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Course of *International Financial Economics*

Mundell-Fleming Trilemma: Evolution in Emerging Markets

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1. Introduction

In the early 1960s, the Keynesian open-economy macroeconomic policy model was extended individually by Robert Mundell and Marcus Fleming, whose aim was to systematically incorporate the role of capital flows into this Keynesian model. Given the rapid and influential importance their contributions were gaining in the economic literature, Rudiger Dornbush decided in a series of articles in 1976 to codify their salient features in what he called the Mundell-Fleming Model, which would later become known as the Mundell-Fleming Trilemma in the open-economy macroeconomic literature, obscuring the individuality of their work.

As Boughton (2002) summed up in his work, in the 1960s and 1970s, the study and analysis of the open economy in Keynesian literature was attributed to James Meade, whose description of the effects of monetary and fiscal policies mainly dealt with the resolution of the differential effects on internal and external equilibrium, as well as considering the differences between monetary and fiscal policies as relevant only for the capital account. Fleming's contribution simplified and reoriented Meade's framework towards a significantly interesting policy issue, namely examining the consequences of choosing a country's exchange rate regimes on the effectiveness of fiscal and monetary policies. His version focuses on greater effectiveness of monetary policy in a context of fluctuating exchange rates both in absolute terms and in relation to a fiscal policy of a certain magnitude, as well as the ambiguity that the effect of fluctuations, measured as the autonomous change in domestic spending with a fixed stock of money, has on the effectiveness of fiscal policy.

In parallel, the entire analysis developed by Mundell is grouped in a series of articles written between 1990 and 1993. Among these, the "Principle of Effective Market Classification" introduced the idea that a policy instrument should be assigned to the target over which it has the greatest influence. Mundell developed the dynamic adjustment of the internal and external balance in response to monetary shocks using a variant of the previous Laursen and Metzler model (1950) to derive the balance of goods and services markets and exchange rates. The results showed that the orientation of monetary policy inwards or outwards depends on the type of exchange rate regime. This theme was then expanded in the series of subsequent articles, showing how a series of alternative policies could have been used to restore the external balance if monetary policy had been assigned to the internal balance (1961), or the twofold greater effectiveness of monetary and fiscal policies in restoring the balance under conditions of fluctuating exchange rates compared to fixed ones (1961) or, on the contrary, the ineffectiveness of fiscal policy in an extreme case of perfect mobility of capital to restore the internal balance (1963). The

Mundell-Fleming model, later known as the Mundell-Fleming Trilemma, is essentially the combination of Fleming's equation and Mundell's policy analysis.

This paper presents the application of the Mundell-Fleming Trilemma to global emerging markets from 1950 to our days, organized as follows: Chapter 2 presents the theoretical framework underpinning the Trilemma in order to highlight its fundamental mechanisms; Chapter 3 presents a historical overview highlighting the transition of the Trilemma's policy choices that occurred between Bretton Woods era and the onset of global financial integration; Chapter 4 presents the evolution of emerging markets as a function of global financial changes, emphasizing the dynamics that led to the general periods of financial stress; Chapter 5 presents the common features and differences of the periods of crisis experienced by the markets of our interest and the tools/mechanisms used for their resolution and the rebirth of their economies; Chapter 6 presents an empirical study of Trilemma's policy choices over time, as well as a study of the specific behaviors of certain types of markets and their underlying causes. The work ends with the Concluding Remarks where I draw the sums of what discussed and analyzed and propose a future vision of the Trilemma.

2. Theoretical Framework

The Trilemma's theoretical framework suggests that, given certain achievable macroeconomic objectives, world countries can undertake policy actions for the pursuit of national/international interests in the light of only some of these, given their irreconcilable nature. The desirable macroeconomic goals mentioned can be represented figuratively as the vertices of a triangle and specifically they correspond to:

- monetary independence
- exchange rate stability
- financial integration (intended as free flow of capital)

The specific technicalities of the individual options create conflicts between them due to their mutual exclusiveness. As such, this makes only one side of the triangle feasible at any given time. In this regard, Mundell's contribution was fundamental in one of his study in the 1960s where he developed a derivation of the "Trilemma" in the context of a theoretical extension of the open economy present in the Keynesian model. His analysis is highly simplified, focusing on polarized binary choices: a permanently fixed or purely floating exchange rate; perfect mobility of capital or in alternative financial autarchy. To help us in understanding this compromise, please refer to *Figure 1*, where, in addition to the vertices aforementioned, all the combinations of choice are presented according to a given macroeconomic policy.

