover, it provides further impetus for the creation of mechanisms of regional support, such as reserve pools, which might allow countries to have access to larger stocks of reserves and hence surpass the apparent threshold of reserve effectiveness.

## CHAPTER 3

### INSURING AGAINST NEIGHBORING CRISES: OPTIMAL RESERVE ACCUMULATION AND CONTAGION IN LATIN AMERICA

#### 3.1 Introduction

One of the defining trends in international finance of the last two decades has been the unprecedented growth in the levels of international reserves accumulated by emerging nations. International reserves held by developing countries in 2007 were nearly 13 times as large as those in 1990. In a global financial system characterized by market failures and sudden stops, many developing countries have opted for the protection provided by individual accumulation of reserves as a second-best outcome. However, as suggested by Rodrik (2006), the accumulation of reserves comes at a hefty (social) opportunity cost to the nations that hold them. It is this particular aspect that brings into question—or at least merits a re-examination of—the validity and efficiency of reserve accumulation as a stabilization and development strategy, particularly in the context of some cash-strapped developing nations.

A concurrent trend, and a direct response to this dilemma, has been the push for the creation of regional arrangements of cooperation throughout the developing world. Arguments in favor of these mechanisms have ranged from pure political and cultural ties to the benefits of risk-sharing and macro coordination. An important category of these regional mechanisms has involved the establishment of reserve pooling and foreign exchange swap arrangements. Institutions like the Latin American Reserve Fund (FLAR) and the Chiang Mai Initiative (CMI) in South East Asia have gained a new impetus in recent years. Moreover, these institutions have become an important component of the

International Monetary Fund's recent attempt to reshape itself to better deal with the "Global Imbalances" problem and with the much needed democratization of the Fund. In a recent speech about the future of the IMF, its Managing Director, Dominique Strauss-Kahn (2010), had this to say about the role of regional reserve pooling arrangements:

"...we might look at ways to collaborate with regional reserve pools. We certainly do not see such funds as 'competitors.' Indeed, they can be a positive and stabilizing force in international financing—as exemplified by recent European Union lending in parallel with Fund programs. At its most ambitious, such collaboration could even include Fund resources serving as a backstop to regional pools."

The literature on international reserves demand has addressed many of the key issues with respect to the motive, size adequacy, and, to a degree, potential alternatives to the current framework of reserve accumulation. However, and despite the extensive evidence of the prevalence of crisis contagion tendencies among emerging market countries, the literature has paid limited attention to the critical linkage between the optimal reserve demand decision and the potential risk associated with contagion. Traditional models of reserve demand have adopted a country-specific approach under which the optimal reserve demand function is determined partially in a vacuum. Thus, with a few exceptions (e.g. Agosin (2000), and a recent paper by Basu et. al. (2010)), the degree to which this decision is made based on external conditions, particularly those of neighboring countries, remains largely unexplored.

This chapter addresses the nexus between international reserve accumulation and the prevalence of contagion in Latin America by first identifying to what degree countries in the region are taking the risk of contagion (originating in neighboring countries) into their demand for reserves, if at all. In order to accomplish this task, a proxy for contagion

risk is first constructed based on previous models of exchange rate market pressure. Using cross-sectional time series data for the seven largest countries in Latin America and least squares estimation techniques, this chapter empirically identifies a significant positive effect of contagion risk on the growth rate of the accumulation of reserves. Based on this result, it places the effects of insuring against contagion risk in context, by estimating the cost of this additional level of insurance. Moreover, by employing the widely used method of coverage ratios, this chapter concludes with an exploration of the increased insurance coverage that may ensue from reductions in the countries' variability in the balance of payments. This decrease in variability is based on the premise that regional reserve pools reduce contagion risk, which in turn leads to more stable balance of payments. Simplified simulations based on different hypothetical levels of reduced variability are considered to calculate potential increases in insurance coverage.

The empirical identification of the role of contagion risk in the optimal demand for reserves has important policy implications. Latin American monetary authorities, looking to maintain a comparable level of protection against sudden stops and real market shocks, and to reduce the opportunity cost of holding reserves, would benefit from alternative strategies to the current model of "self-insurance." This chapter finds that the opportunity cost of the precautionary accumulation of reserves to deal with contagion risk is not negligible. Thus as previously argued by others in the literature and as illustrated in the last section of this chapter, countercyclical policies like regional reserve pooling—through a reduction in contagion risk and balance of payments volatility—can lead to significant efficiency gains in the optimal reserve accumulation process.

The remainder of this chapter is as follows. The following section explores the literature on optimal reserve demand, contagion, and reserve pooling, and places the Latin American experience within the context of the recent rise in reserve accumulation. Section III develops a proxy variable for contagion risk, which is then used to empirically extend the traditional Buffer Stock Model. This section also details the methods used to estimate the gains from reserve pooling. Section IV presents the empirical findings. Section V concludes.

## **3.2 Literature Review and Background**

### **3.2.1 Reserve Accumulation in Latin America**

If not at the same levels observed in East Asia, the accumulation of reserves in Latin America has dramatically increased in recent years. In 2007, the region's total reserves were almost 84 times those in 1970 in nominal terms. The aggregate reserves of the seven largest Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela) reached \$460 billion US Dollars in the third quarter of 2008; a significant figure by most standards. Among these countries Brazil, Mexico and Colombia experienced the most dramatic increase, while Venezuela, Chile and Ecuador saw their reserves increase at a more moderate rate (See Table 3.1 and Figure 3.1).

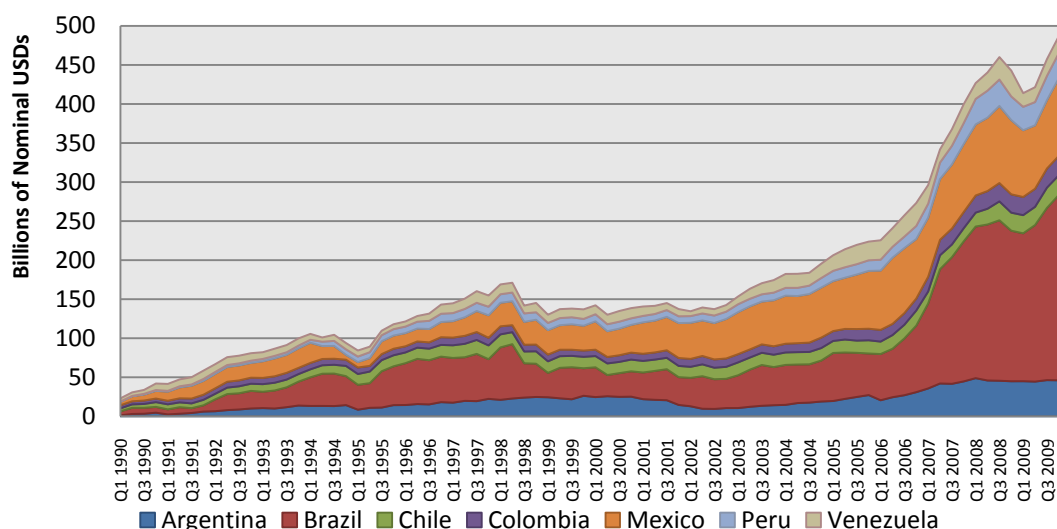
**Table 3.1. Average Total International Foreign Reserves (1970=1)**

	1970-79	1980-89	1990-95	1996-97	1998-99	2000-01	2002-03	2004-05	2006	2007
Argentina	4.29	6.67	17.75	30.91	37.55	29.12	18.08	35.01	46.97	67.69
Brazil	5.00	6.52	22.82	46.81	33.72	28.94	36.61	44.85	72.14	151.55
Chile	1.78	8.59	26.94	43.11	39.82	37.60	39.81	42.04	49.52	43.00
Colombia	6.57	19.36	35.56	47.88	40.67	46.45	52.52	68.75	74.50	101.11
Mexico	2.28	8.31	21.21	32.00	42.12	53.16	72.55	91.47	100.96	115.35
Peru	2.15	5.73	13.99	32.92	27.95	26.07	29.47	39.62	51.50	82.05
Venezuela, RB	6.40	11.01	12.37	16.11	14.26	13.46	15.73	25.42	35.08	32.26
Latin America & Caribbean	4.26	8.35	18.52	31.44	29.98	29.51	33.39	44.60	58.10	83.69

*Source: Calculations based on WB's GDF data*



**Figure 3.1. Latin American (Non-Gold) Foreign Reserves**



Source: IMF's IFS

The growth in reserves goes beyond its nominal level considerations, and is also evident in terms of the countries' short-term debt and imports—two critical variables when considering the precautionary role of reserves. The region overall has steadily increased its ratio of international reserves to short-term debt in the last four decades, with all the countries in the sample having ratios in excess of one by the end of 2007 (See Table 3.2). In contrast, before 1990 only three countries (Venezuela, Colombia and Chile) had reserves exceeding their short-term debt. This ratio is significant not only because it serves as a strong signal of a country's ability to meet its debt obligations in the upcoming year, but also because this measure is being explicitly used by country officials as part of the management process of their reserves (IMF (2001)). Accelerated efforts to increase foreign reserve holdings following the Asian Financial Crisis (AFC), along with a conscious attempt at restructuring the external debt in favor of longer term commitments have reduced the apparent vulnerability of the region, at least in terms of

**Table 3.2. Reserves/Short-Term Debt**

	1970-79	1980-89	1990-95	1996-97	1998-99	2000-01	2002-03	2004-05	2006-07
Argentina	1.43	0.61	1.10	0.77	0.85	0.81	0.67	0.77	1.08
Brazil	1.92	0.64	0.92	1.57	1.36	1.17	1.81	2.17	4.41
Chile	0.75	1.46	3.24	2.75	3.31	2.58	2.45	2.27	1.66
Colombia	0.92	1.81	2.65	1.70	1.72	3.13	3.02	2.53	3.56
Mexico	0.72	0.84	0.59	0.85	1.27	2.48	5.77	9.16	10.04
Peru	0.72	0.87	0.77	1.72	1.78	2.59	3.91	4.50	5.29
Venezuela, RB	4.34	2.11	4.18	5.02	4.69	1.75	2.21	2.97	2.99
Latin America & Caribbean	1.52	0.85	1.00	1.36	1.40	1.54	2.10	2.32	3.09

*Source: Calculations based on WB's GDF data*

**Table 3.3. Reserves in Months of Imports**

	1970-79	1980-89	1990-95	1996-97	1998-99	2000-01	2002-03	2004-05	2006-07
Argentina	9.78	4.11	5.71	5.68	6.25	5.28	5.47	6.50	7.83
Brazil	4.63	2.83	6.25	7.49	5.19	4.36	6.18	5.60	8.78
Chile	3.21	5.13	8.21	7.82	7.76	6.83	6.91	4.41	3.06
Colombia	5.14	6.55	7.18	5.85	5.73	6.22	6.62	6.13	5.12
Mexico	1.60	2.09	2.28	2.24	2.33	2.33	3.24	3.36	3.13
Peru	3.99	4.64	6.59	10.35	9.77	9.15	9.62	8.66	8.81
Venezuela, RB	9.45	8.97	9.02	9.78	7.47	6.29	10.29	10.13	7.98
Latin America & Caribbean	5.78	3.67	4.57	5.01	4.25	3.76	4.55	4.56	5.13

*Source: Calculations based on WB's GDF data*

meeting its short-term debt obligations. Thus by 2007, countries like Mexico, Peru and Brazil found themselves in a position to potentially cover over 10, 5 and 4 times, respectively, their short-term debt requirements by using their accumulated international reserves. Moreover, it is important to note that according to the widely-cited Guidotti-Greenspan rule of reserve adequacy (Greenspan (1999))<sup>13</sup>; all countries in the sample hold massive excess reserves.

If reserves are seen through a precautionary lens, countries—especially the less-developed ones—would be expected to be concerned about securing the continuous flow of critical imports. In case of a crisis, international reserves, if available, could be relied upon to temporarily stabilize imports by allowing countries to fulfill their needs in the international markets with acceptable foreign currency. Consequently, the number of months of imports that international reserves could potentially cover is an important indicator of reserve adequacy. Growing integration into the world markets by countries in the region has meant a significant increase in their level of imports. Therefore, as imports grow along with foreign reserves, this indicator has remained relatively stable for the region overall: around 4-5 months of imports (See Table 3.3). The sample countries with the strongest performance in terms of this indicator by 2007 include Brazil, Peru, and Venezuela.

### **3.2.2 Optimal Reserve Demand**

The economics literature on the demand for international reserves can be loosely divided into reserve accumulation driven by mercantilist and precautionary motives. Proponents

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<sup>13</sup> This rule of thumb states that countries should hold levels of reserves equal to their short-term external debt.

of the mercantilist approach to reserve demand argue that the recent accumulation of reserves by developing countries can be best explained by conscious efforts by their monetary authorities to maintain an undervalued currency, and thereby increase the competitiveness of their exporting industries (e.g. Dooley et al. 2005). Evidence from the case of China—with reserves nearing US\$2.5 Trillion by the end of 2009 and a largely undervalued Renminbi—and other South East Asian nations seems to give some validity to this view.

On the other hand, the precautionary view of reserve accumulation is based on the idea that countries accumulate savings in the forms of reserves to deal with the uncertainties that may arise from sudden-stop episodes and other balance of payments shocks. The precautionary motive approach remains the focus of the reserve demand literature, and as such, it has closely resembled the main tenets of the quantity theory of money. From the precautionary point of view, reserves are seen to serve three critical roles: 1) provision of liquidity during shocks to the balance of payments, or during national emergencies, 2) reduction in adjustment costs following a crisis, and 3) boosting confidence in the finances of the local economy, and thus contributing to the deterrence of potential speculative attacks.

Cooper (1968) highlights the role of reserves in providing short-term policy space to countries facing balance of payments shocks and thus reducing and/or delaying the implementation of painful expenditure switching and expenditure reduction measures. Financial crises in developing countries, including Latin American ones, tend to be accompanied by costly disruptions to their economies, such as low or negative economic growth, growing unemployment rates, declining terms of trade, deterioration in the debt

structure, among others. Thus, reserves are seen as a countercyclical buffer aimed at minimizing the potential damage to the domestic economy, either by deterring a crisis from happening, or by alleviating the negative consequences when one does occur.

However, along with these important benefits, there is a significant opportunity cost attached that must also be considered when demanding foreign reserves. By their precautionary nature, foreign reserves are typically in the form of very liquid, safe assets (e.g. US Treasury securities) with corresponding low yields. In the meantime, many Latin American countries are increasingly recurring to the international financial markets for the financing of their public and private economic activities by issuing high yield securities (e.g. Brady Bonds). The gap between the yield structures of the assets and liabilities held by developing countries' central banks accounts for the opportunity cost of reserves<sup>14</sup>. Heller (1966) first provided a model based on a cost minimization problem, where the monetary authorities select an optimal level of reserves to minimize the costs (adjustment and opportunity costs) that may arise from a crisis event.

While the concept of opportunity cost within the context of reserve demand was first introduced by Heller (1966), it was Frenkel and Jovanovic (1981), who building upon this work, developed the “buffer stock” model. This model, which to this day provides the basic framework for most empirical studies of reserve demand, directly reflects the maximization problem stated above. In the buffer stock model, changes in reserve holdings  $dR(t)$  follow a Wiener process (driven by the stochastic process that governs payments and receipts). Monetary authorities face a cost minimization problem, where cost consists of the expected adjustment cost associated with the occurrence of a

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<sup>14</sup> Bahmani-Oskooee and Brown (2002) provide an extensive review of the literature of optimal reserve demand.

crisis event and the opportunity cost of holding reserves. Therefore, monetary authorities select their initial level of reserves ( $R_0$ ) in order to minimize this expected aggregate cost. Adjustments are necessary when the level of reserves reaches a lower bound, which for the sake of simplicity is assumed to be zero. Solving for the optimal stock of reserves yields, Frenkel and Jovanovic (1981) derive the following equation:

$$\ln R = b_0 + b_1 \ln \sigma + b_2 \ln r + u,$$

Where  $\sigma$  is a volatility measure of reserves,  $r$  accounts for the opportunity cost of holding reserves, and  $u$  is the error term. Based on the theoretical model, the predictions are that  $b_1 = 0.50$  and  $b_2 = -0.25$ . Moreover, Frenkel and Jovanovic (1981) conducted regression estimations of the model above for a panel of 22 developed countries for the 1971-1975-period. They calculated the variable  $\sigma$  as the standard error of the trend-adjusted changes in reserves, while the opportunity cost,  $r$ , was captured using data for the government bond yield. Their empirical findings show the coefficients to be of the right sign, significant, and similar in magnitude to the predictions ( $b_1=0.505$ ,  $b_2=-0.279$ ). In line with the earlier theoretical work in Triffin (1961) and Olivera (1969)—both of which had proposed the level of trade (represented by imports) as a determinant of reserve demand—Frenkel and Jovanovic (1981) extend their structural specification to:

$$\ln R = b_0 + b_1 \ln \sigma + b_2 \ln r + b_3 \ln M + u, \text{ where } M \text{ accounts for the level of imports.}$$

The level of reserves demanded is expected to be positively correlated with imports, through a precautionary channel (Olivera) in which countries with larger imports face higher potential adjustment costs. Frenkel and Jovanovic's empirical testing of this structural extension to the original buffer stock model found a positive (and significant)

elasticity of demand for reserves with respect to imports ( $b_3=0.352$ ), while the elasticity of demand for reserves with respect to the variability and opportunity cost measures retained its original signs and significance ( $b_1=0.676$ ,  $b_2=-0.233$ ).

While the mercantilist motive seems to have played a role in the unprecedented accumulation of reserves in East Asia, Aizenman and Lee (2007) and Perez (2009) argue that the empirical evidence for the Latin America does not support the idea that reserve accumulation in the region is primarily the result of exchange rate manipulations. Moreover, when it comes to Latin America, there appears to be a widely-held consensus in the literature that supports the idea that foreign reserve demand by Latin American countries is more in line with the traditional precautionary motive first advanced by Heller (1966). With that in mind, the remainder of this chapter will concentrate on the treatment of reserve accumulation from the point of view of insurance protection against potential costly crisis events, without entirely dismissing potential mercantilist reasons. In any event, mercantilist reasons can arguably be subsumed under the precautionary motive if one assumes that the sustainability of a stable (and positive) current account would help avert some of the crises previously mentioned.

### **3.2.3 Contagion and the Precautionary Motive**

The literature on the optimal demand for reserves has paid limited attention to the linkage between reserves demand and the risk of contagion. In order to test this contagion risk as an explanatory variable on the demand for reserves, we must first consider the separate, but extensive, literature on contagion. Interest in contagion in international markets (especially those of emerging countries) reached its apex soon after the Asian Financial

Crisis of the late 1990s, and has only regained prevalence in the last year due to the recent fears associated with the sovereign bonds markets of some Mediterranean members of the European Union. However, while interest in the topic has partially wended down since the late 1990s, several key aspects of contagion and the methods used to measure it remain mostly unresolved. As stated above, this chapter aims to explore the relationship between contagion risk and the optimal reserve accumulation decision from a precautionary motive point of view. In particular, it seeks to account for the effects that the risk of contagion (mainly originating from *neighboring* countries) has, or should have, on the level of accumulation of reserves of each country. Unlike the “first generation” crises of the 1980s in Latin America, which can be directly traced to the financial decisions of individual countries, contagion crises can occur regardless of the strong state of a country’s own fundamentals. This chapter assesses the effects of the risk associated with contagion crises by endogenizing this risk into the traditional specification of the buffer stock model outlined above. Table 3.4 presents *prima facie* evidence of the co-cyclicity of exports and the risk premium faced by countries in the region.

Before exploring this aspect any further, it is necessary to revisit the literature to identify what is meant by contagion. In its coarsest form, contagion in the context of financial crisis has come to be understood as a dominoes effect under which even relatively healthy economies can face painful crisis episodes resulting from economic shocks in other economies; in many cases regardless of their own fundamentals.<sup>15</sup> Forbes

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<sup>15</sup> Although as it became clear during the Asian Financial Crisis with the spread of the crisis to Brazil and Russia, contagion is not limited to a country’s neighbors. However, this type of event would be best characterized as “Shift Contagion” in the Forbes and Rigobon (2001) sense.



**Table 3.4 . Correlation Matrices (1999-2009)\***

<b>Exports</b>	Argentina	Brazil	Chile	Colombia	Mexico	Peru	Venezuela
Argentina	-----						
Brazil	<b>0.97</b> (26.59)	-----					
Chile	<b>0.91</b> (13.03)	<b>0.92</b> (14.76)	-----				
Colombia	<b>0.99</b> (36.8)	<b>0.97</b> (25.51)	<b>0.93</b> (15.18)	-----			
Mexico	<b>0.96</b> (21.62)	<b>0.97</b> (25.32)	<b>0.96</b> (20.49)	<b>0.97</b> (25.86)	-----		
Peru	<b>0.96</b> (22.23)	<b>0.98</b> (27.53)	<b>0.97</b> (23.88)	<b>0.98</b> (27.04)	<b>0.98</b> (34.62)	-----	
Venezuela	<b>0.29</b> (1.83)	<b>0.39</b> (2.54)	<b>0.49</b> (3.45)	<b>0.30</b> (1.89)	<b>0.45</b> (3.08)	<b>0.43</b> (2.92)	-----

<b>EMBI Spread</b>	Argentina	Brazil	Chile	Colombia	Mexico	Peru	Venezuela
Argentina	-----						
Brazil	<b>0.61</b> (4.54)	-----					
Chile	-0.09 (-.51)	<b>0.38</b> (2.39)	-----				
Colombia	<b>0.46</b> (3.11)	<b>0.87</b> (10.6)	<b>0.57</b> (4.13)	-----			
Mexico	0.18 (1.08)	<b>0.69</b> (5.59)	<b>0.81</b> (8.3)	<b>0.89</b> (11.6)	-----		
Peru	<b>0.36</b> (2.27)	<b>0.85</b> (9.72)	<b>0.62</b> (4.73)	<b>0.96</b> (20.09)	<b>0.91</b> (12.77)	-----	
Venezuela	<b>0.37</b> (2.39)	<b>0.62</b> (4.73)	<b>0.84</b> (9.26)	<b>0.75</b> (6.69)	<b>0.85</b> (9.75)	<b>0.74</b> (6.59)	-----

Source: Author's calculations based on IMF's IFS Database

\* T-values in parentheses. The values in **bold** are significant at the 10% level.

and Rigobon (2001) provide a useful and widely-cited taxonomy of the main approaches to contagion in the literature. They differentiate interdependence approaches to contagion from those dealing with “shift-contagion”. Interdependency contagion is defined as the extension of a crisis episode from one country to another without a structural change in the co-movement of their fundamentals. It represents a risk that is derived from the endemic and pre-existing relations among the countries involved. On the other hand, shift contagion is defined as a structural change in the co-variance of the fundamentals between the countries involved as a result of a crisis episode. These linkages can be measured as the correlation in asset returns, the probability of speculative attack, or the transmission of shocks or volatility.