Figure 1 - Trilemma's scenarios representation

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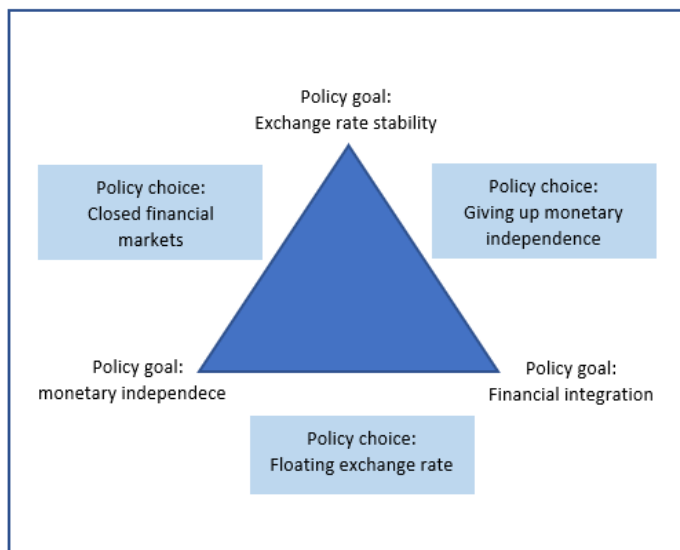
First, consider the scenario where a fixed exchange rate regime is combined with perfect capital mobility, typical of Eurozone or Currency Board member states and coinciding with the macroeconomic configuration displayed on the right side of the triangle. In a context where domestic and foreign government bonds are perfect substitutes, a credible fixed exchange rate implies that the national interest rate is equal to the foreign interest rate, an implication resulting from the parity condition of the uncovered interest rate. In virtue of this premise, the central bank's desire to increase the money supply would generate downward pressure on the domestic interest rate, which in turn would cause investors to sell domestic bonds in search of a higher yield from foreign bonds. As a result of these arbitrage forces, the central bank faces both an excess demand for foreign currency for the acquisition of foreign bonds and an oversupply of domestic currency against it.

Now, according to the fixed exchange rate assumed at the beginning of the analysis, an intervention in the foreign exchange market to meet public demand for foreign currency at the official exchange rate will be necessary by the central bank, which, as a result, will sell foreign currency to the public. In this process, the central bank gains back the excess of domestic money supply that is triggered by its own attempt to increase the money supply. The result is that the central bank loses control over the money supply, which is gradually adapting to the demand for money. A monetary policy transmission instrument such as an open market operation only changes the composition of the central banks' balance sheets between domestic and foreign assets, without generating any effect on the monetary base and the domestic interest rate. This implies that, in a context such as a small open economy, the determination of the domestic exchange rate is relegated to the country where the exchange rate is pegged.

A small open economy willing to maintain its financial integration can regain its independence in monetary policy by giving up the fixed exchange rate regime in favor of a variable one. This new combination shifts our analysis to the scenario presented on the lower side of the triangle in *Figure 1*, which is quite usual especially for the US, UK, Japan and several OECD countries.

 In a flexible exchange rate regime, the expansion of the money supply has a negative effect on the interest rate by reducing it, which consequently generates an outflow of capital in search of a higher foreign return. For this reason, in a flexible regime including financial integration, the monetary policy of the country in question assumes greater importance and value than in the previous case. In fact, a higher supply of money reduces the interest rate, thus increasing national investment, and weakens the national currency at the same time, which allows the economy to expand through the increase of net exports.