Furthermore, Forbes and Rigobon (2001) classify the literature on the propagation of shocks into crisis-contingent and non-crisis-contingent theories. The first set of theories is in accordance with the “shift-contagion” approach, and consists in the transmission of crisis shocks through mechanisms of multiple equilibria (i.e. investor psychology), endogenous liquidity (i.e. reduced liquidity leading to portfolio re-composition), and political contagion (i.e. changes in fixed exchange rate regimes as a result of changes in other countries.) These mechanisms of transmission of shocks are based on a structural change in the relationship between the affected countries. As such, they represent a new method of crisis transmission, which does not exist before the onset of the crisis. As suggested by its name, the second set of theories, non-crisis-contagion theories, encompasses all theories in which a crisis is not necessary for the shock transmission process to take place. Therefore, this set of theories is in line with what Forbes and Rigobon (2001) described as ‘interdependence’. The channels of transmission

remain constant with or without the occurrence of a crisis episode. They include trade (e.g. devaluations), policy coordination, re-evaluation/learning by investors (i.e. application of lessons learned in one country to another similar country), and random aggregate/global (exogenous) shocks (e.g. a rise in the international interest rate). While these categorizations are important, contagion risk, whether it originates from either shift-contagion or from interdependence, exerts significant costs on individual countries. Moreover, as argued by Machinea and Rozenwurcel (2006), the information asymmetries and herding behavior that characterize “shift-contagion” also tend to intensify the interdependence among countries in the region.

The existing literature on contagion (under alternative definitions and measurements) provides ample empirical evidence for the prevalence of this phenomenon in Latin America. Calvo and Reinhart (1996) conclude that capital flows to four small Latin American countries depend on standard determinants, *and* a contagion proxy (consisting of the capital flows to four large countries in the region). Moreover, using data for weekly stock market returns for selected Latin American and Asian countries, they find that correlation coefficients increased among Latin American countries and decreased between Latin American and Asian countries following the December 1994 Mexican Peso devaluation. The authors conclude that this finding provides further evidence that contagion is highly regional in nature. Similarly, Glick and Rose (1999) claim that the trade linkages and patterns that prevail in a region due to geographic proximity are important in propagating a crisis, and consequently contribute to contagion propagation at the regional level. Kaminsky and Reinhart (1999) find that the conditional probability of a crisis in a Latin American country (when one or several other Latin

American countries already face a crisis) is as high as seventy-eight percent. Burki and Edwards (1996) looked at contagion in Brazil, Argentina, Venezuela, Chile and Colombia as a result of the Mexican crisis, and found that contagion was present, but selective.

### **3.2.4 Reserve Pooling**

The events that surrounded the Asian Financial Crisis of the late 1990s, including the prevalence of contagion, showed that the current international financial institutions and the overall global financial structure remain inadequately designed to address the hazards of globalization that afflict developing nations<sup>16</sup>. Consequently, along with the exorbitant growth in the accumulation of reserves, many developing countries have opted for the promotion of alternative arrangements of coordination and balance of payments support at the regional level. Some of these mechanisms range from simple bilateral swap arrangements of hard currency (e.g. the Chiang Mai Initiative) to a more formal pooling of foreign reserves. In the Latin American context, the well-established Latin American Reserve Fund (FLAR), and the nascent Bank of the South (BOS)<sup>17</sup> are the two institutions that exemplify the continuous push for the regionalization of the reserve accumulation process (see Rosero and Erten (2010)).

Some in the literature, while supportive of the tenets of regional cooperation, have expressed valid reservations about the feasibility of reserve pooling mechanisms in Latin America. For example, Machinea and Rozenwurcel (2006) argue that regional

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<sup>16</sup> Ocampo (2000) and Stiglitz (2002) provide an extensive treatment of this view.

<sup>17</sup> While the Bank of the South was recently established as a development bank, its role as a regional insurance provider (against balance of payments crises) remains central to the agenda of most of its founders.

cooperation in the region (including reserve pooling) faces significant obstacles. Chiefly among them is the relative—to the European Union—lack of existing interdependence as manifested by the low levels of intraregional trade and financial links, as well as the tendency of Latin American countries to try to differentiate themselves from their neighbors following a crisis—in an attempt to avoid being bunched together by unknowledgeable investors. For the case of the FLAR, Eichengreen (2007) concludes that in order for this reserve pool to effectively serve as a lender of last resort during the occurrence of sudden stops, it must overcome key challenges like the loss of insurance coverage for some countries that would ensue from the pooling of reserves among low-variability and high-variability countries. Consequently, he argues that the FLAR's resources would be better utilized to purchase “contingent debt securities issued by Latin American governments and corporations: domestic-currency inflation-indexed bonds, GDP-indexed bonds, commodity-price-indexed bonds.”

Notwithstanding these concerns, and as shown by the recent interest of the IMF in the concept, there is strong support in the literature for the creation of mechanisms of regional coordination and support like reserve pooling. The rationalization for the creation of these mechanisms has been based on principles well summarized in Ocampo (2006), among others. For instance, according to Ocampo the rise of “open regionalism” that has accompanied globalization has intensified the degree at which externalities from the macroeconomic policies of one country can affect its neighbors in the area. Thus, in line with arguments presented in this chapter, he states that policies that only address the problems of an individual country (while ignoring the effects on its neighbors) are likely to result in outcomes that aggravate contagion (e.g. reduced regional trade and

competitive devaluations). Moreover, he argues that as globalization continues to undermine the policy space of individual countries' economic decision-making, it is at the regional level that countries are able to retain some of their "policy autonomy". The author argues that International Financial Institutions (IFIs) like the IMF might face diseconomies of scale in the provision of financial services (e.g. crisis prevention and resolution). In contrast, regional and subregional financial institutions—serving as subsidiaries to the IMF—would be better equipped to deal with localized problems. Finally, Ocampo suggests that increased competition in the provision of financial services would be beneficial for small and medium-size countries, whose current power in dealing with IFIs is very limited because of their size. Moreover, regional institutions enjoy an increased level of "ownership" by its small member countries. This contrasts with the current financial structure under which the voice of small nations is mostly negligible.

In addition to the arguments above, Agosin (2000) makes a normative argument for partial pooling of reserves in Latin America based on contagion. Within the context of "third generation" crises, he argues that by protecting a country from a crisis occurrence, regional monetary institutions produce valuable positive externalities to other countries in the region. Mistry (1999) proposes regional institutions as "mezzanine bulwarks" of crisis response between national and global response mechanisms, which are critical to reduce "...the short- and long-term 'neighbourhood costs' of crisis mismanagements by international financial institutions throughout the developing world." He argues that regional crisis containment mechanisms are well suited to restrain the spread of contagion through coordinated prevention (e.g. supervision and macroeconomic policy synchronicity) and response. Mistry purports that the ability to respond in unified manner

creates a credible front of defense against speculation, limits the extent of trade and financial markets disruptions and avoids competitive devaluations among neighboring countries.

As presented in the first section of this chapter, Latin American countries have embraced the precautionary role of reserves and have accumulated significant resources to deal with the vagaries of the international financial markets. Thus, while relying on the normative arguments presented above, this chapter empirically links the role of contagion risk to the optimal accumulation of reserves, and thus provides additional impetus for the creation of regional reserve pools and similar mechanisms of crisis prevention and response. Moreover, aside from the regional cooperation benefits that derive from the correction of coordination failures, and which others have previously outlined in the literature, reserve pooling, by internalizing the risk of contagion into the individual demand for reserves, can increase the level of insurance coverage and/or decrease the opportunity cost of precautionary accumulation.

### **3.3 Methodology**

This chapter tests the effects of contagion on the demand for international reserves. The analysis is divided in two parts. First, it empirically extends the traditional Buffer Stock model by introducing a proxy for contagion risk. Next, it carries out the results from this extension to illustrate the potential efficiency gains from hypothetical reductions in variability associated with regional reserve pooling. Data for some of the variables of interest, especially that of the spread of the Emerging Bond Market Index, are not widely available pre-1999. This limits the number of quarterly observations available per country

to forty-two. To overcome this problem and to gain richness in the analysis, regressions in this chapter are conducted using pooled series for the seven countries under consideration—Argentina, Brazil, Chile, Colombia, Peru, Mexico and Venezuela. Unless otherwise stated, the data employed in this chapter ranges from Q1-99 to Q1-09, and thus coincides with the period that followed the Asian Financial Crisis and the subsequent crises that took place throughout Latin America. Appendix C presents the descriptive statistics for the variables used in this analysis.

### **3.3.1 A Proxy for Contagion**

In order to endogenize contagion risk into the optimal demand for reserves, it is necessary to account for the presence and extent of the risk originating from abroad. While there is not a universal method of identifying and measuring contagion, several attempts have been made in the literature to empirically address this question. Eichengreen, Rose, Wyplosz (1996) provides a good starting framework. Using panel quarterly data (Q1-59 to Q4-93) for twenty industrialized countries, Eichengreen et, al. address the question of “by how much does the probability of a *currency* crisis taking place in a country  $i$  in period  $t$  change as a result of the presence of a currency crisis in a different country  $j$  at time  $t$ ?” Even after several checks for sensitivity analysis, they conclude that “A speculative attack elsewhere in the world is associated with an increased probability of a domestic currency crisis by around eight percentage points”.

The first step in identifying the increased probability of a currency crisis taking place, as a result of a crisis elsewhere, involves determining what is meant by a crisis episode. Eichengreen et, al. start by arguing that not all potential currency crises



materialize because in some instances central banks are able to deter them by running down their stocks of reserves, devaluing the currency (abandoning/relaxing currency controls), and/or increasing the interest rate. Thus, they propose a weighted exchange market pressure index (EMP), such that:

$$EMP_{i,t} = [(\alpha\% \Delta e_{i,t}) + (\beta \Delta(i_{i,t} - i_{G,t})) - (\lambda(\% \Delta r_{i,t} - \% \Delta r_{G,t}))]$$

where  $e_{i,t}$  is the price of a unit of the center country currency in terms of country  $i$ 's currency,  $i_{G,t}$  is the short-term interest rate of the center country, and  $r_{G,t}$  is the reserve ratio (reserves/M1) of the center country. Coefficients  $\alpha$ ,  $\beta$ ,  $\lambda$  are weights. Moreover, in order to normalize the variances of the three factors, the weights  $\alpha$ ,  $\beta$ ,  $\lambda$  are set such that

$$\alpha=1, \beta = \frac{\sigma[\Delta(i_{i,t} - i_{G,t})]}{\sigma[(\% \Delta e_{i,t})]}, \lambda = \frac{\sigma[(\% \Delta r_{i,t} - \% \Delta r_{G,t})]}{\sigma[(\% \Delta e_{i,t})]}$$

Crisis episodes are identified as significant deviations of the EMP from its mean value.

The binary crisis variable is thus obtained:

$$\begin{aligned} \text{Crisis}_{i,t} &= 1 \text{ if } EMP_{i,t} > 1.5\sigma EMP + \mu EMP \\ &= 0 \text{ otherwise} \end{aligned}$$

Where  $\mu$  and  $\sigma$  are the sample mean and standard deviation of the EMP. To avoid double counting, Eichengreen et, al. suggest applying a one-period exclusion window, which implies that in case in which a crisis episode is immediately followed by another crisis episode, the latter is dropped.<sup>18</sup>

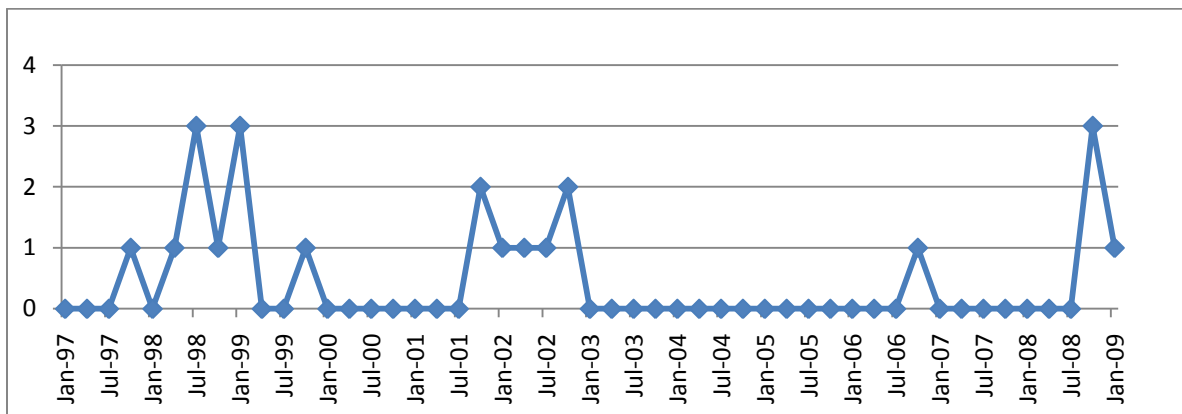
The research presented here identifies 22 crisis episodes in the region (Figure 3.2) by adapting Eichengreen et, al.'s methodology and using quarterly data for seven Latin American countries in the sample for the Q1-97 to Q1-09 period (49 quarters per

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<sup>18</sup> The same one-period exclusion window is applied to tranquil periods.

country). However, unlike their specification, which used Germany as the center country, the application of the index to the Latin American context in this chapter is done using the US as the center country—given the strong trade and financial links between the region and the US, as well as the relative stability of the US dollar. Moreover, as seen in Figure 3.2, this index captures the significant exchange market pressure felt in the region before and during the 1999 Brazilian currency crisis and the 2001-2002 Argentinean crisis, as well as the exchange rate pressure resulting from the latest global crisis (see Q4-08). The three quarters between Q2-98 and Q1-99 experienced 8 non-consecutive crises in Brazil, Chile, Colombia, Mexico and Peru. Similarly, the intensification of the Argentine crises that accompanied the elimination of the Peso-Dollar Parity in January 2002 seems to have been associated with 7 non-consecutive crisis episodes in Argentina, Brazil, Mexico and Venezuela.

**Figure 3.2. Crises Episodes**



Given the limitations in terms of the time coverage of the data (and thus its limited variation) used in this analysis, it is not possible to reach a conclusive result for the level of contagion risk as the one obtained through the probit model specified by

Eichengreen et, al. However, the pressure index values obtained and the consequent identification of common crisis episodes do provide partial support for the hypothesis of contagion prevalence in the region. More importantly, the values of the exchange rate market pressure index allow for the quantification of potential crisis tendencies in neighboring countries, even if only within the context of currency crises. If as previously suggested in the literature, Latin American crises tend to be contagious in nature, high positive EMP values in neighboring countries suggest that a crisis has or is likely to happen in the region. Therefore high EMP values in the rest of the region can arguably be used to proxy contagion risk, and thus should be expected to be associated with larger current levels of reserves.

As suggested above, the exchange market pressure index provides the basis for the creation of a proxy index for contagion. However, rather than using direct levels of the EMP index, the variable *CONTAGION* used in this empirical estimation consists of the aggregate of number of standard deviations from their individual mean for each of the countries in the sample other than country *i*.<sup>19</sup> That is,

$$CONTAGION_{i,t} = \sum_{j \neq i} \frac{EMP_{j,t} - \overline{EMP}_j}{\sigma_j}$$

where  $EMP_{j,t}$  is the EMP value for country *j* at time *t*, while  $\overline{EMP}_j$  and  $\sigma_j$  are respectively the mean and standard deviation of the EMP series for country *j* during the sample period (Q1-97 to Q1-09).

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<sup>19</sup> The use of standard deviations is preferred to actual EMP values because the former allows us to retain the relative degree of pressure faced by individual countries, which otherwise is lost when aggregating across countries.

Therefore, this measure of contagion risk is equivalent to the aggregate of the z-scores for the EMP values of neighboring countries included in the sample. A large number of the aggregate of standard deviations suggests large pressure on the exchange rate of neighboring countries, and can thus signal deteriorating conditions in the region, which arguably raise the potential for crisis at home. Consequently, under a precautionary approach to reserve accumulation, a high value of *CONTAGION* is expected to be positively associated with the growth level of reserves demanded.

### **3.3.2 Buffer Stock Model Revisited**

The increasing interconnectedness in terms of trade and financial flows that has prevailed in the past few decades necessitates a reformulation of the traditional models of international reserve demand. The buffer stock model by Frenkel and Jovanovic provides a realistic theoretical framework for accumulation of reserves from a precautionary approach. However, like most of the literature on optimal reserve demand, it fails to fully capture the potential risks that may originate from outside the country being studied. In a world of open economies, the precautionary role of reserves cannot stop at the borders of the country in question. In plain terms, getting fire insurance against your house is no longer sufficient if your neighbor's house now directly abuts yours. This reality became increasingly evident during the East Asian financial crisis, as well as the recent experiences in Brazil and Russia.

The buffer stock model addresses the accumulation of foreign reserves based on their implicit insurance role against crises. As traditionally stated, empirical specifications of this model do not address the presence of contagion risk, which go

above and beyond the idiosyncratic risk faced by each country. Contagion, as recent crises from Asia, Latin America, and Europe have shown, can wreak havoc on the economies of neighboring countries, which in some instances turn out to be innocent bystanders. Given the large potential adjustment costs that are associated with the spread of a crisis (e.g. a balance of payments, currency, and/or banking crisis), it seems theoretically necessary to incorporate this risk factor into the traditional specification of the buffer stock model in order to avoid omitted variable bias. Thus, the basic structural extension proposed in this chapter is such that:

$$\ln Reserves_{i,t} = \beta_0 + \beta_1 \ln var_{i,t} + \beta_2 \ln EMBI_{i,t} + \beta_3 \ln VULNERABILITY_{i,t} + \beta_4 CONTAGION_{i,t} + \mu_t$$

All variables (with the exception of *CONTAGION*) in this empirical specification are expressed in logarithmic terms. The variable *CONTAGION* is kept in levels in order to retain its economic meaning. The dependent variable *lnreserves* accounts for the natural log of the stock of total reserves, excluding gold, for each country under consideration. Data for this variable is measured in millions of current of US Dollars and is obtained from the IMF's International Financial Statistics database. In line with the original specification in Frenkel and Jovanovic (1981), the first regressor, *lnvar*, serves as a proxy of idiosyncratic country risk by tracking the natural log of the variance of reserves. This variance is calculated based on an eight-quarter moving average, of the detrended level of total reserves (excluding gold), which in turn is obtained using a Hodrick-Prescott filter. Higher variance in the level of reserves in previous periods is assumed to implicitly capture the risk associated with the economy being insured, and thus it is expected to be positively correlated with the current level of demand for reserves.

Unlike Frenkel and Jovanovic (1981), who use government bond yields as a proxy for the opportunity cost of holding reserves, the specification used here relies on the Emerging Bond Market Index Plus (EMBI) spread to account for this cost. The natural log of the EMBI spread, measured in basis points, captures the gap between the total returns on sovereign debt instruments (e.g. Brady Bonds, Euro Bonds, etc.) from emerging countries and the total rate of return on risk-free US Treasury bills of comparable maturity terms. Countries with a high  $\ln EMBI$  spread face relatively higher cost of finance in international markets. As most emerging countries, Latin American nations tend to have low private and public savings rates, which coupled with a restricted tax base tends to make their governments net international debtors. The difference between what emerging markets have to pay in order to borrow abroad (i.e. the return on sovereign bonds) and the return that they get on their savings (i.e. especially the yield on US treasury securities) is particularly relevant for countries which are indirectly financing their reserve holdings by issuing debt of their own. Therefore, as in previous studies, it is expected that higher opportunity costs are negatively associated with the level of reserves demanded. EMBI+ Spread data was obtained using the EMBI+ index developed by JPMorgan and by calculating quarterly averages.

Frenkel and Jovanovic (1981) used the level of imports as a measure of the size of the asset to be covered. That is, in the event of a crisis, the value of imports is used as a measure of the level of coverage that reserves should provide. However, the liberalization of the capital accounts of developing countries (including those in Latin America) makes this measure obsolete. As argued in Titelman et, al. (2008), unlike the crises of the 1970s and 1980s, recent crises in Latin America tend to be financial in nature. With increased

exposure to foreign financial flows, the reversal of net capital inflows (sudden stop) has a large potential to wreak havoc on the domestic economy. Thus, a measure of the asset to be covered by reserves should also include the net capital flows of the country. The variable *lnVULNERABILITY* in this context is analogous to the scalar variable *lnM* introduced in the original buffer stock model specification. In addition to the level of imports, the variable *lnVULNERABILITY* accounts for the aggregate of net portfolio investment and foreign direct investment inflows. Data on the natural log of net portfolio and foreign direct investment capital inflows and imports is available from IMF's IFS database and is measured in millions of current US Dollars. Given the insurance perspective of the buffer stock model, it is expected that the larger the natural log of aggregate of imports, net portfolio and foreign direct investment capital inflows, the larger the amount of reserves demanded.

An alternative measure for asset coverage from reserve accumulation is a country's short-term debt obligations. Several authors (e.g. Bussiere and Mulder (1999)) have previously found short-term debt to be a positive and significant predictor of the level of reserves demanded. In order to test this alternative specification, Models 2, 2a and 2b include the variable *lnOBLI*. This variable is equal to the aggregate of short-term debt obligations and imports. Short-term debt is defined as the total (public and private) debt obligations with an original maturity of one year or less. Data for this variable was obtained from the Special Data Dissemination Standard (SDDS) component of the Quarterly External Debt (QEDS) dataset compiled by the IMF and the World Bank. Data limitations for this variable preclude the inclusion of Venezuela in the estimations of the second set of specifications.

Finally, and in line with previous work in the literature, Models 1b and 2b account for the presence of barriers to the free floating of exchange rates. Using data from the IMF's Annual Report on Exchange Rate Arrangements and Exchange Restrictions, a dummy variable for the *de facto* exchange rate regime is created. Countries classified by this report as free floaters are assigned a value of one, and zero otherwise. Traditionally, it has been proposed that countries with free-floating exchange rate mechanisms benefit from the automatic adjustments that occur through changes in the real exchange rate, and thus by definition require fewer reserves to adjust to external shocks. Therefore, it is assumed that the *floatingD* variable is negatively correlated with the dependent variable *lnReserves*.

A Fisher test, as developed in Maddala and Wu (1999), shows that with the exception of *CONTAGION*, all of the variables considered have unit roots when measured in levels and are stationary of degree 1 (see Appendix D). Based on these findings, first-difference least square estimations with time fixed effects are conducted based on the extended models outlined above. The time fixed effects specification is included to account for those shocks which are common to all countries, but which change across time. Moreover, by running the model in differences, the country fixed effects are implicitly eliminated from the estimation, and thus are not included in this empirical exercise.

### **3.3.3 Estimating the Effects of Contagion and the Benefits of Reserve Pooling**

The estimated coefficients for the variable *CONTAGION* from the model specifications outlined above provide a parameter for the partial effect that contagion risk has on the



growth rate of reserves demanded. It is possible to build upon this finding to establish a basic estimate of the amount of reserves that countries have been accumulating as part of their protection mechanism against contagion risk. This theoretical exercise, presented in the following section, illustrates the tangible effects of the cost of the precautionary accumulation of reserves associated with contagion risk.

To take the analysis a logical step further, while connecting it to the literature on regional coordination, we estimate the hypothetical gains from reserve pooling in Latin America. A traditional method of assessing the benefits of reserve pooling in the literature has been through the calculations of coverage ratios (e.g. Dodsworth (1992), Eichengreen (2007), Rajan et. al. (2003)) based on the Theory of Clubs as developed by Buchanan (1965). Under autarky, each country faces a given coverage ratio,  $C_i$ , based on its level of liquidity and the variation of its balance of payments, such that

$$C_{Ai} = \frac{R_i}{Var R_i}$$

Where  $R_i$  is the average level of reserves of country  $i$ , and  $Var R_i$  is the variation of reserves expressed as the standard deviation for a given period (Q1-1999 to Q1-2009 in this case). Under a pooling arrangement the coverage ratio,  $C_{pi}$ , can be expressed as

$$C_{pi} = \frac{R_i + \sum_{k \neq i} R_k \rho}{Var[R_i + \sum_{k \neq i} R_k \rho]}$$

The term  $\rho$  accounts for degree of reserve pooling ( $0 \leq \rho \leq 1$ ). Reserve pooling mechanisms are beneficial to a country as long as the coverage ratio it faces as a result of pooling is lower than that faced under autarky ( $C_{pi} > C_{Ai}$ ). A replication of this simplified method for a pool made up of the seven largest countries in Latin America is presented in the following section.

As argued by others in the literature (e.g. Ocampo (2006) and Mistry (1999)), mechanisms of reserve pooling, by providing enhanced liquidity and coordinated responses and monitoring, are likely to reduce the risk of contagion occurring at the regional level. Reduced contagion risk, along with an expanded toolbox of crisis response, is likely to lower variability in the balance of payments of member countries. Unfortunately, at present there are limited formal empirical estimations of the true relationship between the level of reserve pooling and the variability of reserves. Thus an extended cost-benefit analysis of the decision to join a pool by individual countries is necessary, and will be addressed in future research. However, in the meantime it is useful to build upon the coverage ratio method described above by accounting for hypothetical reductions in variability that might result from decreased contagion risk. Coverage ratios under alternative scenarios of variability reduction are calculated for each country as follows,

$$C_{P^*i} = \frac{R_i + \sum_{k \neq i} R_k \rho}{[\text{Var}(R_i + \sum_{k \neq i} R_k \rho)](1 - \tau \rho)}$$

where  $\tau$  accounts for different multiples of hypothetical percentage reductions in the variability of the denominator, such that  $0 \leq \tau \leq 0.1$ . In lieu of a formal relationship, this hypothetical framework, based on a simplified linear relationship, allows for the illustration of potential improvements in coverage ratios that would emerge from reserve pooling ( $C_{P^*i} \geq C_{pi}$ ). The next section of this chapter presents simulations based on different hypothetical levels of reduced variability and reserve pooling, as well as the potential increases in insurance coverage associated with these scenarios.

Finally, an alternative approach to conceptualize the benefits of lower contagion risk and variability due to reserve pooling consists in calculating the hypothetical level of

reserves that would be required to attain the same coverage ratios obtained under reserve pooling ( $C_{P^*i}$ ). Hypothetical reserves ( $HR_i$ ) can be calculated as

$$HR_i = Var R_i * C_{P^*i}$$

Moreover, by subtracting the current average level of reserves (under autarky) from the hypothetical reserves ( $R_i - HR_i$ ), we can visualize the reserve savings (or disavings) from alternative hypothetical arrangements. As before, these scenarios are constructed based on hypothetical reductions of reserve variability ( $\tau$ ) and different degrees of reserve pooling ( $\rho$ ).

### **3.4 Findings and Results**

#### **3.4.1 Model Results**

Table 3.5 presents the empirical results for six different specifications based on the unbalanced quarterly panel for the seven countries under consideration during the Q1-99 to Q1-09 period. Model 1 is based on the basic specification of the Buffer Stock Model, excluding *CONTAGION*. Model 1A introduces contagion into model 1. Similarly, Model 1B extends model 1A by including a dummy variable (*FLOATINGD*) to account for free-floating exchange arrangements. Models 2, 2A, and 2B repeat the exercise above, but with *OBLI* as an alternative specification to the *VULNERABILITY* variable. Pedroni tests for cointegration revealed that the variables in the models are not cointegrated, and thus all of the variables included (with the exception of contagion) are run in first differences to correct issues of non-stationarity in the original series (see Appendix D).

The results on this table provide empirical support for the hypothesis that contagion risk is positively and significantly correlated with the optimal level of reserves.

Across the six different model specifications presented, the coefficient for contagion remains positive, significant, and of a consistent magnitude. According to these results, an increase by one unit in the *CONTAGION* variable is associated with a 0.02 percentage point increase in the quarterly rate of growth of reserves demanded. Thus, an increase in contagion risk appears to trigger an acceleration in the accumulation of reserves. In order to put this coefficient in context, it is useful to interpret it in terms of standard deviations. A change by one standard deviation in the *CONTAGION* variable (3.33) is associated with a 0.067 percentage point increase in the growth rate of reserves. This in turn is equivalent to about 48% of one standard deviation in the quarterly rate of growth of reserves. Moreover, the inclusion of *CONTAGION* as a regressor improves the explanatory power of the model, as evidenced by the increase in the values of R-square from Models 1 and 2 to Models 1A and 2A, respectively.

An interesting result from these empirical estimations is the lack of statistical significance (and in some cases negative sign) of the value attached to the coefficient of the estimator *dlmvar*, which stands in direct contradiction to the expectations and the traditional findings in the literature, including those in Frenkel and Jovanovic (1981). However, once one takes into consideration that the first-differenced natural log of the variance of detrended reserves from previous periods is used as a proxy for the idiosyncratic country risk to correlate *today's* level of demand for reserves, this finding is not as surprising. In addition to capturing idiosyncratic risk, the growth rate of variation in previous levels of detrended reserves might also capture previous periods' response in the growth rate of reserves to ongoing shocks. Future specifications of this model should revisit the appropriateness of the use of variance of de-trended reserves as a proxy for

idiosyncratic risk, by either extending the period of the moving window, or by finding another measure altogether.

As shown in Table 3.5, the remaining coefficients are in accordance with expectations in terms of their signs. Moreover, all of them (again with the exception of the coefficient of *dl $n$ var*) are statistically significant at the 10% level. According to these results, all else equal, a one percentage point increase in the growth rate of the opportunity cost of reserves, as measure by the EMBI+ spread, is associated with approximately a 0.07 percentage point decrease in the quarterly growth level of reserves demanded. Similarly, a one percentage point increase in the growth rate of the aggregate of imports, net portfolio and foreign direct investment (*vulnerability*) tends to be matched by a 0.055 percentage point rise in the rate of growth of demanded reserves. Moreover, the alternative specification *dl $n$ OBLI* appears to provide higher explanatory power to the model than *dl $n$ VULNERABILITY*. According to the results of Model 2A, a one percentage point increase in the growth rate of *OBLI* is associated with a 0.15 percentage point increase in the quarterly growth rate of reserves demanded. Finally, the empirical findings presented in Models 1B and 2B fail to provide support for the inclusion of free-floating exchange regime dummy variable as part of the reserve demand process. In both cases the coefficients of *FloatingD*, while negative, are not statistically significant, and thus do not contribute to the explanatory power of the model<sup>20</sup>. Overall, Models 1A and 2A (i.e. those including contagion risk), explain 25.4% and 38.4% of the variation in the growth rate of reserves.

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<sup>20</sup> Authors like Bastourre et, al. (2009) have found similar contradictory results.

**Table 3.5. Least Squares Panel Regression with Time Fixed Effects**

Dependent: Dlnreserves						
Model	1	1a	1b	2	2a	2b
C	0.027** (.006)	0.033** (.006)	0.033** (.009)	0.036** (.007)	0.039** (.007)	0.054** (.011)
Dlnvar	-0.024 (.015)	-0.020 (.015)	-0.020 (.015)	0.000 (.019)	0.002 (.019)	0.005 (.019)
Dlnembi	-0.072** (.033)	-0.068** (.033)	-0.068** (.033)	-0.073** (.03)	-0.072** (.03)	-0.068** (.03)
Dlnvulnerability	0.058** (.016)	0.055** (.015)	0.055** (.015)			
Dlnnobli				0.164** (.046)	0.156** (.046)	0.156** (.046)
Contagion		0.022** (.007)	0.022** (.007)		0.016* (.009)	0.019* (.01)
FloatingD			-0.001 (.012)			-0.018 (.014)
R-square	0.220	0.254	0.254	0.364	0.384	0.378
# of X-sections	7	7	7	6	6	6
Period	99Q2-08Q4	99Q2-08Q5	99Q2-08Q6	02Q2-09Q1	02Q2-09Q2	02Q2-08Q4
N	266	266	266	137	137	134

\*\* Statistically Significant at the 5% level.

\* Statistically Significant at the 10% level.

Standard Errors reported in parentheses

### 3.4.2 Effects of Contagion

The main finding from the previous section is significant in itself. However, it is important to conceptualize the effects of contagion on reserve demands in order to assess the economic meaning of this effect, especially as it relates to the real cost of holding these additional reserves. A simple way of making this assessment is by forecasting the annual change in the level of reserves due to hypothetical changes in contagion risks. In other words, if one assumes that the prevailing average growth rate of reserves (from the observable sample) would continue in the future, we would expect the level of reserves to grow accordingly. However, if on the contrary, one assumes a change in the level of contagion risk in the last period by one unit, it will be associated with a 0.02 percent increase in the growth rate of reserves—and thus the level of reserves that would be accumulated. The gap between these two growth paths accounts for the cost of contagion (see Appendix E). The hypothetical annual cost of changes in contagion risk in relation to GDP can thus be expressed as:

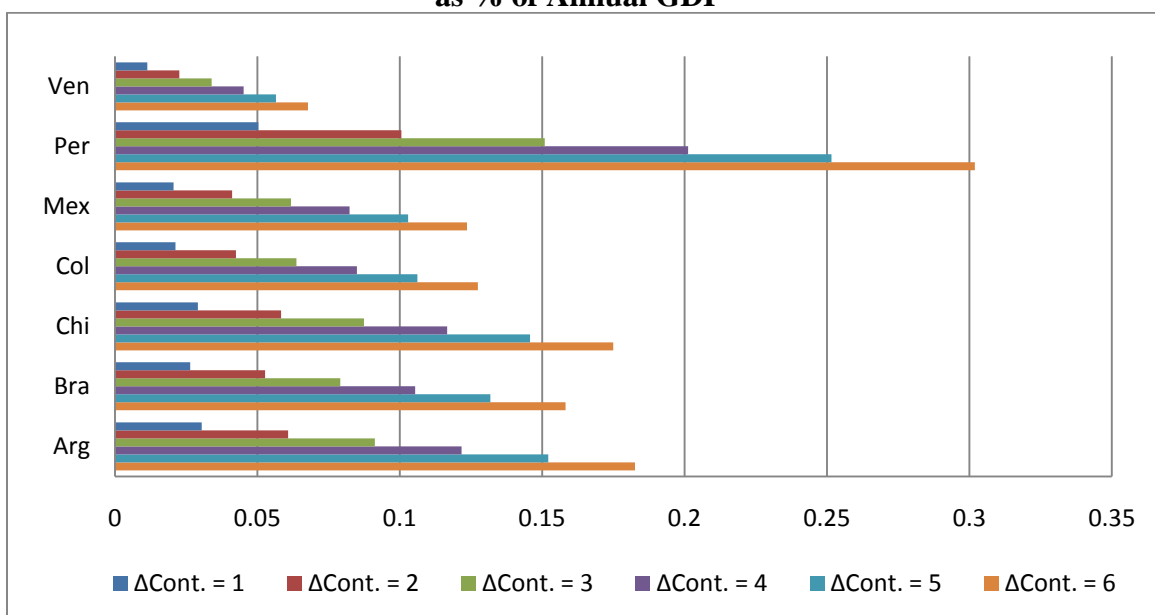
$$\text{Annual Cost of Contagion} = \frac{\sum_{t=1}^4 [R_{i,0}(\dot{R}_i + 0.02\Delta C_{i,1}) - R_{i,0}(\dot{R}_i)]}{\sum_{t=1}^4 GDP_{i,t}}$$

Where  $R_{i,0}$  corresponds to country  $i$ 's level of reserves at the last observed period,  $\dot{R}_i$  is the average quarterly growth rate of reserves for country  $i$ ,  $\Delta C_{i,1}$  is the hypothetical change in level of contagion risk faced by country  $i$  at the first forecast period.

Figure 3.3 captures this cost under different scenarios involving hypothetical changes in contagion risk. As shown in this figure, the costs of accumulating additional reserves as a result of changes in contagion risk are not negligible. For instance, in the case of Peru an increase in the level of contagion by two units would be associated with a change in reserves due to contagion equivalent to about 0.1% of this country's annual

GDP. While this figure might not seem like a significant amount, it is important to put it in perspective in relation to the country’s spending on social priorities. For instance, in 2008 Peru spent only about 1% of its GDP on primary education. Therefore, even a tenth of 1% of GDP could arguably be redirected toward more productive ends. As argued in the following section, mechanisms like regional reserve pooling—aimed at reducing contagion risk—would free up significant resources, which could in turn be redirected to alternative development purposes.

**Figure 3.3 Change in Reserves due to Hypothetical Changes in Contagion as % of Annual GDP**



### 3.4.2 Benefits of Pooling Scenarios

Table 3.6 presents the coverage ratio under different degrees of reserve pooling for the countries under consideration during the sample period. In line with the findings in Eichengreen (2007), this chapter finds that under this traditional method of calculating



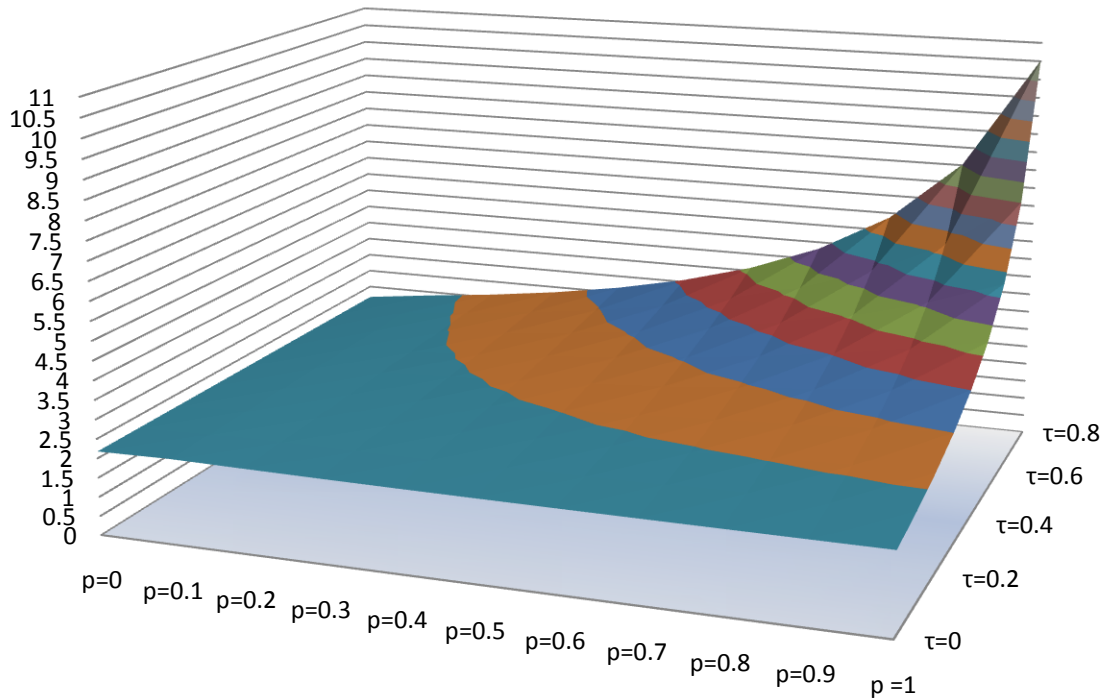
**Table 3.6. Coverage Ratios under Reserve Pooling (1999-2009)**

	$\rho = 0$	$\rho = 0.1$	$\rho = 0.2$	$\rho = 0.3$	$\rho = 0.4$	$\rho = 0.5$	$\rho = 0.6$	$\rho = 0.7$	$\rho = 0.8$	$\rho = 0.9$	$\rho = 1$
Argentina	2.18	2.20	2.18	2.16	2.14	2.13	2.13	2.12	2.11	2.11	2.10
Brazil	1.31	1.44	1.56	1.66	1.75	1.83	1.90	1.96	2.01	2.06	2.10
Chile	6.75	2.97	2.53	2.36	2.27	2.22	2.18	2.15	2.13	2.12	2.10
Colombia	2.69	2.29	2.20	2.17	2.15	2.13	2.12	2.12	2.11	2.11	2.10
Mexico	2.92	2.69	2.53	2.41	2.33	2.27	2.22	2.18	2.15	2.13	2.10
Peru	1.79	1.98	2.04	2.06	2.08	2.08	2.09	2.10	2.10	2.10	2.10
Venezuela	2.45	2.38	2.28	2.22	2.18	2.16	2.14	2.13	2.12	2.11	2.10

coverage ratios some low variability countries would see their coverage reduced as a result of pooling with high variability countries. Based on this result, countries like Chile and Mexico would be most negatively affected by reserve pooling, and would thus have little incentive to join such arrangements.

However as previously argued in this chapter and by others in the literature, reserve pooling, through the expansion of crisis response resources and coordination, is likely to reduce contagion risk (as expressed in lower balance of payments variability of member countries). Moreover, given the empirical finding presented in table 3.5, these potential decreases in the level of contagion risk would have tangible consequences for the opportunity cost of precautionary reserve accumulation. In that vein, Figures 3.4a-4g (remaining figures shown in Appendix F) illustrate the potential gains in coverage ratios once one accounts for reductions in variability. From these tables it can be seen that once contagion risk (and thus variability) reductions are considered, the prospects for reserve pooling in Latin America change significantly. Given a sufficiently high reduction in variability, there could be significant incentives for all countries in the region to join a regional reserve pool. However, we can also see from these figures that relatively low-variability countries like Chile, Mexico and Colombia would require significant reductions in variability for such an arrangement to make sense for them—approximately 68%, 27% and 22%, respectively. On the other hand, a country like Argentina (see figure 3.4a below), which under the traditional method would not benefit from pooling, would see its coverage ratio improve considerably even from a marginal reduction in variability (as low as 1%).

**Figure 3.4a. Coverage Ratios under Reserve Pooling: Argentina**



Appendix G presents the reserve savings/disavings that result from hypothetical reductions in contagion and different levels of reserve pooling. As shown by the area in blue, even moderate reductions in variability would lead to significant savings in terms of the potential level of reserves that would have to be held to maintain the higher level of coverage under reserve pooling. Here again, it is the relatively high-variability countries that would benefit the most. For instance, assuming a scenario under which countries contribute half of their reserves to the pool ( $\rho=0.5$ ) and incremental reductions in volatility of  $\tau=0.5$  (thus a total reduction in volatility of 25%), Argentina, Brazil, Colombia, Mexico, Peru and Venezuela would each save approximately \$7.7, \$64.8, \$7.8, \$22.5, \$7.9 and \$3 Billions US Dollars in that order. On the other hand, Chile

would face disavings of \$9.2 Billion US Dollars in Reserves, given the resulting lower coverage ratio.

### **3.5 Conclusion**

The last two decades have been characterized by two key trends in international finance, particularly as it relates to developing countries. First, these countries have accumulated unprecedented levels of international reserves for countercyclical purposes. Second, institutions of regional cooperation, such as regional reserves pools, have emerged and strengthened. In the Latin American context, both of these trends have been visibly present. Unlike China and countries in South East Asia, Latin American reserves appear to reflect the traditional precautionary motive for accumulation. That is, these nations continue to demand high levels of reserves to match the increasing openness of their current and financial accounts, as well as the increased volatility that comes with it. While relatively high levels of foreign reserves allow for deterrence and more manageable adjustments in the face of crisis episodes, they come at a significant opportunity cost.

Traditional optimal reserve models, such as the buffer stock model, have incorporated this cost, as well as the potential readjustment cost to develop a cost-minimization framework that captures the optimal level of “insurance” that countries should purchase. Nevertheless, the continued trend towards globalization, and particularly capital account liberalization, on the part of emerging economies necessitates a reconsideration of the traditional models by incorporating risks exogenous to the country in question. This chapter fills a gap in the literature by illustrating that contagion risk, in particular, is an integral part of this insurance acquisition decision by Latin

American countries. The empirical findings presented here suggest that in an increasingly open-economy world with imperfect information, these countries are in fact concerned with the conditions both within their borders, but also with those of surrounding nations—which might have significant effects on their own crisis prospects due to contagion. Based on a proxy for contagion risk, this chapter finds that an increase by one unit in the *CONTAGION* variable (i.e. one additional standard deviation in the aggregate EMP index for neighboring countries) is associated with approximately a 0.02 percentage point increase in the quarterly growth rate of reserves demanded. Moreover, by taking this result a step further, it shows that the estimated cost of holding reserves due to contagion risk is not negligible, especially when taking into consideration the otherwise capital-deprived nations that hold them. With this background, it seems clear that any mechanism that could reduce contagion risk in the region would also free up significant resources that could be redirected to more productive ends.

Many in the literature have provided normative arguments in favor of regional cooperation mechanisms in the region. By empirically showing that Latin American countries insure against contagion risk, this chapter provides an additional impetus for the creation of such mechanisms. Regional reserve pools, as complements to the traditional international financial institutions, are uniquely positioned to prevent and respond to regional financial crises in a timely manner, and thus reduce the threat of contagion. By building on this assumption, this chapter showed that unlike previous analysis which ignore the potential reduction in contagion risk from pooling, a regional reserve pool in Latin America might prove beneficial to most (if not all) countries in the region even under relatively small reductions in balance of payments variability.

The implication of these findings is critical for the promotion of countercyclical regional arrangements aimed at lowering the cost, while providing comparable levels of insurance. If Latin American countries, in fact, insure not only against their own risk, but the risk originating from deteriorating conditions in the neighborhood, co-insurance mechanisms like regional reserve pool funds (e.g. the Latin American Reserve Fund) and swap arrangements might prove useful in taking advantage of the cost-savings afforded by these schemes. In other words, these findings imply that countries have a stake at ensuring that a crisis does not occur in a neighboring country, which consequently would decrease their own exposure to contagion risk, and thus their need for reserve holdings.