An alternative way of regaining monetary independence from a small open economy is to opt for a stable exchange rate regime at the expense of financial integration, favorite choice for most OECD countries and developing countries during the 1945-1970 Bretton Woods regime. This combination shifts our analysis again to the last macroeconomic scenario offered by the left side of the triangle, which can be reached through closed financial markets and a pegged exchange rate regime. To renounce financial integration means to prevent arbitrage between domestic and foreign bonds, by relocating the domestic interest rate from the foreign one. Monetary policy operates similarly to a closed economy, where in the short term the central bank has control over the supply of money and monetary expansion causes a reduction in the domestic interest rate.

The basic theory of this model has been the subject of numerous debates for many years about its feasibility in common macroeconomic policy practice. The numerous studies carried out on it have been fundamental, not only to strengthen the basic assumptions, but also to enrich and modify them. In this regard, it is fundamental to mention the various experiments carried out by Aizenman, Chinn and Ito, which examined the development of open economic policy choices for both major industrialized and developing economies, obtaining important results on the size of the respective Trilemma configurations and their convergence towards new trends. In this respect, a pioneering aspect of their study was the introduction of indices[1] measuring the degree to which monetary independence, exchange rate stability and financial openness have been achieved. By virtue of the new instruments created and beyond the empirical analysis just described, their study also focused on more theoretical aspects of the Trilemma, such as the demonstration of the linearity between the trinity's macroeconomic objectives and their exclusivity. Their analysis showed that the increase in value of two of the three mentioned indices, determined by macroeconomic policy choices of whichever state, led to a reduction in the value of the third index, confirming the basic theory of the Trilemma. Similarly, among the many studies that have enriched the basic theory of the "impossible Trinity", there are the numerous analyses conducted by Maurice Obstfeld, Jonathan D. Ostry, and Mahvash S. Qureshi. Their results have led to important conclusions on the propagation of interest rate shocks in different exchange rate regimes, demonstrating how the adoption of a flexible exchange rate guarantees less risk to operating governments.

Starting from the previous decade, market conditions and macroeconomic regimes adopted by countries around the world are leading to different derivations of the model. A first derivation of our basic theory

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[1] MI, ERS KAOPEN that respectively stands for Monetary Independence, Exchange Rate Stability and Financial Openness/Integration

is the Dilemma one. This states that the so-called peripheral countries are exposed to a Global Financial Cycle, in which the monetary policy of the economic center influences the national policy of the other countries through cash flows. These cascading effects limit the operational capacity of the peripheral countries because it makes their exchange rate regimes irrelevant and thus makes them lose one of the macroeconomic choices provided by the basic model.

On the same wavelength, the second derivation of our basic theory is the Quadrilemma. An undesirable consequence of financial globalization is that developing countries have been exposed to increasing capital flight and deleveraging crises. The significant costs associated with these crises have added financial stability to the objectives of the Trilemma policy, thus changing the structure of the initial policy framework.

However, although both new visions are supported by real evidence, the configuration of the trilemma is still the most valid and feasible.

3. Historical overview of global context, from 1960s to the new millennium

Although the macroeconomic concept of our analysis implies strong constraints for its concretization, the possibility of choosing between several objectives to pursue also guarantees pragmatic capabilities. For a complete and coherent study of the topic, it is necessary to analyze how the different political forces, the development of the global context and the new economic market relationships have influenced the status that the Trilemma assumed from time to time and how the introduction of new market variables have influenced its functioning. In this respect, this chapter is intended to present these dynamics from the post-World War II to the early 2000s.

3.1 Bretton Woods Era

Many theorists have observed that the macroeconomic theory of the Trilemma is applicable much more to past periods, such as the 1950s and 1960s, when the Mundell-Fleming model was developed, than to the current global context, which is constantly evolving in different ways.

The harsh lesson of the monetary chaos that reigned in the period between the two World Wars was the key to achieving a communion of intent among the main industrialized countries of the Western world regarding the creation of a system of rules and procedures for the control of international monetary policy. The period of the "Great Depression" was a still vivid memory in the minds of economists, who had witnessed the economic disaster resulting from the strict political model of that period based on exchange control and high trade barriers. It was for this reason that the Bretton Woods Accords, signed in 1944 in New Hampshire, gave the impression of overcoming the defeat of the 1930s, when control of foreign exchange markets had created major cracks in the international payment system on which world trade was based. The governments of the agreement had to overcome, through the proposed new system, the decline in domestic revenue, rising unemployment, falling demand and the general decline in world trade.