## CHAPTER 4

### **REGIONAL POOLING OF INTERNATIONAL RESERVES: THE LATIN AMERICAN RESERVE FUND IN PERSPECTIVE**

#### **4.1 Introduction**

A staple of Latin American regional integration since 1978, the Latin American Reserve Fund (FLAR) continues to serve its functions as a lender of last resort to member countries facing balance of payments difficulties. Despite its nature and its co-existence in an unprecedented environment of country-level reserve accumulation, the literature provides relatively little analysis of this institution and of its functional performance in comparison to the existing literature on other multilateral institutions. This chapter is directed at highlighting the role that FLAR plays in the regional financial structure, while critically identifying both the strengths and potential challenges to its success.

The first section provides a background of the institution and its functions. The following section captures some of what the literature has to say about this institution and its role both within the regional and global financial structure. Next, this chapter provides a critical analysis of the effectiveness of the FLAR by assessing three case studies of loans approved to FLAR members. By synthesizing available qualitative data from reports and documentation with quantitative measures of economic performance, these case studies provide a first empirical assessment of the context under which FLAR has approved loans and subsequent economic trends. It aims to answer a simple, yet partially neglected question: Have FLAR interventions worked? Lastly, the analysis revisits the normative prescriptions for FLAR that have commonly been found in the literature,

comparing these to data from in-person interviews and the lessons learned from the case studies.

## **4.2 Background**

The Latin American Reserve Fund is one of the remaining regional institutions of the Import Substitution era. A direct descendant of the 1969 Cartagena Accord, FLAR was first formally established as the Andean Reserve Fund (ARF) in 1978, thus serving as the reserve branch of the Andean Community of Nations. Original members of the ARF included Bolivia, Colombia, Ecuador, Peru, and Venezuela. Through the Lima Agreement of June 1988, and in attempt to further regional integration in the continent, ARF officially changed its name to the Latin American Reserve Fund, and evolved into a more inclusive regional model, hence allowing membership to non-Andean nations. Costa Rica was the first non-Andean nation to join on March 30, 1999, and would more recently be followed by Uruguay, which joined the institution on May 30, 2008. The Fund's financial resources derive primarily from its members' contributions, which as of June 2011 totaled US\$2,343.8 million in subscribed capital, of which US\$1,892.9 million has already been paid into the fund. The three largest member countries (Colombia, Peru, and Venezuela) account for 20% shares of this capital, while the smaller countries account for 10% each. FLAR has three main goals, which have been approached in the following order:

- Assisting member countries during balance of payments crises or in the restructuring of their debt through the provision of loans and/or the guaranteeing of third party loans.
- Contributing to the better management of the reserves held by member countries, either through the attainment of better yields in the constitutive funds of the



institution or through the direct management of funds assigned by the member countries, but which do not form part of the paid capital of the institution.

- Promoting regional coordination through the harmonization of exchange rate, monetary and financial policies of member countries.

Historically it has been the first objective that has taken precedence over the others.

However, as will be argued later, this is likely to change as the number of loans requested and approved by the Fund continues to decline in recent years.

Based on the goals outlined above, FLAR offers several key services to its member countries' central banks, to some of their public institutions, and more recently to other public institutions in non-member countries in the region. FLAR offers five main types of loans with different structures aimed at addressing different potential problems that might affect its member countries: balance of payments support, foreign debt restructuring, liquidity, contingency, and treasury credit lines. The following table summarizes the total number of each type approved per country over the FLAR's history.

**Table 4.1. Number of Loans Approved by Type.**

	BoP Support	Debt Restructure	Liquidity	Contingent
Bolivia	2	-	9	-
Colombia	1	-	4	1
Costa Rica	-	1	-	-
Ecuador	5	1	10	-
Peru	2	-	4	-
Uruguay	-	-	-	-
Venezuela	1	-	1	-

Note: Calculated based on official FLAR data.

Balance of Payments (BoP) credits are potentially the largest type of loans available to a member country under a FLAR agreement. They are extended with a 3-year term for repayment with a 1-year grace period for capital amortization. At present, BoP loans are granted at an interest rate equal to the 3-month Libor rate plus 400 basis

points, and a prepayment fee of 30 basis points. As its name suggests, BoP credits are extended to the central banks of member countries member countries facing problems arising from either its current or financial accounts. In order to qualify for this type of loan, the requesting central bank must provide a written report detailing its shortage of reserves, as well as outlining its current and future plans to reverse its balance of payments deficit. Moreover, as part of the loan contract, the soliciting country agrees not to impose measures that may affect the imports from other member countries as part of its balance of payments restructuring process. The terms of the loan (e.g. length, cost, and limits) are ultimately at the discretion of the Board of Directors and the Assembly (See Appendix I). However, in practice FLAR follows the statutes outlined in Article 9 of its constitutive chapter, which states that BoP loans can be approved for the smallest of:

- Up to 2.5 times the paid-in capital of the member country, with the exception of Bolivia and Ecuador, which have preferential access of 2.6 times their contribution (USD 314 million for Uruguay; USD 395.25 million for Costa Rica; USD 484.64 million in the case of Bolivia and Ecuador; USD 931.75 million for Colombia, Peru, and Venezuela, as of July 2009).
- The global deficit of the country's balance of payments account in the preceding twelve months.
- The percentage set by Board of Directors of the total of imports by the soliciting country's imports originating from other member countries.

Foreign debt restructuring support (FDRS) loans, granted directly to the countries' central banks, represent the other potential source of medium-term financing for member countries under FLAR. As its name suggests, and as will be illustrated in the case studies section of this chapter, these loans have the potential to significantly improve the performance of the central bank's liabilities by allowing for the repurchasing of a high yield outstanding sovereign instruments. Like the BoP lines of credit, these loans are

approved for a period of 3-years with a 1-year grace period, at a rate equivalent to the 3-month Libor rate plus 400 basis points, and with a 30 basis points prepayment fee. They are also subject to approval of the fund's Board of Directors. However, FDRS loans provide a smaller potential credit limit than BoP Loans. FDRS credit lines are capped at 1.5 times a country's paid-in capital, with the exception of Ecuador and Bolivia which can access up to 1.6 times their paid-in capital.

The remaining three loans are aimed at providing short-term financing. Liquidity loans have a one-year term limit, and directed towards helping countries resolve temporary shocks to their liquidity standing. Credits equivalent to a country's paid-in capital are available at a rate that equals the 3-month Libor rate plus 150 basis points, with a pre-payment fee of 10 basis points. Contingent lines of credit are offered by FLAR for 6-month, renewable, periods. This type of credit line, the most widely used in the history of FLAR, provides precautionary access to funds to better address unforeseen internal or external shocks. Contingent financing, when used, accrue interest equivalent to the 3-month Libor rate plus 150 basis points, with a repayment fee of 10 basis points, and a commitment fee of 90 basis points. Contingent lines are available for up to times a country's paid-in capital<sup>21</sup>. Treasury loans are of up to twice the amount paid into the fund and are available for terms not to exceed 30 days. Unlike the longer-term loans, which must be approved by the Board of Directors, liquidity, contingent, and treasury credit lines can be promptly approved by FLAR's Executive President.

Given the heterogeneity in size and economic conditions of the FLAR, it is important to consider what the resources available represent in terms of protection against

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<sup>21</sup> Bolivia and Ecuador can access up to 2.1 times their paid-in capital to the fund, in the form of liquidity loans or contingent lines of credit.

shocks, given each country's specific characteristics. For instance, Table 4.2 considers the case of BoP loans, which provide access to the largest potential amounts. Using the first lending parameter (typically the applicable binding constraint) one can put in perspective the relative importance of these loans in relation to the potential needs of the member countries:

**Table 4.2. Largest Potential Loans Relative to Key Indicators (As of 2009)**

	<b>Reserves</b>	<b>Short-term Debt</b>	<b>Imports</b>
Bolivia	6.4%	87.5%	8.5%
Colombia	3.8%	22.7%	2.2%
Costa Rica	9.7%	16.9%	3.2%
Ecuador	16.9%	34.1%	1.8%
Peru	2.9%	19.7%	3.6%
Uruguay	3.9%	27.9%	3.9%
Venezuela	4.3%	5.8%	1.4%

Source: Calculated based on World Bank National Accounts Data

As can be observed from this table, the significance of the available funds under the FLAR varies considerably from country to country. For smaller countries like Ecuador, Costa Rica and Bolivia, the loan limits represent a significant portion of their potential needs. On the contrary, the large member countries (e.g. Peru, Venezuela and Colombia) cannot rely on FLAR funds to cover a large portion of their financing needs in the case of a crisis. This difference in the relative significance of the FLAR funds for large and small countries underlies the decrease in the number of loans requested and approved by the fund in recent years. Since 1992, only two loans have been requested and approved for a large country (one of them never disbursed)—both to Colombia in 1999. By contrast, during the same period 8 loans were approved to small countries, particularly to Ecuador (5 loans). These figures pale in comparison with those of the

previous fourteen years (1978-1991), when the total number of loans requested and approved was 30 and the small/large country participation was balanced. The sudden decline (in the number of loans) that has prevailed in the second half of the time of existence of the FLAR highlights a worrisome trend for the viability and relevance of the fund.

### **4.3 Literature Review**

#### **4.3.1 Regional Integration**

The case of FLAR must first be considered in the context of the overall push for the creation of regional arrangements of cooperation throughout the developing world. In the aftermath of the Asian Financial Crisis, the ability of international financial institutions and the overall global financial structure to address the hazards of globalization for developing nations have increasingly been called into question. Thus an alternative has been the promotion of alternative arrangements of coordination and balance of payments support at the regional level. These mechanisms range from simple bilateral swap arrangements of hard currency (e.g. the Chiang Mai Initiative) to more formal pooling of foreign reserves.

There is strong backing in the literature for the creation of mechanisms of regional coordination and support<sup>22</sup>. Arguments in favor of these mechanisms include not only political and cultural ties, but also the benefits of risk-sharing and macroeconomic coordination. Indeed, these institutions have even become an important component of the International Monetary Fund's recent attempt to reshape itself to better deal

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<sup>22</sup> The extent and functions of such institutions are still a matter of debate.

with the “Global Imbalances” problem and with the much needed democratization of the Fund (Strauss-Kahn 2010).

Ocampo (2006), among others, have summarized the rationalization for the creation of these mechanisms. For example, Ocampo argues that the rise of “open regionalism” that has accompanied globalization has intensified the degree to which externalities from the macroeconomic policies of one country can affect its neighbors in the area. Thus policies that only address the problems of an individual country are likely to result in outcomes that aggravate contagion (e.g. reduced regional trade and competitive devaluations). Moreover, he argues that as globalization continues to undermine individual countries’ economic decision-making, it is at the regional level that countries are able to retain some of their “policy autonomy.” Furthermore, International Financial Institutions (IFIs) like the IMF might face diseconomies of scale in the provision of financial services (e.g. crisis prevention and resolution), while regional and sub-regional financial institutions would be better equipped to deal with localized problems. Finally, Ocampo suggests that small and medium-size countries, whose influence with IFIs is limited, can benefit from increased competition in the provision of financial services. In contrast to the negligible role of small nations under the current financial structure, regional institutions enjoy an increased level of “ownership” by its small member countries.

In Latin America in particular, Agosin (2000) argues that by protecting a country from a crisis occurrence, regional monetary institutions produce valuable positive externalities to other countries in the region. Mistry (1999) proposes regional institutions as “mezzanine bulwarks” of crisis response between national and global response mechanisms, which can reduce the “neighbourhood costs” of crisis mismanagements by

international financial institutions. He argues that regional crisis containment mechanisms are well suited to stem the spread of contagion through coordinated prevention (e.g. supervision and macroeconomic policy synchronicity) and response. Mistry purports that this then creates a credible front of defense against speculation, limits the extent of trade and financial markets disruptions and avoids competitive devaluations among neighboring countries.

Some in the literature, while supportive of regional cooperation in general, have expressed valid reservations about the feasibility of reserve pooling mechanisms in Latin America. For example, Machinea and Rozenwurcel (2006) argue that regional cooperation in the region faces significant obstacles. For example, there is a relative (to the European Union) lack of existing interdependence as evidenced by the low levels of intraregional trade and financial links. Moreover, there is a tendency among Latin American countries to try to differentiate themselves from their neighbors following a crisis—in an attempt to avoid being bunched together by unknowledgeable investors.

#### **4.3.2 The Role of FLAR**

Literature discussions of the role of FLAR in relation to existing international mechanisms of balance of payments of support like the IMF have largely agreed that the former is better suited to play a complementary role, and not a substitute for the latter. Eichengreen (2006) argues that FLAR should serve as a complement to the IMF because by doing so, it would ensure the additionality of resources available for crisis support. Moreover, he claims that surveillance and conditionality are best exercised by outside institutions in order to avoid the time-consistency problem. Similarly, Agosin (2000) and

Agosin and Heresi (2010) see a complementary role for FLAR, under which it would serve the same roles traditionally assigned to the IMF, but at a regional level. In their view, FLAR could serve as an intermediary of IMF funds, especially in the event of simultaneous crises associated with extraordinary demands for financing. Along the same lines, Ocampo (2006) proposes a “division of labor” among mechanisms of support, under which the IMF would provide support during large-scale crisis affecting large countries, while regional mechanisms like FLAR provide complementary support to small and medium-size countries. On the other hand, Guarnieri (2008), while still considering a role for the IMF, argues that a Latin American and Caribbean Monetary Fund (largely based on the FLAR model) could provide countries with “bridge” loans during large balance of payments crises, and thus allow the leveraging of larger loans from the IMF at better terms when these are needed.

McKay et al. (2010) develop a set of “optimal financing criteria” to assess the suitability of regional institutions of crisis response to contribute to global financial stability. They argue that these mechanisms should be evaluated based on the size of the financing pool, timely access to relevant information, analytical expertise, speed of decision-making, impartiality in lending decisions, and monitoring and enforcement mechanisms. When comparing their assigned ratings for FLAR to those of the IMF, FLAR is seen outperforming the IMF in terms of access to relevant information and speed of decision-making, while slightly lagging with regards to the other criteria. In addition to these last two attributes; Titelman (2006) and Agosin (2000) argue that FLAR is relatively better positioned than the existing international financial institutions due to the sense of ownership afforded to member countries. As pointed in these papers, FLAR



benefits from preferred-creditor status, which has implied that member countries have never defaulted on their obligations to the institution, even in cases when they have defaulted on loans to other multinational organizations and private lenders. Moreover, in support of the effectiveness of FLAR, Ocampo and Titelman (2010) point out that despite its relatively small size, FLAR has provided balance of payment loans to its member countries during times of crisis of equivalent or larger size than those provided by the IMF. Consequently, Agosin and Heresi (2010) propose FLAR as a starting framework for the strengthening of regional financial integration—A view shared by this author.

Among the few empirical studies of the effectiveness of FLAR, Rincón (2007) using a 43-country panel (including six of the FLAR countries) for the 1984-2003 period looks at the relationship between belonging to FLAR and key macroeconomic outcomes. It finds that while FLAR membership is not significantly associated with economic growth or macroeconomic volatility, countries that belonged to this institution faced significantly less volatility in consumption. Eichengreen (2006) calculates simple coverage ratios<sup>23</sup> for the member countries of FLAR, and finds that while some countries would benefit from pooling of their reserves, others like Ecuador and Venezuela would experience a significant decline in the level of reserve coverage. Based partly on these findings, Eichengreen concludes that rather than using its resources for emergency lending to deal with sudden stops, FLAR should use a part of these resources and borrowed funds to acquire contingent public and private debt securities with the aim of deepening the domestic financial sector.

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<sup>23</sup> Coverage ratios are calculated as the ratio of total reserves available under the pooling arrangement and the variability of these reserves.

While there is extensive normative evidence that highlights the strengths of FLAR as an institution of crisis support, the analysis of the effectiveness of the institution could benefit from a deeper look at the actual outcomes of its interventions. For the most part, the works discussed above concentrate on the broader institutional benefits, sometimes at the expense of the country/loan-specific level of analysis. For instance, Titelman (2006) claims that “...for the beneficiary countries, these [FLAR’s] funds have helped significantly to relieve liquidity restrictions.” However, a further analysis of specific interventions provides stronger evidence for this claim. This chapter addresses this point by taking a more narrative approach, using both qualitative and quantitative data, to assess the context under which loans were given and how effective they were. By doing so, it will provide a more objective look at the role that the FLAR plays in the regional financial structure, while highlighting the strengths and potential challenges to its success.

#### **4.4 FLAR’s Performance Revisited: Three Case Studies**

The following analysis seeks to explore the effectiveness of FLAR’s interventions by considering three case studies of loans to member countries. When assessing its effectiveness, we must keep in mind that FLAR has intervened (more so) during periods of crisis. So the basic question is, to what extent did the FLAR loan alter the economic performance of the country? More broadly, though, the analysis seeks to explore what the FLAR experience can show us about cooperation in Latin America: The good, the bad, and the (im)possible.

The three key case studies selected have occurred during the period since the East Asian Financial crisis—a period of rapid growth in reserve accumulation in the region. Moreover, the cases considered capture the span of the types of loans offered by FLAR, as well as the size of the requesting country. In this way, these cases attempt to gather wide-ranging lessons that illustrate the performance of FLAR in recent years. The 1999 Colombian case captures the role that contingent lines of credit can play in averting further deterioration of a large country's financial conditions. It also highlights the ability of the institution—along with other regional partners—to help mobilize larger resources. The 2003 Costa Rica loan provides a look into the highly effective support that FLAR can provide to small member countries through activities such as the provision of foreign debt restructuring support. The positive results of the loan provide further impetus for the possibility of geographic expansion of the fund to non-Andean countries like Costa Rica, which joined only a few years earlier in 1999. By considering the 2006 Ecuador loan, one can get a glimpse of FLAR's ability to provide effective and sustainable support to frequent borrowers.

For each one of the case studies, loan documents, institutional reports and contemporary literature are matched with ex-ante and ex-post data on reserves, GDP, sovereign bond spreads, among other key indicators. The empirical evidence is analyzed to determine whether the FLAR's interventions improved certain key indicators associated with a lower probability of a balance of payments and/or currency crisis. Did the economy stabilize and recover after the FLAR's intervention? In order to do this, I rely on empirical data from 8 quarters before and after the loan was approved. Additionally, I consult the loan application letters (and other related documents)

submitted by the central banks to the FLAR, detailing the reasons for the application and what steps they expect to take to resolve the crisis.

#### **4.4.1 Colombia 1999**

Requested on August 11<sup>th</sup>, 1999, this set of loans for \$500 million US Dollars (\$125 million in the form of a liquidity loan, and \$375 million as a contingency loan) were promptly approved two weeks later on August 26<sup>th</sup>. Moreover, the larger contingency loan—having been approved but not disbursed—is likely to shed some light into how countries might use the fund as a source of contingent funding, and/or how the fund might be able to better position itself by providing new mechanisms of contingency funding (e.g. swap arrangements, etc.) These loans, along with two others granted to Ecuador the same year, were the only applications for help around the time of the Asian Financial Crisis. These Colombia loans are also intriguing in that they represented the last official application for help from a large member country.

FLAR's loans were part of a larger “rescue package”, which totaled US\$6.9 billion. In addition to FLAR's contribution, this package consisted of US\$2.7 billion from the International Monetary Fund (IMF), US\$1.7 billion from the Inter-American Development Bank (IDB), US\$1.4 billion from the World Bank, and US\$600 million from the Andean Development Corporation (CAF) (“Colombia to Receive” 1999). It is important to note that while FLAR loans were approved within two weeks, the Extended Fund Facility contingency loan by the IMF was finally approved months later on December 20<sup>th</sup>, 1999. Unlike the funds secured from the IMF, a portion of the liquidity FLAR loan, along with those from the IDB, the World Bank and the CAF, were directed

towards strengthening the social safety net through contributions to the Social Emergency Fund (“President Explains” 1999).

The Colombian economy experienced its worst performance in recent history during the first half of 1999, when GDP shrank at an unprecedented 6.9%. During this time the country’s stock of international reserves plummeted to US\$8,215 million from US\$8,741 million the previous year, as the traditional current account surplus turned into a deficit and capital flight intensified. All while unemployment reached 20.9%, and government revenues dropped significantly, leading to growing budget deficits and rising sovereign foreign debt. The signs of a brewing crisis were evident.

The origins of this impending crisis are debatable. For instance, the IMF concludes that the crisis was “...the result of unsustainable fiscal policies, external shocks, and a difficult internal security situation.” (IMF 1999). Growing government expenditures and the 1991 constitutional mandate that required the central government to share revenues with state-level governments were seen as the main perpetrators. An alternative explanation of the change of fortunes in Colombia is based on the country’s adoption of neoliberal policy. The 1990s liberalization process in Latin America was mainly characterized by drastic tariff reductions, public enterprises privatization, increasing capital account openness, and more recently inflation-targeting. Lower tariffs opened the way for a surge in imports, which contributed to the transformation of current account surpluses into deficits. Accelerated elimination of tariffs exposed small domestic producers to foreign competition and led to the elimination of jobs, and a deterioration in the government budget deficit as revenues fell. Moreover, capital account liberalization exposed the country to many of the external shocks outlined under the IMF argument.

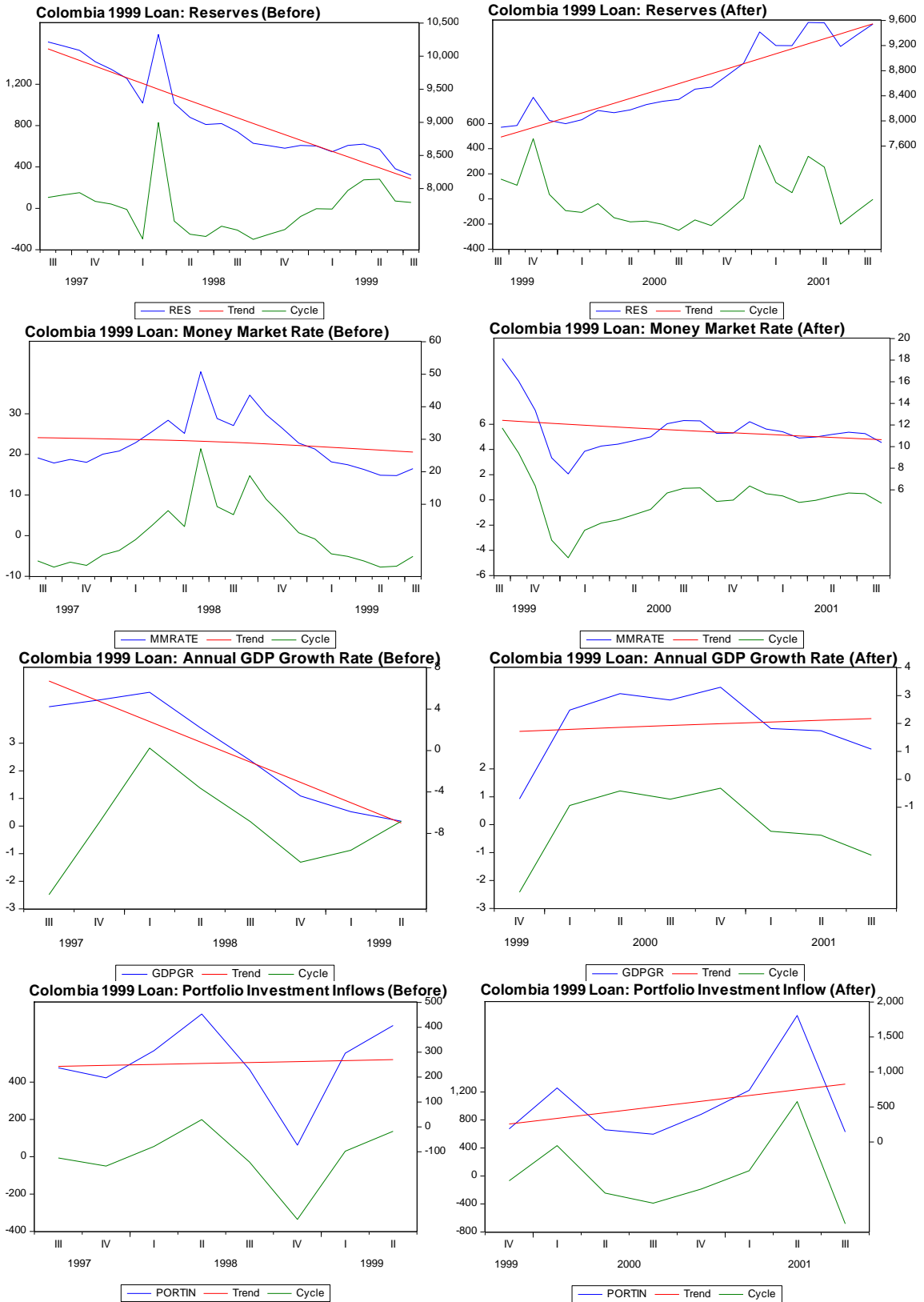
Given this scenario, it is difficult to isolate the effect of FLAR's intervention both through its liquidity and contingency loans. In the particular case of the 1999 Colombia loans, this task is further complicated by the fact that other loans were simultaneously approved by other multinational organizations, including the one by the IMF which had a significant conditionality component associated with it. Figure 4.1 presents the performance of four key indicators before and after the approval of this set of loans. The cyclical and trend components of each indicator are obtained using a Hodrick-Prescott (HP) filter (see Hodrick and Prescott (1997)). These findings are supplemented by simple mean equality t-tests presented in Table 4.3. Based on the HP decompositions, it appears that the period following the approval of FLAR's loans was characterized by a marked switch in the direction of the trend of international reserves. After a prolonged period of decline, reserves grew in the two years after the FLAR loans were approved. Despite the improvement in the trend component of reserves, reserves remained (statistically) significantly lower in the 2-year post-loan period than in the pre-loan period, averaging US\$9,118 million and US\$8,637 million respectively.

Colombia's gross domestic product also experienced a pronounced change in its trend component as the country returned to periods of growth following the approval of these loans. Similar to the case of reserves, average annual GDP growth rate during the post-loan period was lower than that during the pre-loan period considered (-0.135% versus 1.954%); albeit not significantly different from each other in statistical terms. Average portfolio investment flows were higher in the two years following the approval of FLAR loans increasing from US\$257 million in the pre-loan period to US\$541 million. However, our t-test reveals that these two means are not significantly different

from each other. Finally, one area where there appears to be significant improvement is in the credit markets. The money market interest rate continued its downward trend, and was significantly lower in the post-loan period. Money market interest rates in Colombia averaged 28.7% in the pre-loan period and 11.5% in the post-loan period.

A few lessons can be drawn from the particular experience of this loan. First, and perhaps more importantly, this case study highlights the ability of FLAR to work in coordination with other regional institutions to mobilize much larger extra-regional resources, as was the case with the US\$2.7 billion loan from the IMF. In that sense, by being a first-mover in providing support to Colombia, it arguably also lent credibility to the country's reform plan. Nevertheless, the fact that the FLAR's share of Colombia's rescue package was relatively very small—and thus needed to be complemented by larger funds from other sources—also underscores some of the limitations that currently ail the institution in terms of being a viable lender of last resort to the larger member countries with respectively larger needs. This is further evidenced by the fact that during the last financial crisis Colombia bypassed FLAR altogether and secured directly a contingent line of credit with the IMF, under this last institution's recently created Flexible Credit Line arrangement for US\$10.5 billion.

**Figure 4.1. Colombia's August 1999 Loan**





**Table 4.3. Means Tests of Equality: Colombia 1999**

	<b>Pre-Loan Mean</b>	<b>Post-Loan Mean</b>	<b>T-stat<sup>1</sup></b>
International Reserves (Mills USDs)	9,118.223	8,637.351	2.663*
Money Market Interest Rate (%)	28.777	11.488	10.152**
GDP Annual Growth Rate (%)	-0.135	1.954	1.129
Portfolio Investment Inflows (Mills USDs)	256.676	541.279	-1.347

1.  $H_0$ : Pre-Loan and Post-Loan Means are equal.

\* Statistically significant at the  $\alpha=0.05$  level.

\*\* Statistically significant at the  $\alpha=0.01$  level.

#### **4.4.2 Costa Rica 2003**

Costa Rica requested a foreign debt restructuring support loan from FLAR on March 4, 2003, which was promptly approved on April 7, 2003 at an interest rate equivalent to the 3-month Libor rate plus 200 basis points (FLAR 2003). While this loan was approved for a four-year term with a one-year grace period, it was repaid in advance in April of 2006. This loan—Costa Rica’s only—is interesting in that it is one of only two loans granted in FLAR’s history for the purpose of foreign debt restructuring. How Costa Rica used the US\$156 million to restructure its debt and the effects of this restructuring highlight the role that the FLAR plays/could play in promoting preventive measures aimed at reducing the odds of a crisis and at improving the yield of its members’ financial resources.

At the time of the loan request Costa Rica was experiencing a slight economic recovery after three years of languid economic growth. GDP growth rates increased in large part due to growing external demand, which increased exports and led to a smaller deficit in the current account relative to previous years. Financial account surpluses also contributed to the offsetting of the current account deficit and led to a growing stock of international reserves relative to the previous year. Despite these positive developments, the literature reveals the existing concern by international institutions at the time about

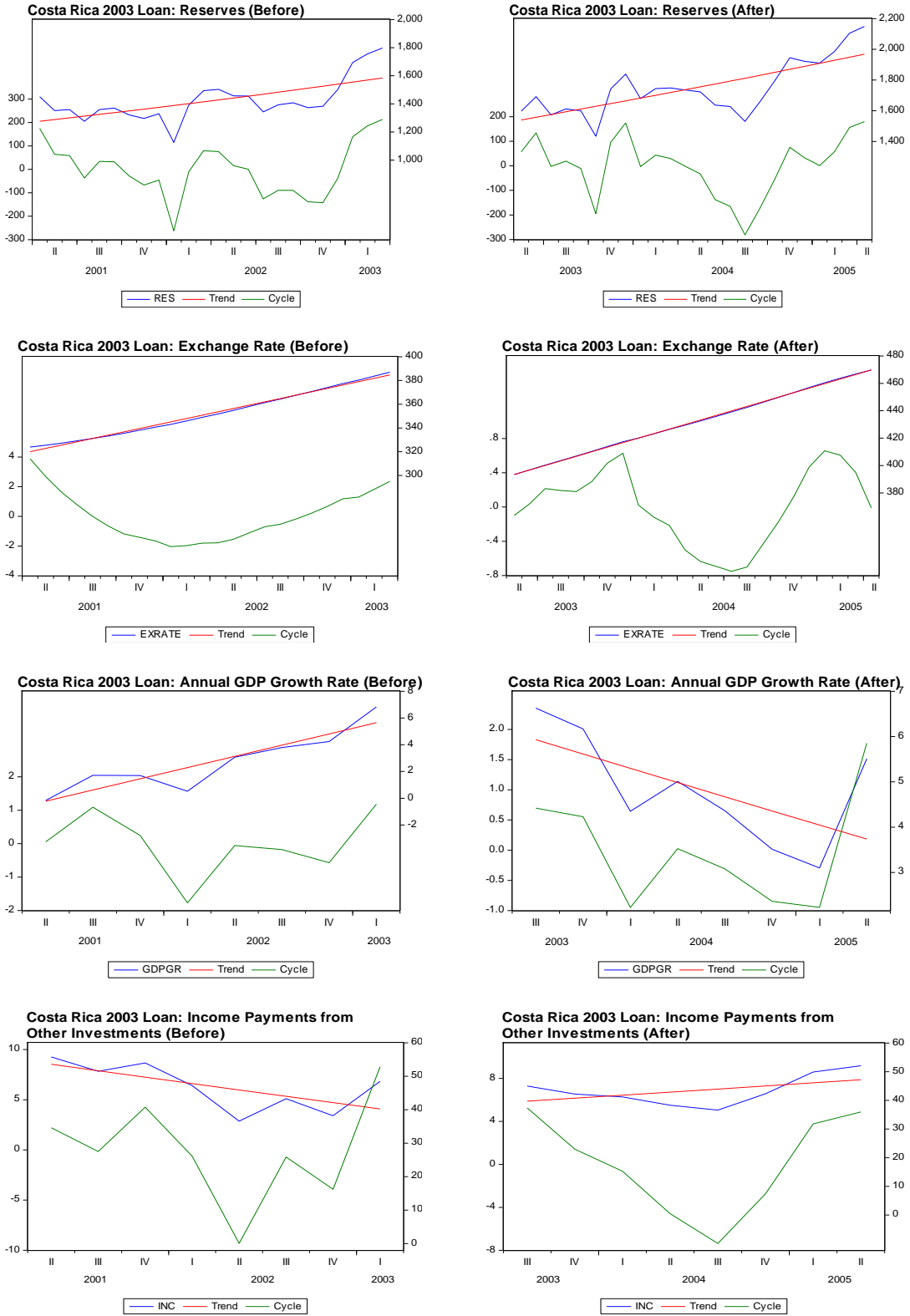
the country's perceived internal and external vulnerabilities originating from persistent fiscal imbalances, and the rising interest rates resulting from the government financing of these imbalances (ECLAC (2004), Deutsch Bank (2004), IMF (2003)). Moreover continuous depreciation of the domestic currency, along with the perceived riskiness associated with government debt led to a growing dollarization of the domestic economy and thus reduced control of monetary policy by the central bank.

FLAR's loan was requested as part of the Costa Rican government's attempt to improve the performance of the liabilities side of its balance sheet. More specifically, the Central Bank used the \$156 million loan granted by FLAR to redeem in advance its outstanding Series A Brady bonds with maturity date of 2010 in the third quarter of 2003 (Deutsch Bank (2004)). The savings associated with this debt restructuring operation are evident when one considers that the redeemed Brady bonds required interest payments of 6.25%, while the applicable interest rate for the FLAR loan was the Libor rate plus 200 basis points, or approximately 3.11% as of July 2003. This debt restructuring was followed by the Central Bank's repurchasing of its Series B Brady bonds in January 2004, financed by the issuing of certificates of deposit. (ECLAC (2004)). It is clear that FLAR's loan facilitated the beginning of a long-term process of debt restructuring aimed at lowering the financing cost of its external debt, as well as the eventual reduction in risks associated with original sin. For instance, in his outgoing report of 2010, Francisco de Paula Gutiérrez—Costa Rica's Central Bank president for the 2002-2010 period—concludes that foreign-currency-denominated liabilities went from accounting for half of all of the Central Bank's liabilities to 28% by December 2009.

An analysis of the empirical data available partially supports the stabilization process that the Costa Rican economy was experiencing during the period following the approval of FLAR's loan. As seen on Figure 4.2, Costa Rica's stock of foreign reserves was on a positive (albeit very modest) trend in the two-year-period preceding April 2003. This positive trend was intensified in the period that followed the approval of this loan as conditions improved. Also, as shown on Table 4.4, average reserves for the post-loan period were significantly higher than in the pre-loan period; averaging US\$1,749.5 million and US\$1,424.8 million, respectively. The persistent depreciation trend of the Costa Rican Colón continued into the post-loan period. The average nominal exchange for the post-loan period was ₡431.6 CRCs per USD, compared to ₡352.2 CRCs per USD during the pre-loan period. In terms of economic growth, Costa Rica's uptick in gross domestic product during the period that preceded FLAR's loan approval was stabilized in the two-year period that followed. Costa Rica's average annual GDP growth rate post-loan was significantly higher than that during the pre-loan period (2.713% versus 4.83 percent).

While EMBI spread data is not available for Costa Rica, it is possible to partially capture the effect of this loan on the country's debt burden by considering the income payments associated with debits accruing from interest payments on the "other investments" category of the current account. This category includes—but is not limited to—interest payments on foreign-held debt. Income payments from other investments decreased after the loan approval, but increased slightly in the second quarter of 2004. Thus, the average income payments from other investments during the post-loan period were not significantly different from those of the pre-loan period. An alternative method

**Figure 4.2. Costa Rica's April 2003 Loan**



of accounting for the potential effect of this loan involves considering the rates paid on zero-coupon bonds issued by the country. As shown in Appendix J, rates on all maturities of these loans declined considerably following the April 2003 loan by FLAR.

Costa Rica's experience with its 2003 loan illustrates one of the basic ways in which FLAR loans can benefit member countries. The fact that Costa Rica's loan was requested during a recovery period reinforces the preventive nature that FLAR's interventions can adopt. By using a foreign debt restructuring loan from FLAR to repurchase a significant portion of its outstanding foreign debt, Costa Rica managed to significantly reduce the interest payments associated with its liabilities.

**Table 4.4. Means Tests of Equality: Costa Rica 2003**

	Pre-Loan Mean	Post-Loan Mean	T-stat <sup>1</sup>
International Reserves (Mills USDs)	1,424.764	1,749.503	-6.819**
Exchange Rate (CRC/USD)	352.225	431.612	-12.627**
Income Payments from Other Investments (Mills USDs)	46.888	43.45	-1.098
GDP Annual Growth Rate (%)	2.713	4.83	-2.327*

1.  $H_0$ : Pre-Loan and Post-Loan Means are equal.

\* Statistically significant at the  $\alpha=0.05$  level.

\*\* Statistically significant at the  $\alpha=0.01$  level.

#### **4.4.3 Ecuador 2006**

In the midst of political upheaval, the Ministry of Economics and Finance through the Central Bank of Ecuador officially requested a US\$400 million balance of payment support loan from FLAR on August 26, 2005, which was approved on October 3, 2005. Despite having been approved in October, this loan was not disbursed until March 2, 2006 when the government of newly-elected president Alfredo Palacio was finally able to meet the FLAR's requirement of having a Central Bank Board in place. Once disbursed, the loan was to be repaid in three years with interest rate accruing at the Libor rate plus

200 basis points. In addition to the traditional terms of the loan, the agreement with Ecuador (FLAR's most prolific client to date) stipulated as an additional condition that Ecuador maintain a fiscal surplus of at least 2% of GDP during the period 2006-2008 (FLAR 2006a).

Relying on petroleum exports for about 43% of its fiscal revenues, Ecuador's economy came to a halt during the summer of 2005 as PetroEcuador workers and residents from the oil-rich eastern provinces of the country engaged in a general oil strike demanding payment of back wages and infrastructure investments ("Venezuela to lend" 2005). The loss in government revenues associated with the strike was estimated by the Ecuadorean Ministry of Economics and Finance to be around US\$190 million, and was cited as the main reason for the loan request (FLAR 2006b). While the country's economy was in relatively good shape in most other respects, the shock created by the oil strike, as well as the volatile political situation complicated the government's access to financing, and threaten the country's liquidity and ability to meet its financial obligations. This was further compounded by the dollarization and capital account liberalization process in which the country had actively embarked since 2000, which further exposed the country to external fluctuations due to changing perceptions of the country's ability to pay back.

The approval of the loan by FLAR, along with the rising price of oil reinstated some of the lost investor confidence as evidenced in the successful issuing of a 10-year, US\$650 million bullet bond in December 2005 (IMF 2006). Once disbursed, the FLAR loan contributed significantly to increasing the liquidity of Ecuador's Central Bank in the first quarter of 2006. Of the US\$933 million rise in liquidity, US\$400 million originated

from this loan (Banco Central del Ecuador 2006). While the oil impasse had been partially surmounted by the time the FLAR loan was disbursed, the funds—along with part of the proceeds from the December bond issue—were used to repurchase 59.2% of its Global 2012 bonds in May 2006 (“Ecuador rescata” 2006). Savings from of this action were significant given the different yields associated with the new liabilities relative to those of the bonds repurchased. While Global 2012 bonds have a 12% yield, the December 2005 bullet bonds have a coupon rate of 10.75%, and more importantly the FLAR loan had a yield equivalent to the 3-month Libor rate plus 200 basis points, or approximately 6.98%. Ecuador successfully paid back the FLAR loan in full 14 months in advance of its due date.

An empirical analysis of the data (shown in figure 4.3 and table 4.5) for key indicators during the two-year periods that preceded and proceeded the approval of the FLAR loan further portray an improvement in the standing of the Ecuadorean economy. The disbursement of the FLAR loan appears to have allowed Ecuador’s stock of reserves to overcome the temporary setback caused during the disruption of oil exports, allowing it to resume the positive trend that prevailed in the pre-loan period. Consequently, the average level of reserves during the post-loan period considered was significantly higher than that of the pre-loan period—almost doubling from US\$1,185.3 million to US\$2,377.4 million. Arguably the most significant contribution of this loan was its contribution to Ecuador’s regained access to the international financial markets at better terms. This is evident in the figures for the Emerging Market Bond Index Plus (EMBI+) spread—an indicator of a country’s cost of accessing funds abroad. The average index spread for the two-year-period before the loan was approved stood at 748.5 basis points

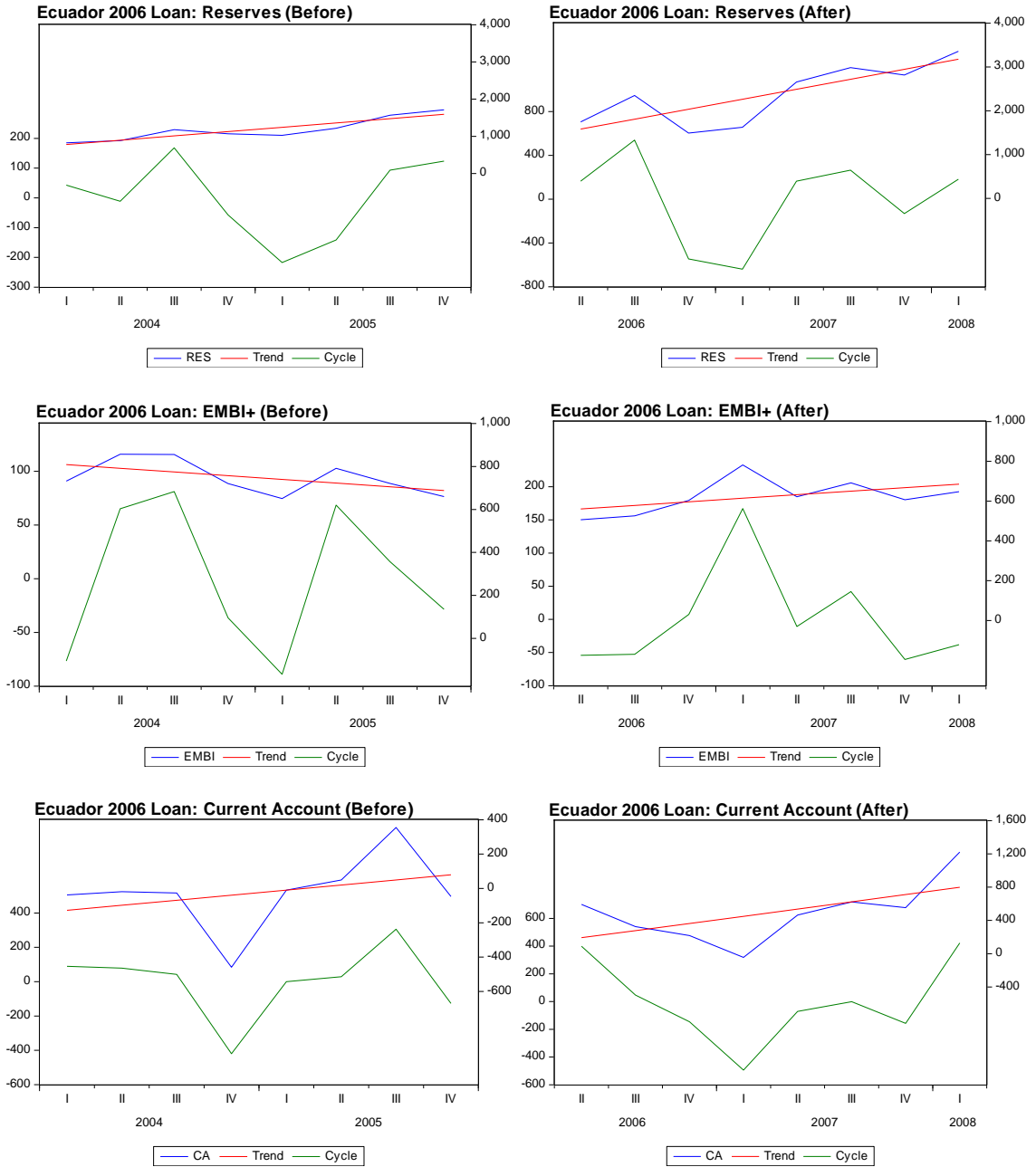
and declined significantly to an average of 623.2 basis points during the two-year that followed—a large spread by regional standards, but a significant improvement nonetheless.

Both the current and financial accounts appear to have stabilized following the approval of the FLAR loan. The current account recorded surpluses in the post-loan period and retained a positive trend component. The average current account balance improved significantly from US\$24.4 million deficit in the pre-loan period to a US\$494.2 million surplus in the post-loan period. Similarly, the trend component of the financial account went from a consistent decline to being more stable. However, the figures for the average financial account balance during the pre-loan and post-loan periods were not significantly different from each other, as revealed in the equality test presented in Table 4.5 below. Economic growth continued on a more stable path, albeit at slightly lower rate. Average annual GDP growth rate in the pre-loan period was significantly higher (7.311%) than in the pre-loan period (3.641%).