The Bretton Woods agreements represent a compromise between the plans presented by John Keynes and Harry White, the US and UK delegate respectively. The United States gave priority to the stability of the currency, due to the aforementioned imbalances of the 1930s, while the UK focused on obtaining more room for monetary independence, given the severe limitations of monetary policy decisions compared to the needs of that period. Given the macroeconomic objectives of pursuing a fixed exchange rate regime and an independent monetary policy for the central banks involved in the agreement, it is

clear how we are in one of the scenarios proposed by the "Trilemma", where freedom of capital flows was at the expense. The compromise that formed the glue between the two visions was the consideration of gold as a lifeline for the Bretton Woods system, the same gold that at the same time was subject to rules that reinforced the autonomy of central banks.

In essence, the Bretton Woods system took the connotations of a Gold Exchange Standard, in which all currencies were traded at fixed exchange rates and were all pegged to the dollar, which in turn was pegged to gold. From a real point of view, the international system created was composed of a core and a periphery. The central nucleus, in the 1960s represented by the United States, had the privilege of issuing the currency that was used as an international reserve and, in this way, was able to work beyond its actual capacity. Alongside this, the periphery, then composed mainly of Europe and Japan, was engaged in export-led growth based on maintaining an undervalued exchange rate through the accumulation of low-yield international reserves issued and denominated in the central country's currency. The main points were obviously valid for all parties to the agreement and can be summarized as follows:
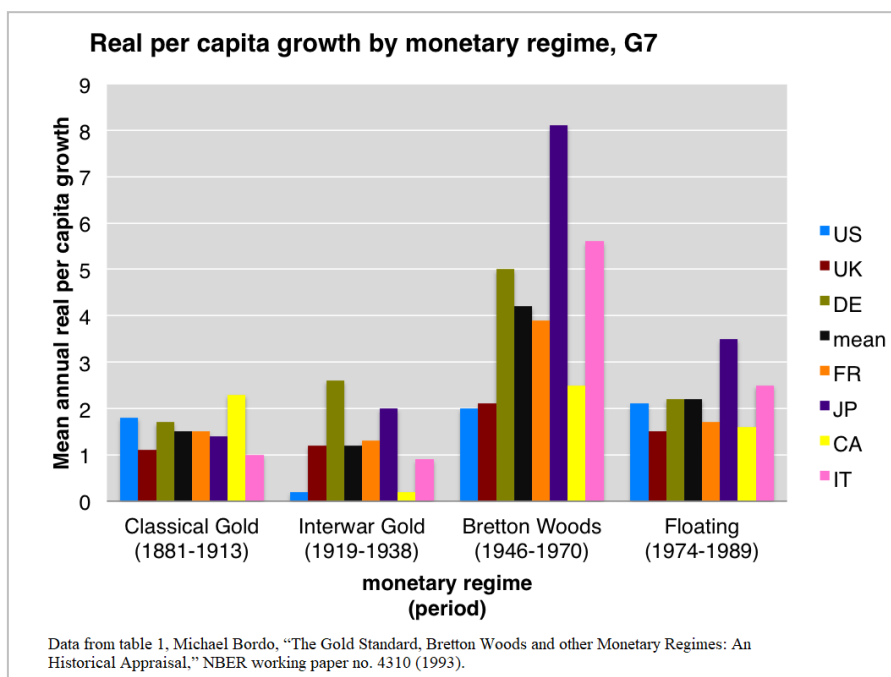
* All currencies with reference to the parties of the agreement had to be convertible into gold. As a result, there was a "dollarization" of the economic system since the prices of strategic goods (i.e. oil, raw materials, etc.) were all expressed in dollars;
* The central banks had to maintain a stable exchange rate system with the dollar. In particular, in the event of exchange rate fluctuations, banks whose currency was involved, except for the US one, had to carry out open market operations aimed at realigning rates;
* The creation of the International Monetary Fund, with the task of monitoring monetary stability in order to restore open and multilateral international trade.