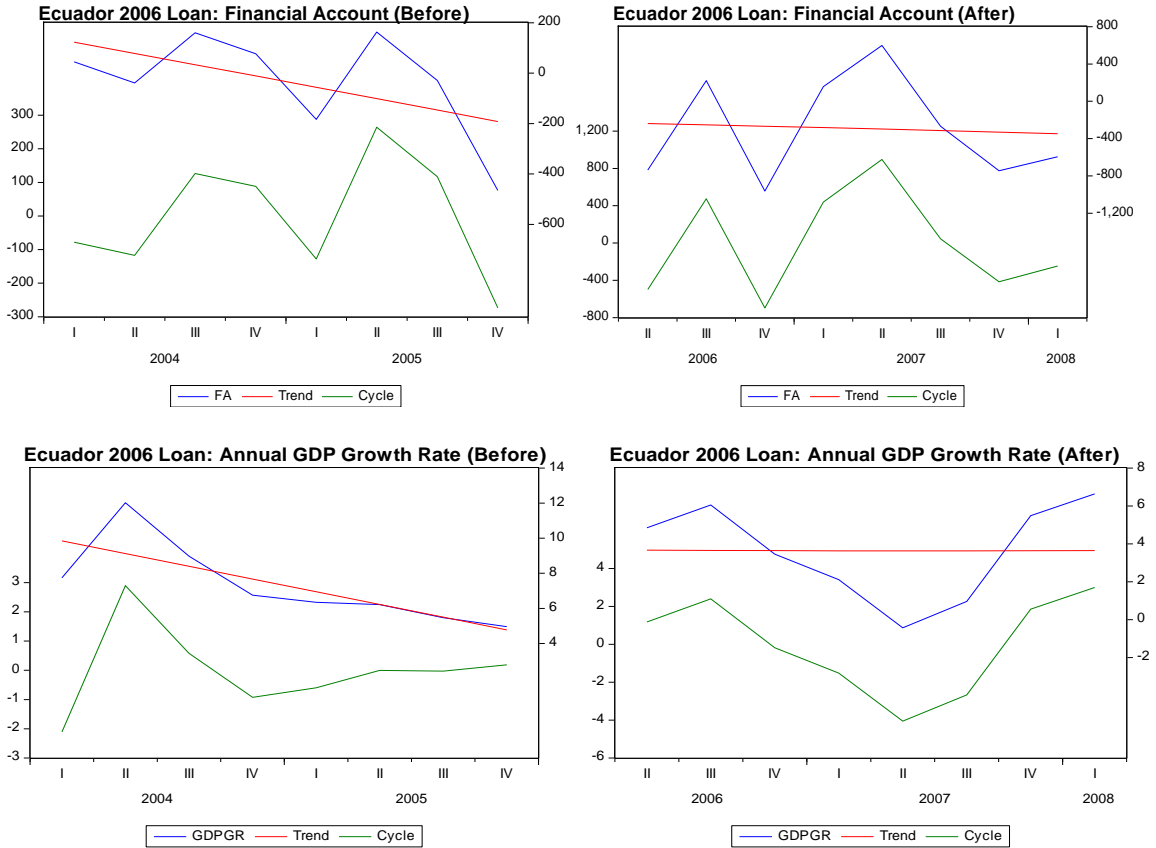
Of the case studies considered, the Ecuadorean 2006 loan provides perhaps the clearest evidence of successful intervention by FLAR. Unlike the Colombian case, this loan made up a significant proportion of the total assistance available to the country during its oil shock. Moreover, the loan was helpful in overcoming this shock and contributing to the country regaining access to international financial markets. This loan supports the idea that as it stands, FLAR has the ability to play a significant role in supporting small member countries, even those which have relied on the fund during several crisis episodes.



**Figure 4.3. Ecuador's March 2006 Loan**



**Figure 4.3. (continued)**



**Table 4.5. Means Tests of Equality: Ecuador 2006**

	Pre-Loan Mean	Post-Loan Mean	T-stat <sup>1</sup>
International Reserves (Mills USDs)	1,185.303	2,377.411	-4.437**
EMBI Spread (Basis Points)	748.545	623.238	2.988**
GDP Annual Growth Rate (%)	7.311	3.641	3.027**
Current Account (Mills USDs)	-24.376	494.221	-3.412**
Financial Account (Mills USDs)	-33.889	-291.236	1.216

1.  $H_0$ : Pre-Loan and Post-Loan Means are equal.

\* Statistically significant at the  $\alpha=0.05$  level.

\*\* Statistically significant at the  $\alpha=0.01$  level.

#### **4.5 The Way Forward: FLAR's Challenges for the Future**

As discussed above, the limited literature on FLAR is full of normative prescriptions on means of improving the organization's performance and relevance. It is worth revisiting some of the most common of these in light of the analysis just presented, as well as considering the position of the FLAR's own leadership. To this end, this section also draws from personal interviews conducted during field research at the FLAR's headquarters in Bogotá, Colombia in 2009. Interviews were conducted with the Secretary General and other department heads.

Most prescriptions stem from a recent decline in activity. The number of loans that have been approved and disbursed has decreased dramatically in recent years, especially when compared to the 1980s levels. This is more surprising in the last couple of years, given the presumed increased in demand for resources from the last global crisis. This demand never materialized. Given the rather stagnant levels of capital subscribed to the fund, the FLAR is increasingly attractive only to the small countries of the region (Ecuador, Bolivia, Costa Rica and Uruguay). The larger member countries (Colombia, Peru and Venezuela) are not using FLAR for their BOP and liquidity needs, but rather relying on larger (more significant) resources available to them from other agencies (e.g. Colombia's recent agreement with the IMF, Venezuela's contingency lines with China—USD's for oil). This further complicates the fund's ability to attract large key players in the region (e.g. Brazil, Mexico, Chile, Argentina) to join the pool. These concerns are indeed reflected by officials in the institution. From interviews with FLAR officials, it is clear that they are increasingly acknowledging that the resources being contributed to the pool are not growing at the same rate as the economies of the member

countries. If this situation continues there is a growing gap between the resources and the size of the funds needed to provide a realistic option of support during crisis.

Given these challenges, a set of common prescriptions have been proposed in the literature (see Agosin 2000, and Agosin and Heresi 2010). The set of policy recommendations that has emerged as potential solutions for the resource limitations of the Fund can be broadly summarized under four main strategies:

- Geographic expansion.
- Resource expansion through larger paid-in capital quotas and the establishment of contingent lines of credit with member country central banks.
- Intermediation in the international financial markets by issuing its own debt securities or securing contingent credit lines with private banks.
- Capturing institutional advantages originating from its supranational nature by creating a regional system of payments aimed at minimizing the need for international reserves in regional transactions, while intermediating in the provision of IMF resources.

This set of policy recommendations provides a useful roadmap for securing the viability of the Latin American Reserve Fund as a veritable source for regional balance of payments support and coordination. They should be implemented to ensure that FLAR can serve as the seed and foundation for a region-wide mechanism of coordination aimed at protecting against balance of payments shocks. The findings explored in the first part of this chapter inform and provide further impetus for the promotion of such policies. The applicability and relevance of a selection of these policies is explored below in the context of the research presented in this chapter.

In terms of the first recommendation, FLAR's geographic area of reach inhibits greater regional cooperation and limits the availability of resources in the fund. The benefits provided to the few Andean nations (and Costa Rica and Uruguay) could be extended to neighboring nations without significantly altering the current mode of

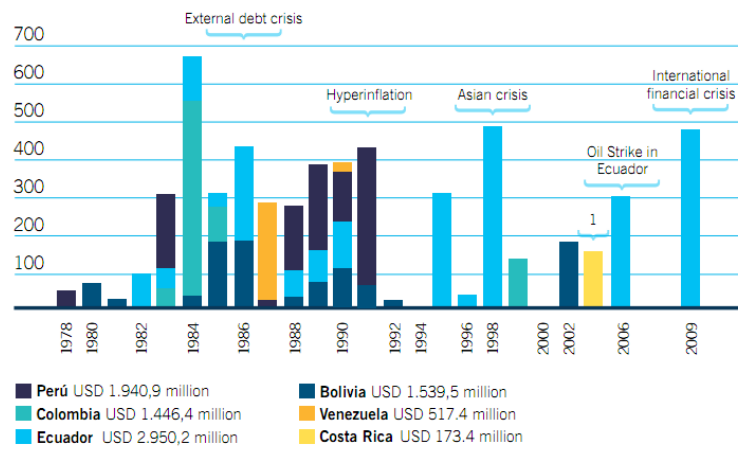
operation. The 1988 Lima Agreement opened the door to the expansion of the fund to the rest of Latin American countries. Since then only two non-Andean countries have successfully joined FLAR. A potential extension of the reserve pool to other countries in the region—especially to the largest ones like Mexico, Brazil and Argentina—could provide important benefits to the fund. It would increase the size of the pool, which would make it possible to increase the size of potential loans available to member countries. As seen in the 1999 Colombian loan case, the participation of FLAR in that rescue package, while useful, only accounted for only about 7% of the total required by Colombia. Thus, it is easy to understand why twelve years have passed since a large member country has requested assistance from the fund.

Beyond the clear benefits that derive from having access to a larger pool of resources associated with a geographic expansion of FLAR, the inclusion of most countries in the region would place the fund in a more favorable position to manage its risk profile. First, the introduction of new members into the pool provides the institution with the opportunity to diversify the risk structure associated with potential applications for support. While similar in many respects, Latin American countries retain some level of diversity in terms of their economic structure. This of course does not eliminate the possibility of a crisis event occurring that would require the provision of assistance to all members in a simultaneous fashion, but it eases the potential strain on reserves associated with a crisis event. Despite its relatively limited size, the experience of FLAR reflects this point.

As seen in Table 4.4, simultaneous loan requests from several member countries have rarely coincided, and have never resulted in FLAR being unable to meet its member

countries' assistance requests. Moreover, as outlined in the second chapter of this dissertation and in Rosero and Erten (2010), an expanded regional reserve pool would provide a more cost-efficient option of ensuring against contagion tendencies originating from neighboring countries. A region-wide reserve pool, by providing prompt access to significant sources of balance of payments support and by promoting regional macroeconomic coordination, is better equipped to deal with potential contagion events. That being said, officials at FLAR acknowledge the difficulties in attracting countries like Brazil or Mexico, which they see as growingly becoming part of a global group of influential emerging markets with more alternatives for their balance of payments support needs.

**Figure 4.4. History of FLAR Loans Granted**



1. For external debt restructure.

Source: FLAR's August 2010 Annual Report

In addition to increments in subscribed capital associated with a geographic expansion of FLAR, the institution should overcome its resource obstacles by increasing the subscribed capital quotas of its member countries. Interviews with officials at FLAR revealed that this strategy has been considered during past meetings of the board of directors, but has faced some level of reticence from the member countries. Subscribed

capital quotas of individual member countries have not changed since March 2000, while these countries' economies have grown significantly since then<sup>24</sup>. As shown in Table 4.6, subscribed capital into the fund represents a very small portion of member countries' total reserves. Large countries like Peru and Colombia pool an equivalent of a mere 1.1% and 1.8% of their total non-gold reserves under FLAR. By comparison, smaller member countries like Ecuador and Costa Rica have committed quotas equivalent to 5.1% and 7.2% of their total non-gold reserves. These ratios are even lower when one considers the actual contributions in place in the form of paid-in capital. In order to avoid becoming the lender of last resort for only small countries in the region, these shares must be updated to reflect the current reality of the bigger economies.

**Table 4.6. Subscribed and Paid-in Capital as percentage of Reserves**

	<b>Subscribed Capital</b>	<b>Paid-in Capital</b>
Bolivia	3.0%	2.4%
Colombia	1.8%	1.4%
Costa Rica	5.1%	4.2%
Ecuador	7.2%	5.9%
Peru	1.1%	0.9%
Uruguay	3.0%	1.6%
Venezuela	3.3%	2.7%

Source: Based on FLAR data as of August 31, 2010 and the IMF's International Financial Statistics dataset.

Considering an expanded pool made up of the current FLAR members plus Argentina, Brazil, Chile, Mexico and Paraguay, Agosin and Heresi (2010) point out that a contribution into the fund of 15% of these countries' reserves could cover capital flight equivalent to each of the countries' short-term debt. Alternatively, such a fund would be

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<sup>24</sup> See FLAR's Assembly Accord No. 93.

able to finance capital outflows equivalent to the value of M1 of each of the countries with the exception of Brazil and Mexico. As shown below, a similar exercise illustrates that even without such a geographic expansion of FLAR, an increase in the size of current members' contributions could make the fund a more realistic option for balance of payments support. Table 4.7 demonstrates how a hypothetical FLAR with paid-in capital equivalent to a quarter of its members' total reserves (excluding gold) could potentially finance capital outflows equal to a member country's short-term debt or the more stringent measure of M1<sup>25</sup> (with the exception of Venezuela)<sup>26</sup>.

**Table 4.7. FLAR with Hypothetical Expanded Capital Contributions (2009)**

	Reserves <sup>1</sup>	Short-term Debt <sup>1</sup>	Expanded Fund/ Short-Term Debt	M1 <sup>1</sup>	Expanded Fund/M1
Bolivia	7,583,785	554,000	45.6	5,100,053	5.0
Colombia	24,747,664	4,109,971	6.1	24,687,801	1.0
Costa Rica	4,066,175	2,341,286	10.8	7,509,382	3.4
Ecuador	2,873,185	1,419,483	17.8	--	--
Peru	32,012,632	4,729,846	5.3	17,480,982	1.4
Uruguay	8,028,642	1,124,000	22.5	6,184,267	4.1
Venezuela	21,702,956	16,008,689	1.6	72,319,050	0.3
Total Reserves	101,015,039				
Expanded Fund (25% Contributions)	25,253,759.70				

Source: Author's Calculations based on World Bank National Accounts Data

<sup>1</sup>In millions of current US Dollars

As far as intermediation goes, FLAR has made limited progress in taking advantage of its preferential access to credit from the international financial markets. The institution enjoys strong AA and Aa2 ratings from Standard & Poor's and Moody's,

<sup>25</sup> As argued by Obstfeld et al. (2009), sudden stop exposure goes beyond the traditional measures of short-term debt, and depends on monetary depth. Capital flight is also usually associated with the domestic and external abandonment of local currency-denominated assets in favor of foreign-denominated assets.

<sup>26</sup> Future research should consider a risk-base contribution into a potential regional fund.



respectively. These ratings are by far superior to any of those of individual member countries sovereign debt, which highlights one of the main benefits of well-managed regional pools. However, aside from the successful issuance of bonds in 2003 and 2006<sup>27</sup>, little has been done by the institution to capitalize on its preferential access to international financial markets. The successful experiences with debt restructuring associated with the 2003 Costa Rica and 2006 Ecuador loans highlight the important role that FLAR could play in leveraging resources at better terms from the international markets, and making part of these resources accessible in the form of loans to its member countries. This intermediation process could provide significant savings to its member countries, and increase the relevance of the institution in the region.

Moreover, in line with the arguments presented in Eichengreen (2006), FLAR could play a central role in contributing to the development of markets for assets denominated in the domestic currency of countries in the region. This would not only contribute to the region's overcoming of the original sin, but it would also introduce valuable counter-cyclical tendencies to the liabilities side of the fund's balance sheet. In fact, officials acknowledged during interviews that there have been proposals in this regard. However, progress has been discontinuous and more recently hindered by the latest global financial crisis, which resulted in increased demand for liquidity by member countries.

This stands in contrast to the recent success of the institution in serving as an alternative destination for liquid investments of regional central banks and public

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<sup>27</sup> FLAR issued its first bond in 2003. This 3-year, US\$150 million bond accrued a fixed coupon rate of 3%, and was duly paid. A second 5-year, US\$250 million bond with a floating rate equivalent to the 3-month Libor rate plus 20 basis points was issued in 2006, and matured earlier this year in February.

institutions. When questioned about the apparent irrelevance of FLAR to large member countries, one official refuted this claim by emphasizing that while the institution's role in balance of payments support has undoubtedly become less attractive to the larger member countries for the reasons outlined above, FLAR has gained significant relevance in terms of its second mandate (that of reserves management). This reality makes it clear that FLAR has the financial expertise and institutional maturity to reach out and serve better more of its current users of financial services.

In terms of cooperation with other multilateral institutions, the 1999 Colombian loan experience exemplifies the role that FLAR can play in leveraging larger resources by coordinating with institutions like the IMF, the World Bank, or the IDB. The prompt approval of a US\$500 million loan for the country provided a meaningful endorsement of Colombia's restructuring plan. It arguably made it possible to overcome coordination failures associated with first-mover disadvantages in multilateral lending. By signaling confidence in the country, FLAR facilitated the later approval of significantly higher resources from the IMF, the World Bank, and the IDB (US\$2.7, US\$1.4, and US\$1.7 billion, respectively). In situations when extraordinary funding is required, FLAR could intermediate between its member countries and the IMF through either direct or indirect lines of credit from the latter. Given its regional nature and its investment profile, FLAR's intermediation could ensure access to IMF funds at better terms. Since FLAR's comparative advantage in multilateral lending derives largely from its knowledge of the regional economy (inherent from the participation of the member countries' finance ministers and central bank directors in its assembly and board of directors), it should

work along with the IMF to ensure that conditionality requirements tied to IMF funds are in line with the reality and expectations of the region<sup>28</sup>.

A final aspect that should inform FLAR's strategy going forward, especially in the face of diminished demand for assistance, is the restructuring of the asset side of its balance sheet. While the balance of payments support role has (and should) played a central role in the mission of the institution, a continued redirection towards its second mandate would be welcomed. As argued above, the management and technical assistance associated with the reserves of the member countries has played an important role in what the FLAR does. However there is growing acknowledgement that more can be done to improve the performance of not only member country reserve assets, but also those of the pool itself. Increasingly public institutions (other than CBs) from member AND nonmember countries are taking advantage of the financial expertise in the management of resources that FLAR offers. This was for example the case with some of Uruguay's institutions, which eventually led to the 2008 joining of the country. As of May 2009, FLAR's intermediation portfolio consisted of deposits from 28 central banks and public institutions from not only its member countries, but also from El Salvador, Guatemala, and the Dominican Republic. The mutual success associated with attracting these deposits from non-member countries should continue to provide a path to future geographic expansions of the fund, especially in cases in which the political drive to join is lacking. When asked about what future she saw for FLAR, the then Secretary General stated that in terms of increasing its relevance and raising its profile, a strong direction

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<sup>28</sup> Up to this point, loans from FLAR have included conditionality only on a case-by-case basis. One official interviewed suggested that it was unnecessary because of the close ties. In his view, member countries see FLAR as "a group of friends" and in that sense face "peer pressure" to meet their financial responsibilities with the institution.

would be “becoming an administrator of public funds, a trainer of central banks and public entities.”

In the case of FLAR’s own managed resources, interviews with the directors of the Financial Research and Asset Management divisions revealed that there is a growing interest in diversifying the maturity terms of assets held by FLAR to match the reduced demand for loans. At present, the pool’s investments are restricted to fixed income, short-term, investment-grade, US dollar-denominated assets. However, the institution is beginning to explore diversifying into higher-yield, higher risk, and longer maturity assets such as Fixed Income Bonds from G7, G10, or G23 countries, currencies, or even variable income bonds (see Bonza et al. 2009).

#### **4.6 Conclusion**

As evidenced by the recent proposals for intensified regional integration, there is significant clamoring for mechanisms of regional coordination and support against crises originating from external shocks. The recent actions of countries like Brazil and Argentina’s 2006 early payoff of their IMF loans and their effective withdrawal from the IMF suggest a growing desire by several countries in Latin America for a partial delinking from international financial institutions (Zibechi 2007). However, success in establishing a region-wide mechanism of balance of payments support through either a Latin American Reserve Fund or through the Bank of the South has proven limited. In the meantime, Latin American countries continue to (individually) accumulate unprecedented levels of costly international reserves. The question that arises is: is FLAR the right institution to fill the gap left by the weaknesses of existing international

financial institutions, and the stagnation of alternative regional proposals like the Bank of the South? In order to answer this question, this chapter empirically reviews the past performance of FLAR, as well as critically analyses its institutional strengths and challenges.

The empirical quantitative and qualitative data employed in the three case studies considered in this chapter provide preliminary evidence in support of the partially successful performance of FLAR. While only a sample of all interventions, and descriptive in nature, the findings presented here capture a wide range of the activities of the fund in recent years. Four common themes emerge from this analysis about the actual and potential benefits of FLAR interventions. First, the institution provides a rapid rate of response to loan requests (28 days on average for the three case studies considered), and stands in sharp contrast to the traditionally protracted process associated with loans from multilateral institutions like the IMF. Second, FLAR has provided important savings to its member countries by making funds available to them at better terms than the ones available to them in the traditional international financial markets. This is most evident in the foreign debt restructuring carried out by both Costa Rica and Ecuador. Third, FLAR has proven to be essential in leveraging additional funds for its member countries through its own lending process. A prompt loan from FLAR has typically resulted in further access to liquidity from other institutions, and thus, it has arguably contributed to overcoming coordination failures associated with the first-mover disadvantage in lending. Finally, the empirical data considered suggests important improvements in key economic indicators following an intervention by FLAR.

From the above discussion on the strategies for FLAR going forward, it is clear that while there are aspects that could be improved; the institutional make-up of FLAR presents a number of strengths to build upon. Granted it is successful at adopting the strategies in the previous section, FLAR is indeed uniquely positioned to fill the gap left by the traditional international financial institutions and the still lagging regional proposals for integration.

In addition to its partial success in adjusting to its funding realities, FLAR has managed to diversify its mandate by concentrating on the services and reserve management portion of its activities. Moreover, as discussed in the case studies, the fund has been uniquely effective at providing prompt support to its member countries during times of crisis. The speed of response can help to overcome constraints associated with the size of the resources available to central banks under this arrangement. This as well as the underlying ease of monitoring can contribute to minimizing the potential for contagion throughout the region.

Finally, while the political challenges in terms of both disparate country size and political ideologies are very real, FLAR has managed to retain an objective approach to its economic decisions. When interviewed, the then secretary general stated: “I think that unlike the Bank of South (which hasn’t been able to settle on a voting scheme), FLAR’s voting mechanism has allowed it to avoid political pressures.” This voting mechanism demands a supermajority of two-thirds of member states, each of which is assigned one vote. This setup has arguably tested the institutional governance of FLAR at times. For example, the selection of last Executive Presidents were problematic, as it took years to ensure that a candidate secure a supermajority of the votes. These

challenges have originated primarily from ideological differences among members, and do not necessarily reflect the presence of a set of dominant countries. Moreover, as explained by the then Secretary General, these ideological differences have not extended to the realm of loan approvals. This was evident in the case of Ecuador's two most recent requests (2006 and 2009). Despite the poor state of diplomatic and economic relations between Ecuador and Colombia, she emphasized that in this particular case: "There was not any political interference. All member countries were genuinely concerned about the health of the Ecuadorean economy, so it was entirely based on economic considerations."

This chapter provides initial evidence to support continuing member involvement and expansion of FLAR. It should also serve as further impetus for research in this area. It is important to recognize the data limitations associated with analyzing its institutional effectiveness. For example, it is difficult to isolate quantitatively the direct impact of each loan intervention. However, more qualitative consideration of the context surrounding each loan provides a more holistic understanding of the effectiveness and potential of FLAR. By considering both quantitative and qualitative evidence from three case studies of recent FLAR interventions, as well as interviews with FLAR officials, this chapter argues that this institution with an enhanced support from expanded pool of member countries, can indeed fill that gap, and thus provide a workable framework for a veritable mechanism of crisis support and prevention.

## CHAPTER 5

### CONCLUSIONS

As discussed throughout this dissertation, developing nations, including those of Latin America, have embraced foreign reserve accumulation as a stabilization and development strategy. This is evidenced in the record stocks of reserves held by these countries in the last few decades. International reserves as precautionary savings must consist of liquid, stable, and hard-currency denominated assets. However, due to this very nature, reserves come at a significant opportunity cost to the holding country. Moreover, evidence (including that presented in Chapter 2 of this dissertation) of the effectiveness of these individually-held reserves in contributing to crisis prevention or recovery is limited and inconclusive.

In light of these findings, it would be premature and unthinkable in the present context to suggest a complete elimination of reserve accumulation by Latin American countries. This is particularly the case in situations without a credible alternative mechanism in place. Nevertheless, it is not premature to explore alternative methods of protection that ensure both stability and effectiveness of national resources committed to providing this protection. Thus, the main argument advanced in this dissertation is *not* for the liquidation of reserves, but rather for a sensible growth of them, and more importantly for efficient accumulation through collectivized protection in the form of regional pools. In the process of developing this argument, this dissertation has contributed to the literature in several respects. First, it expanded the discussion on the effectiveness of reserves, as well as the motives for the accumulation on the part of Latin American



countries. Second, it has provided new empirical evidence to support the viability of regional mechanisms of coordination. This chapter summarizes the findings of the three separate empirical analyses and discusses possible policy implications.

## **5.1 Summary of Findings**

### **5.1.1 Reserves and the Trilemma**

Using a new approach to the assessment of reserve effectiveness, Chapter 2 evaluated the gains from individual reserve accumulation through the lens of the traditional trilemma approach. Some of the key findings from this chapter include:

- The VAR analysis finds that contrary to expectations, individual country accumulation appears to provide limited help in easing the trilemma of international finance. Consequently, when it comes to advancing exchange rate stability, capital account liberalization, or monetary policy independence, reserve accumulation does not appear to be working.
- That being said, two key exceptions to the conclusion above were explored, which are in line with some the existing related literature. First, reserves were only helpful in ensuring exchange rate stability in instances of hard pegs. Second, and perhaps more interestingly, findings in this chapter suggest that reserve accumulation contributes to easing the trilemma *only* in instances when reserve holdings are sufficiently large. In this regard, this finding supports the idea of a reserve efficiency threshold, as proposed in Aizenman et al (2010).

### **5.1.2 Reserve Demand and Contagion**

Chapter 3 contributed to the literature on the precautionary demand for reserves by considering the so far ignored importance of contagion risk in the reserve demand process. The main findings of this chapter included:

- In a world with increasingly liberalized markets and imperfect information, Latin American countries appear to take into consideration contagion when demanding reserves. That is, the evidence suggests that these countries are concerned with the conditions both within their borders, but also with those of their neighboring nations—which might threaten the stability of their own economies via contagion.
- Based on this finding, it is clear that any mechanism that could reduce contagion risk in the region would also free up significant resources that could be redirected to more productive ends. Therefore, by empirically showing that Latin American countries currently “purchase insurance” against contagion risk through the accumulation of reserves, this chapter provides further support for the creation of such mechanisms.
- One of the benefits of reserve pooling was its potential to reduce contagion, which in turn contributes to less balance of payments variability for member countries. By considering a framework based on coverage ratios and alternative simulations, it found that a regional reserve pool in Latin America would prove beneficial to most (if not all) countries in the region even in cases of relatively small reductions in balance of payments variability.

- The implications of these findings are central to the promotion of countercyclical regional arrangements aimed at reducing the cost, while providing equivalent levels of insurance protection.

### **5.1.3 Reserves and FLAR**

By employing empirical quantitative and qualitative data for three loan case studies, this chapter provided preliminary evidence in support of the partially successful performance of FLAR. The most salient conclusions from this chapter included:

- FLAR has the potential to serve as a framework for a region-wide reserve pool. However, this potential hinges on the institution's ability to increase its resources either through expansion of its membership, capital paid-in contributions, and/or more active intermediation in international financial markets to capitalize on its preferential access to these markets.
- FLAR provides a rapid rate of response to loan requests, which stands in sharp contrast to the traditionally protracted process associated with loans from multilateral institutions like the IMF. This is of particular importance in light of the present limitation in terms of the resources available through the fund. Prompt access to crisis support can limit the extent of regional contagion, and thus mitigate the need for large interventions.
- FLAR interventions typically result in important savings to its member countries by making funds available to them at better terms than the ones available in the traditional international financial markets.

- The case studies highlighted the often-ignored, but key contribution that FLAR provides to its member countries in terms of leveraging additional resources. FLAR loan approvals have arguably facilitated the approval of subsequent loans from other multilateral institutions and/or the successful issuing of treasury securities.
- The empirical data considered suggests important improvements in key economic indicators following an intervention by FLAR.

## **5.2 Policy Implications**

Countries in Latin America, like most emerging markets across the globe, have embraced reserve accumulation to levels never experienced before. These reserves, however, do not come free. They come at a high social opportunity cost to the nations that hold them. Countries that by the very nature of their stage of development face large constraints of capital are increasingly diverting their productive resources towards the accumulation of foreign reserves. Alternative uses such as repayment of short-term debt, investment in infrastructure and employment creation measures partially account for the opportunity cost of holding massive amounts of foreign reserves. Furthermore, while countries in the South hold their reserves in low-yield assets from the North (thereby financing capital-abundant countries), they continue to rely on foreign flows of capital at high interest rates to finance their own development. These social costs of holding an insurance policy against financial crisis are considerably high, and they challenge the sustainability and optimality of foreign reserve accumulation as development policy for the South.

Based on the findings of this dissertation, some important policy implications emerge. In the context of unstable financial markets based on imperfect information, and without a reliable alternative for protection against exogenous shocks, the accumulation of reserves remains a necessary evil to avoid the costly effects of a full-fledged crisis. Reserve pooling—as a first step in a process of regional financial coordination—has the potential to improve the efficiency of the precautionary accumulation of reserves.

This dissertation makes a three-pronged case for regional coordination in Latin America through the establishment of a strong pool of international reserves. First, a region-wide pool, if large enough, could enable member countries to have access to reserve stocks that are sufficiently large to meet or exceed the threshold suggested by the findings, without incurring the excessive opportunity costs associated with holding massive stocks of reserves. Second, since countries in the region insure not only against their own risk, but the risk originating from deteriorating conditions in their neighborhood, co-insurance mechanisms like regional reserve pool funds would prove useful in taking advantage of the cost-savings afforded by these arrangements. Finally, FLAR's successful experience of over three decades highlights the important role that this type of institution has both in terms of responding to regional crises, but also at complementing and filling some of the gaps left by the traditional international financial structure.

A cost effective approach to protection against the vagaries of the international financial markets must be based on the promotion of regional coordination and support through an enhanced region-wide reserve pooling mechanism. FLAR's successful track record and institutional experience make it a good candidate in the region to serve as a

foundational base of such an institution. While institutional challenges to regional cooperation remain, the urgency of protecting against exogenous shocks without sacrificing the development agenda shall ensure that this alternative approach to reserve accumulation prevails.

## APPENDICES

### APPENDIX A

#### DESCRIPTIVE STATISTICS I

	Argentina				Brazil			
	RESGDP	ERS	KAO	MPI	RESGDP	ERS	KAO	MPI
Mean	38.213	0.632	0.387	0.502	30.125	0.470	0.148	0.494
Median	36.300	0.690	0.243	0.536	27.600	0.420	0.000	0.434
Maximum	68.900	1.000	0.938	1.000	60.800	1.000	0.527	1.000
Minimum	13.500	0.018	0.161	0.000	3.900	0.062	0.000	0.000
Std. Dev.	14.468	0.346	0.276	0.370	11.746	0.277	0.206	0.388
Skewness	0.207	-0.325	0.845	-0.031	0.461	0.399	0.934	0.060
Kurtosis	1.992	1.632	2.083	1.360	3.046	1.925	2.141	1.300
Jarque-Bera	3.562	11.851	18.500	13.464	2.871	9.265	21.128	14.395
Probability	0.168	0.003	0.000	0.001	0.238	0.010	0.000	0.001
Sum	2751.3	78.4	46.4	60.2	2440.1	58.3	17.7	58.8
Sum Sq. Dev.	14862.4	14.7	9.1	16.3	11036.6	9.5	5.1	17.8
Observations	72	124	120	120	81	124	120	119

	Chile				Colombia			
	RESGDP	ERS	KAO	MPI	RESGDP	ERS	KAO	MPI
Mean	68.637	0.514	0.329	0.485	38.297	0.638	0.149	0.489
Median	74.450	0.484	0.000	0.393	37.650	0.675	0.161	0.475
Maximum	98.200	1.000	1.000	1.000	47.900	0.989	0.692	1.000
Minimum	37.500	0.111	0.000	0.000	30.500	0.114	0.000	0.000
Std. Dev.	16.501	0.236	0.408	0.382	3.641	0.268	0.175	0.405
Skewness	-0.366	0.516	0.653	0.099	0.651	-0.299	1.255	0.036
Kurtosis	1.886	2.355	1.646	1.350	3.321	1.690	4.136	1.275
Jarque-Bera	4.445	7.640	17.700	10.473	5.102	10.720	37.961	10.310
Probability	0.108	0.022	0.000	0.005	0.078	0.005	0.000	0.006
Sum	4118.2	63.7	39.4	44.2	2604.2	79.1	17.9	40.6
Sum Sq. Dev.	16064.7	6.9	19.8	13.1	888.1	8.8	3.6	13.5
Observations	60	124	120	91	68	124	120	83

	<b>Mexico</b>				<b>Peru</b>			
	RESGDP	ERS	KAO	MPI	RESGDP	ERS	KAO	MPI
Mean	23.1692	0.5602	0.5226	0.5267	49.7960	0.5726	0.6543	0.4538
Median	23.6500	0.5282	0.6923	0.5923	56.5500	0.5805	0.7846	0.2611
Maximum	43.7000	1.0000	1.0000	1.0000	107.8000	1.0000	1.0000	0.9999
Minimum	2.0000	0.0397	0.0000	0.0000	3.2000	0.0093	0.0000	0.0001
Std. Dev.	10.5609	0.2839	0.2641	0.3821	28.2015	0.2538	0.3798	0.3976
Skewness	-0.1797	0.0276	-0.3023	-0.1409	0.1129	-0.3041	-0.5886	0.1779
Kurtosis	2.1401	1.7972	2.1274	1.4240	2.0667	2.3532	1.7617	1.2714
Jarque-Bera	4.3430	7.4906	5.6346	11.9617	4.7638	4.0725	14.5953	9.7330
Probability	0.1140	0.0236	0.0598	0.0025	0.0924	0.1305	0.0007	0.0077
Sum	2780.3	69.5	62.7	59.0	6174.7	71.0	78.5	34.0
Sum Sq. Dev.	13272.5	9.9	8.3	16.2	97824.6	7.9	17.2	11.7
Observations	120	124	120	112	124	124	120	75

	<b>Venezuela</b>			
	RESGDP	ERS	KAO	MPI
Mean	223.9536	0.7906	0.4300	0.5346
Median	247.1000	1.0000	0.4041	0.5776
Maximum	466.2000	1.0000	1.0000	1.0000
Minimum	54.9000	0.0189	0.0615	0.0030
Std. Dev.	143.4740	0.3011	0.3035	0.3698
Skewness	0.1474	-1.2616	0.6904	-0.1127
Kurtosis	1.5182	3.2740	2.0331	1.4339
Jarque-Bera	5.3259	33.2804	14.2078	8.8660
Probability	0.0697	0.0000	0.0008	0.0119
Sum	12541.4	98.0	51.6	45.4
Sum Sq. Dev.	1132163.8	11.2	11.0	11.5
Observations	56	124	120	85



## APPENDIX B

### PRELIMINARY TESTS

#### Stationarity Tests (ADF)

Variables	Argentina	Brazil	Chile	Colombia	Mexico	Peru	Venezuela
ERS	-3.13709	-6.00341	-7.51393	-3.12955	-5.75796	-3.51027	-4.54182
	0.0264	0	0	0.027	0	0.0093	0.0003
	1	0	0	1	0	2	0
KAO	-1.74554	0.267492	-0.96027	-1.35766	-2.20225	-0.86095	-1.75461
	0.4059	0.9757	0.7655	0.6007	0.2067	0.7974	0.4014
	0	0	0	0	0	0	0
ΔKAO	-10.7728	-11.0552	-10.7885	-10.8199	-10.7803	-10.824	-10.8232
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
MPI	-11.3238	-10.0763	N/A	-8.45168	-10.2107	-2.92327	-10.591
	0	0		0	0	0.0595	0.0001
	0	0		0	0	10	0
RESGDP	-1.39098	-2.11086	-0.97046	-3.90781	-2.05693	-0.47539	-1.40848
	0.5819	0.2411	0.7582	0.0033	0.2626	0.8909	0.5717
	1	0	0	0	1	4	0
ΔRESGDP	-11.8718	-7.84949	-7.7911		-9.13825	-4.099	-7.55782
	0.0001	0	0		0	0.0014	0
	0	0	0		0	3	0

Augmented Dickey-Fuller Test Statistic, p-value, and lag length are presented in that respective order.

#### Sequential modified LR test statistic (each test at 5% level)

Lag	Argentina	Brazil	Chile	Colombia	Mexico	Peru	Venezuela
1	73.93115	40.73573*	23.34886	32.45194*	63.03323	26.04184	36.60845*
2	13.25679	18.77292	21.59205	8.825801	14.69504	31.43737	16.53149
3	32.35509*	15.3314	38.08410*	17.9828	26.50608*	16.68376	7.066262
4	25.71194	14.45667	18.92756	20.08631	10.29119	22.10683	11.70273
5	22.01281	12.13744	0	12.86697	18.57522	36.74414*	25.84931
6	13.56958	14.29817	NA	16.11282	12.16971	20.86635	NA

\* corresponds to the lag order selected by the criterion

**APPENDIX C**  
**DESCRIPTIVE STATISTICS II**

	<i>Reserves</i>	$\Sigma$	<i>EMBI</i>	<i>Vulnerability</i>	<i>Obli</i>	<i>Contagion</i>	<i>FloatingD</i>
Mean	31567.8	23038258	670.0084	17048.73	1.81E+10	-2.09E-11	0.55
Median	19851.7	2364575	371.3487	8411.775	1.81E+10	-0.235073	1
Maximum	205539	8.26E+08	6630.392	93937.5	7.32E+10	9.102129	1
Minimum	6155.66	37751.38	56.66667	59.48	2.56E+09	-9.263365	0
Std. Dev.	33135.38	90960186	1151.781	20547.53	1.52E+10	3.332063	0.498384
Skewness	3.058775	6.616327	3.745539	1.787102	1.415417	0.183495	-0.201008
Kurtosis	14.15547	50.04582	16.40983	5.314725	5.268075	3.510369	1.040404
Jarque-Bera	1935.683	28561.43	2772.293	210.0392	78.39846	4.725437	46.68571
Probability	0	0	0	0	0	0.094164	0
Observations	287	287	282	278	143	287	280

## APPENDIX D

### PANEL UNIT ROOT TEST (FISHER)

Ho: Unit Root

Variable	At Levels		First-Difference	
	Chi-square	P-value	Chi-square	P-value
lnRESERVES	4.273	0.998	172.85	0
ln $\sigma$	6.332	0.957	91.343	0
lnEMBI	15.621	0.337	160.887	0
lnVULNERABILITY	11.792	0.623	273.797	0
lnOBLI	10.659	0.558	84.9168	0
CONTAGION	53.203	0	-	-

## APPENDIX E

### FORECASTED CHANGES IN RESERVE DEMAND DUE TO HYPOTHETICAL CHANGES IN THE LEVEL OF CONTAGION

(In Millions of USDs)

Hypothetical Changes in Contagion		1	2	3	4	5	6
Argentina	Q2 2009	8.99	17.97	26.96	35.94	44.93	53.92
	Q3 2009	18.36	36.73	55.10	73.48	91.85	110.24
	Q4 2009	28.15	56.30	84.47	112.65	140.84	169.04
	Q1 2010	38.34	76.71	115.10	153.51	191.95	230.40
	Year Aggr.	93.84	187.72	281.63	375.58	469.57	563.59
Brazil	Q2 2009	37.88	75.76	113.64	151.52	189.40	227.28
	Q3 2009	79.17	158.35	237.55	316.76	395.99	475.23
	Q4 2009	124.09	248.24	372.43	496.66	620.95	745.28
	Q1 2010	172.90	345.91	519.01	692.21	865.51	1038.91
	Year Aggr.	414.04	828.25	1242.62	1657.15	2071.84	2486.70
Chile	Q2 2009	4.65	9.31	13.96	18.61	23.27	27.92
	Q3 2009	9.42	18.84	28.26	37.69	47.11	56.54
	Q4 2009	14.30	28.60	42.91	57.22	71.54	85.87
	Q1 2010	19.29	38.60	57.91	77.24	96.58	115.93
	Year Aggr.	47.66	95.34	143.04	190.76	238.50	286.26
Colombia	Q2 2009	4.65	9.31	13.96	18.62	23.27	27.93
	Q3 2009	9.55	19.10	28.65	38.20	47.75	57.31
	Q4 2009	14.69	29.38	44.08	58.78	73.49	88.21
	Q1 2010	20.08	40.18	60.29	80.41	100.54	120.68
	Year Aggr.	48.97	97.96	146.97	196.00	245.05	294.12
Mexico	Q2 2009	17.09	34.19	51.28	68.38	85.47	102.57
	Q3 2009	35.07	70.15	105.23	140.33	175.43	210.53
	Q4 2009	53.97	107.95	161.96	215.99	270.04	324.11
	Q1 2010	73.81	147.67	221.57	295.51	369.50	443.53
	Year Aggr.	179.94	359.96	540.05	720.21	900.43	1080.73
Peru	Q2 2009	6.00	11.99	17.99	23.99	29.98	35.98
	Q3 2009	12.36	24.72	37.08	49.45	61.81	74.19
	Q4 2009	19.10	38.21	57.32	76.45	95.58	114.71
	Q1 2010	26.24	52.50	78.77	105.06	131.36	157.68
	Year Aggr.	63.70	127.42	191.17	254.94	318.74	382.56
Venezuela	Q2 2009	3.51	7.02	10.53	14.04	17.55	21.07
	Q3 2009	7.19	14.39	21.58	28.78	35.97	43.17
	Q4 2009	11.05	22.10	33.16	44.23	55.29	66.36
	Q1 2010	15.09	30.19	45.30	60.41	75.54	90.67
	Year Aggr.	36.84	73.70	110.57	147.46	184.36	221.28

# APPENDIX F

## COVERAGE RATIOS UNDER RESERVE POOLING

Figure 4b. Brazil

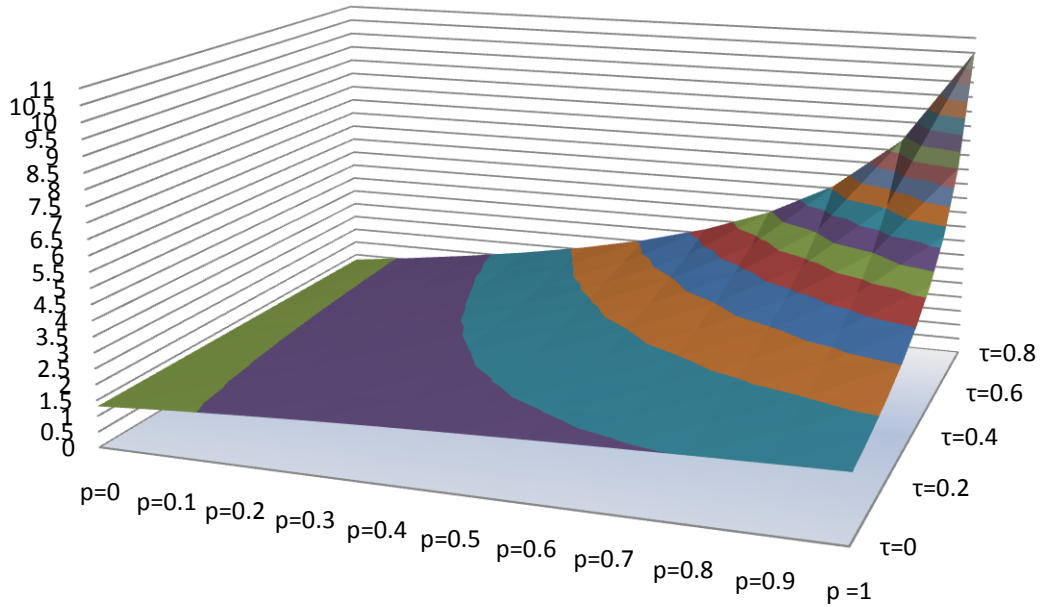
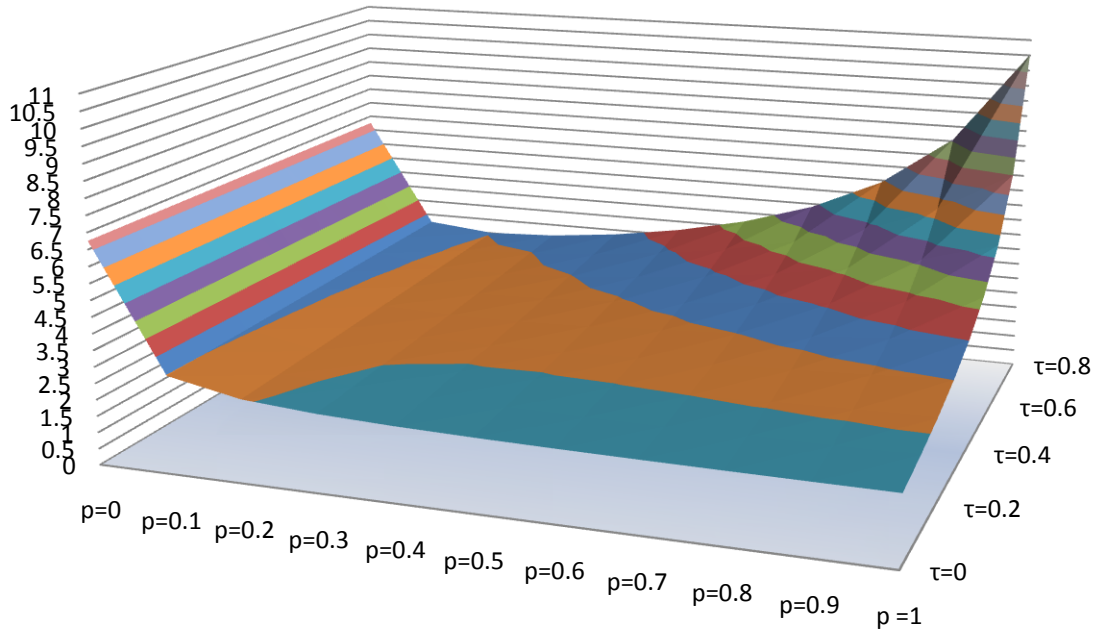
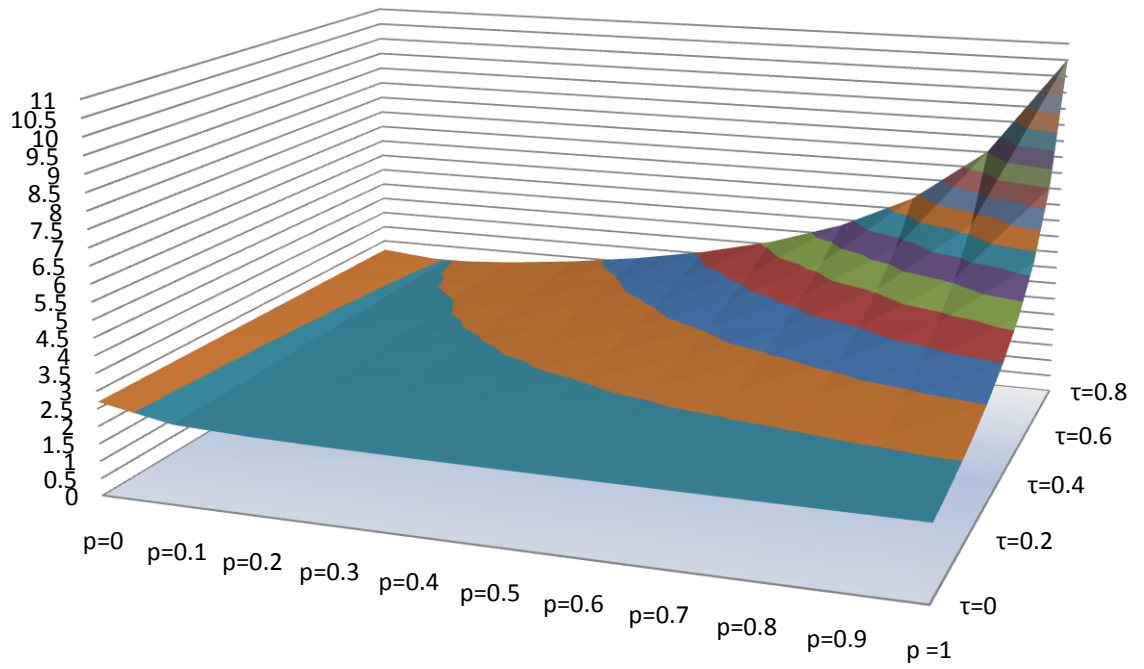


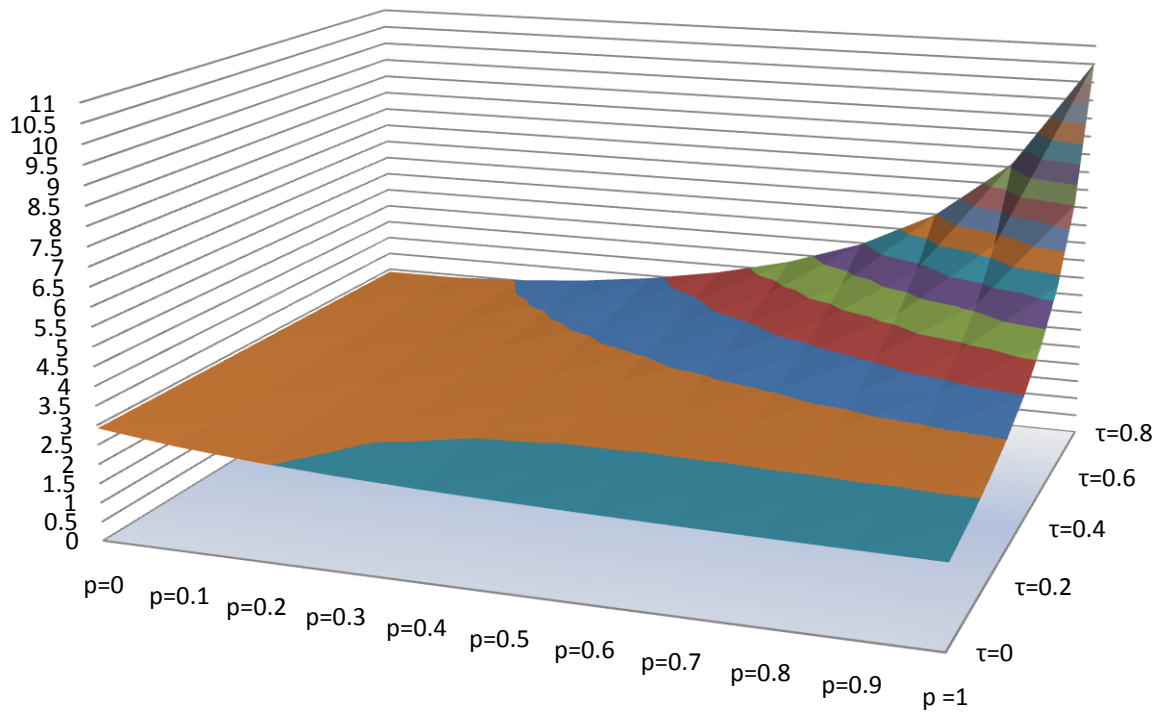
Figure 4c. Chile



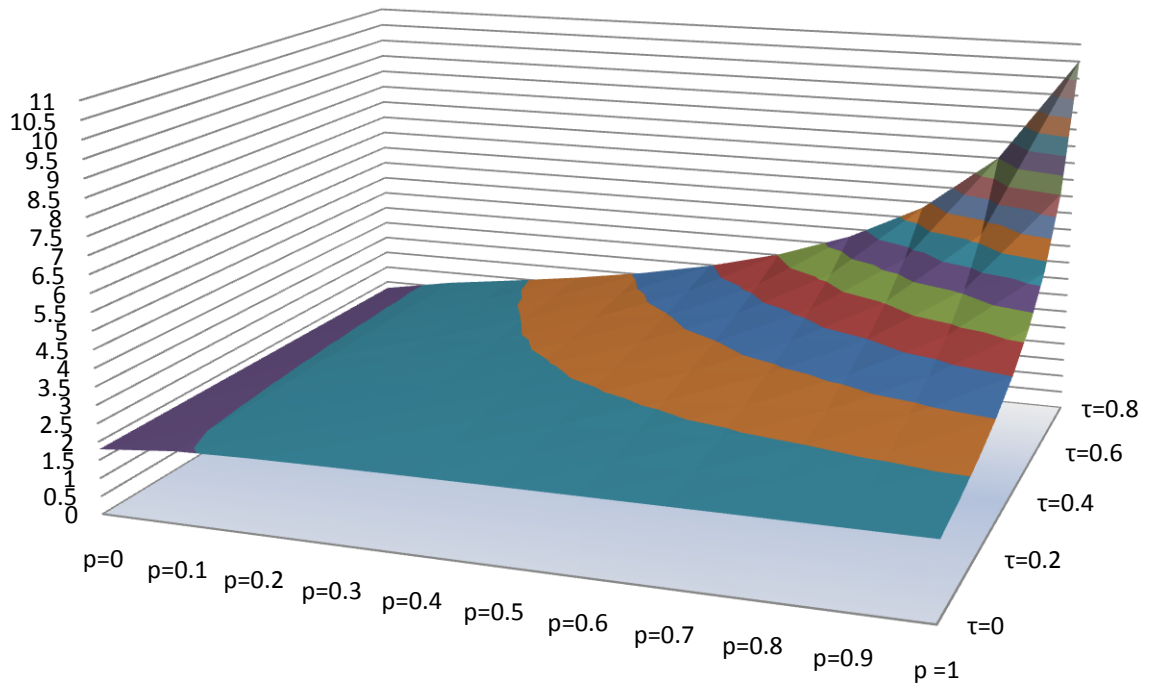
**Figure 4d. Colombia**



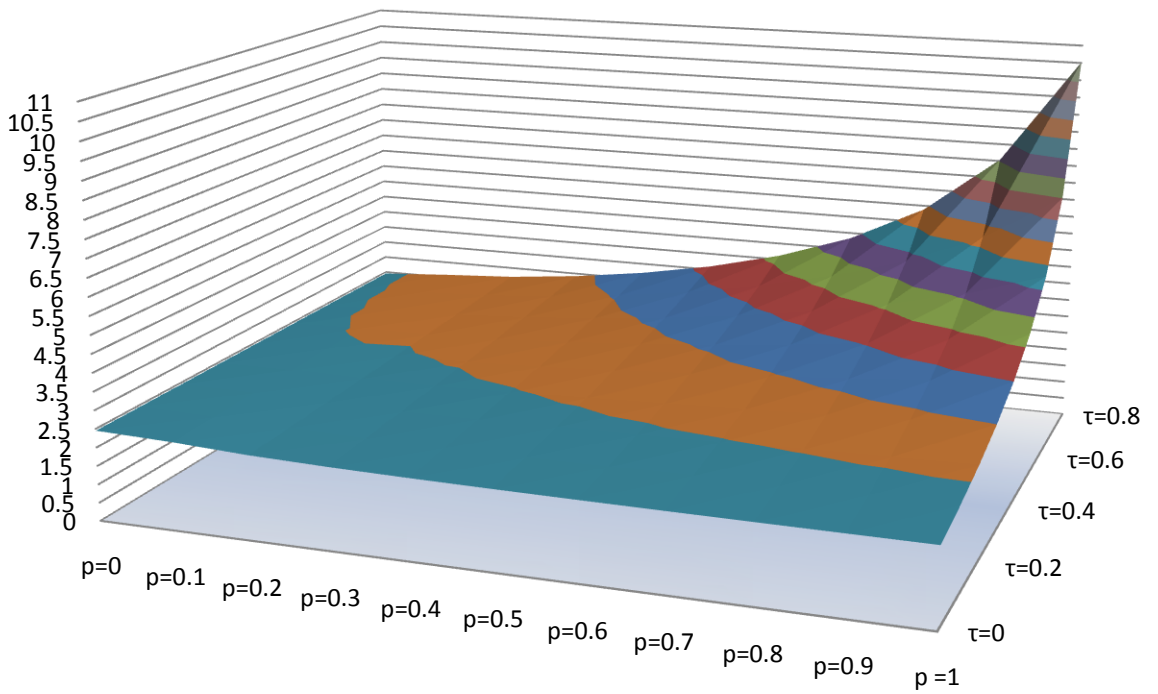
**Figure 4e. Mexico**



**Figure 4f. Peru**

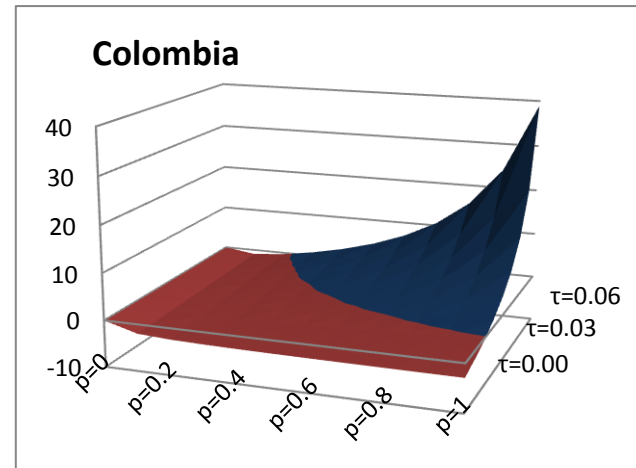
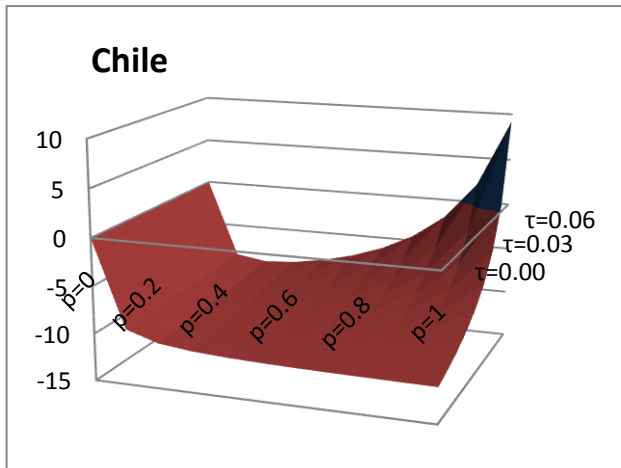
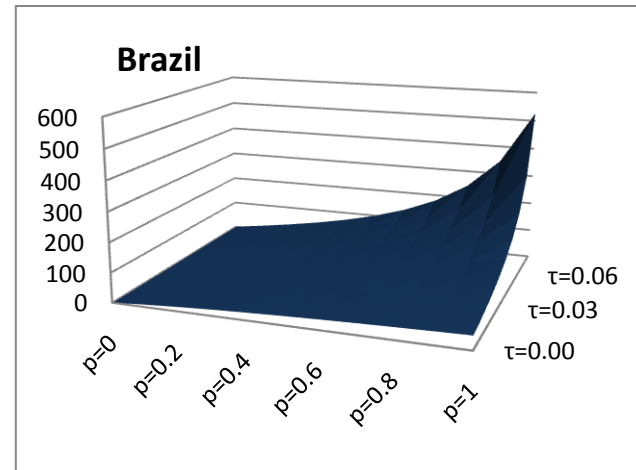
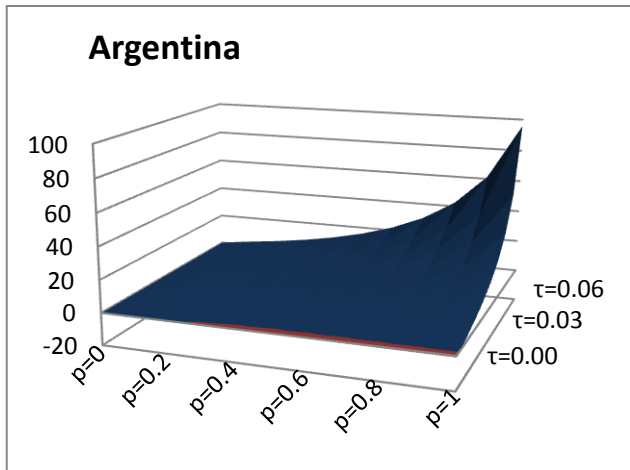


**Figure 4g. Venezuela**

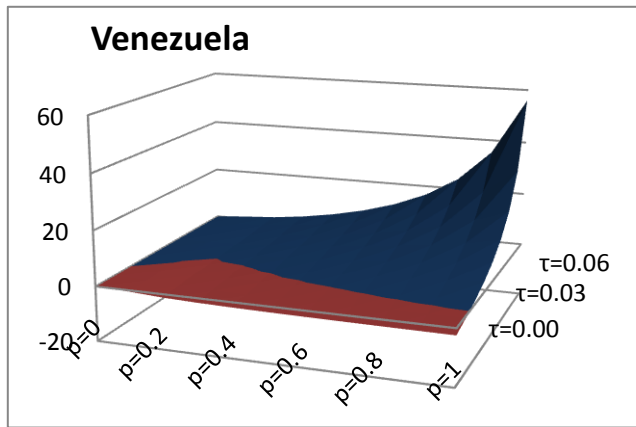
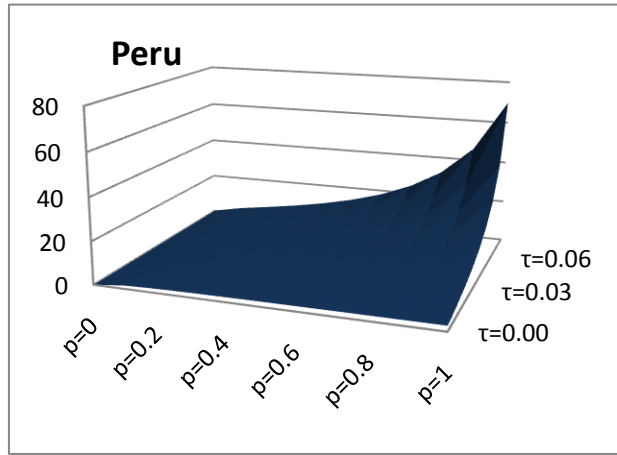
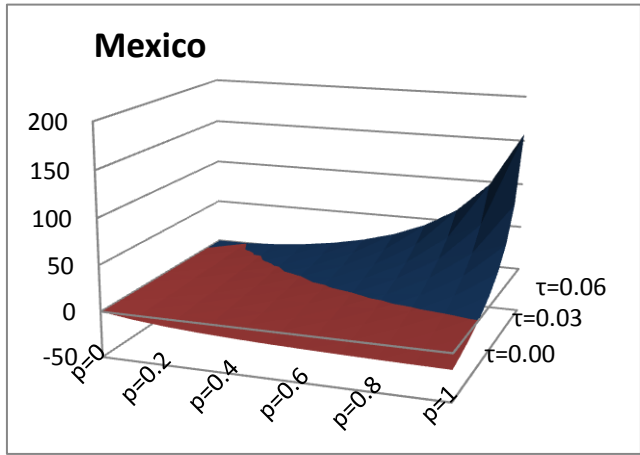


## APPENDIX G

### RESERVES SAVINGS DUE TO RESERVE POOLING: $HRI - RI$ (in Billion USDs)

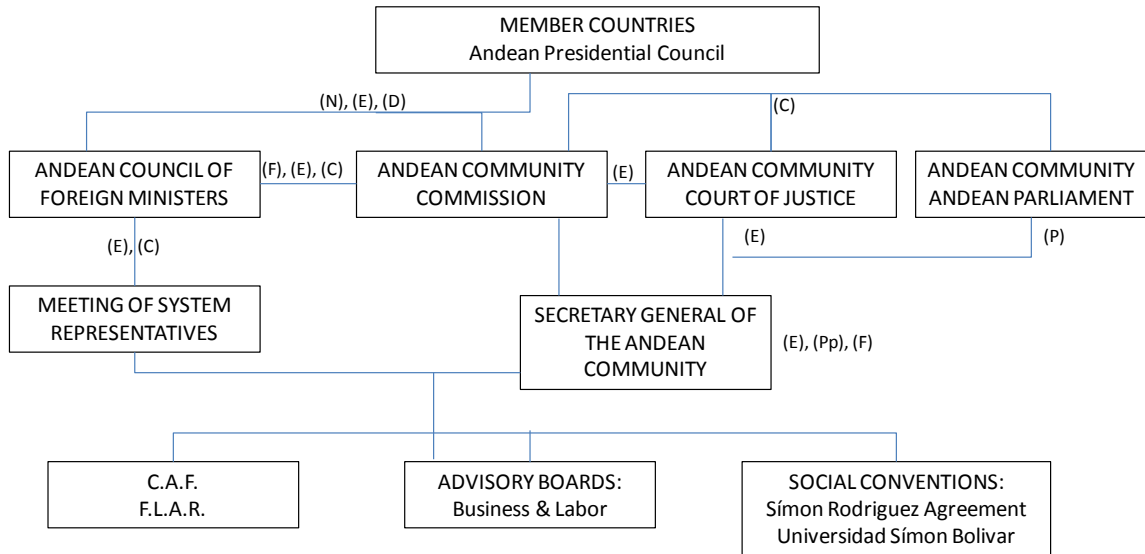






## APPENDIX H

### INSTITUTIONS OF THE ANDEAN AGREEMENT



(C) Coordinates; (D) Directs Policy; (F) Formulates Policy; (N) Names; (P) Promotes; (Pp) Proposes; (E) Examines, Monitors; (So) Submits Legislation

Source: Adapted from Bustamante (2004)

## APPENDIX I

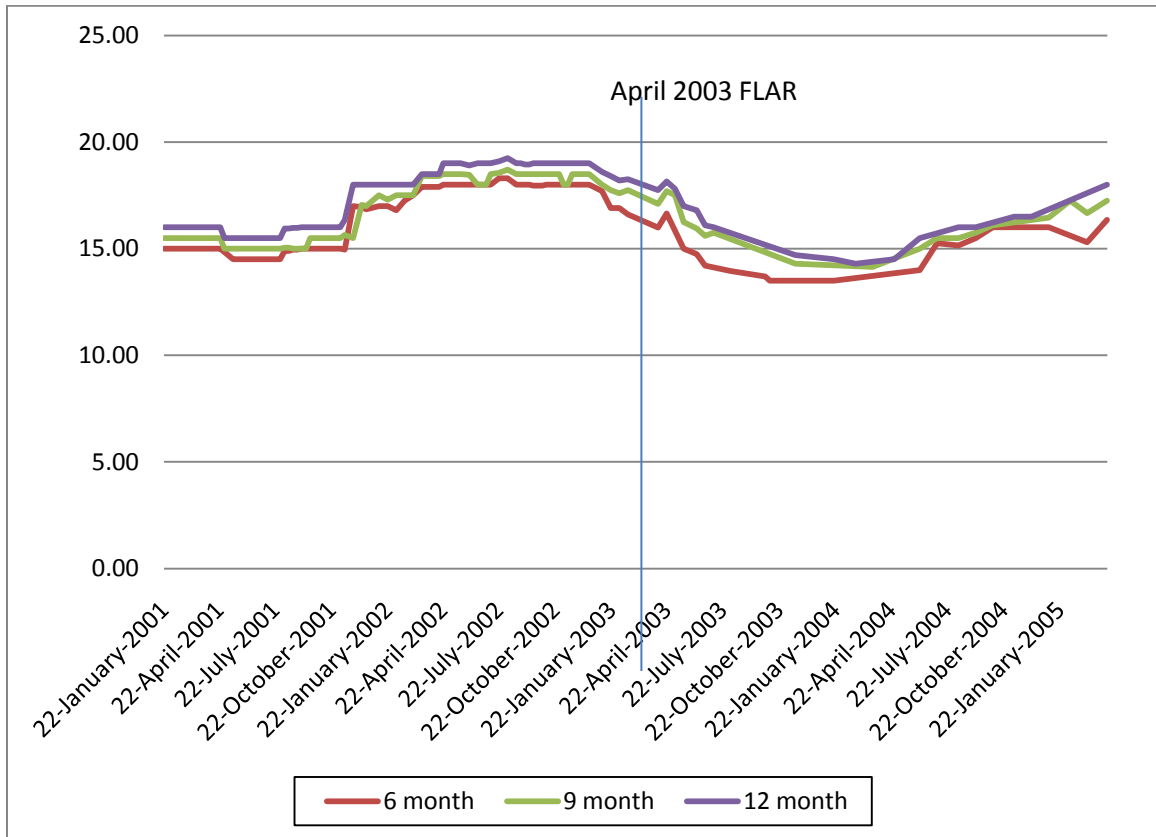
### FLAR'S GOVERNANCE AND MANAGEMENT STRUCTURE



Source: FLAR

## APPENDIX J

### COSTA RICA'S ZERO COUPON BOND RATES BY MATURITY TERMS<sup>1</sup>



Source: Costa Rican Ministry of Finance

<sup>1</sup> Maximum yield based on performance at auctions held by the Ministry of Finance.

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