Although the ultimate goal of stability was essential, it is clear that this system is more concerned with an anchored rate regime than with the rates actually set. However, pegged exchange rates were not the only elements of the regime analyzed. Despite the strong control over capital flows, participating states always had macroeconomic obligations to comply with which included commitments by governments to international trade, encouraging investment and sustaining unemployment. Investment had the effect of stimulating aggregate supply, while the release of trade was functional to the aggregate demand.

The Bretton Woods period showed the fastest growth (*Figure 2*) of any modern exchange rate regime and the macroeconomic performance framework was further strengthened by other real variables. Indeed, the variability of member countries' output was lower than in previous periods, exchange rates were

generally lower than in the past and interest rates remained exceptionally stable.

Figure 2 - Growth comparison among monetary regimes

Real per capita growth by monetary regime, G7

Data from table 1, Michael Bordo, "The Gold Standard, Bretton Woods and other Monetary Regimes: An Historical Appraisal," NBER working paper no. 4310 (1993).

In this context, it is essential to explain the role played by capital controls. The vision of the Bretton Woods system suggested that the use of such controls was essential to reconcile political autonomy with exchange rate stability. The controls on direct and portfolio investment abroad by the United Kingdom, the unorthodox measures of the Bundesbank to discourage the purchase of German goods by foreign residents in order to limit German appreciation and the American Interest Equalization Tax, designed to reconcile internal stimulus with a very worrying external situation, are among the most emblematic examples of that period. However, capital controls have been a practical tool to make credit controls effective despite the costs they involve, given the role of usual instrument used by central banks that they assume.

The purpose of capital controls is generally to allow a certain differential between national and international interest rates to be maintained. However, the central banks of the 1950s and 1960s proposed an alternative solution to separate quantities and prices. Central banks used several credit controls and reserve requirements to fight inflation or, conversely, to increase output while keeping their reference

interest rate stable. By operating in this way, the domestic interest rate remained consistent with the remaining world rates and central banks gained the autonomy necessary to achieve their national unemployment and inflation targets. Although the alternative policy described above shows that capital controls are complementary to credit controls, their indispensability must still be recognized, because without such restrictions companies could have simply borrowed funds from abroad to circumvent the controls. When capital controls were used to make credit controls effective, the spread between national and international interest rates remained close to zero.

 In support of this thesis, between 1963 and 1965 numerous credit controls were carried out in France to face inflation without increasing the discount rate, while controls on incoming capital were made more restrictive. In this way, the French central bank was able to implement an anti-inflationary monetary policy through a mix of credit and capital controls without changing interest rates, so that the spread between French and American rates remained unchanged. Although the application of the principles laid down in the agreements had guaranteed excellent results for the first period, the system had flaws which, over time, compromised its sustainability.

After the end of the Second World War, US gold reserves were worth $26 billion. However, with the rapid growth of world trade, the American balance of payments collapsed. The countermeasures taken, such as the imposition of import quotas on oil and restrictions on the flow of trade flows, were not sustainable enough, as the open gold market was also worsening the situation.

Theoretically, the greater the gap between the price of gold on that market and that of the central bank, set at 35 USD per ounce, the more attractive it was to tackle domestic economic issues by buying gold at a fixed price and then selling it on the open market. It came to the point where the possession of dollars was more valuable than the possession of gold, as the constant deficit in the US balance of payments kept the system liquid and supported the economic growth. The presence of this deficit, however, led to the erosion of confidence in the dollar, as the "reserve currency" created instability. As with previous balance of payments difficulties, measures were taken to contain the problem through the creation of the London Gold Pool, an agreement between nations to control the price of gold in the market.

In 1968, all efforts by the central government of the Bretton Woods system failed with the establishment of the two-tier gold market, forcing the United States to suspend gold sales to governments trading in private markets. The natural consequence of these actions was the increase in the price of gold well above the official price, causing the depletion of US gold reserves due to the actions of some countries that

continued to strengthen their gold reserves. With the increase in growth and trade and the increase in total reserves, Japan and Europe took the form of economic powers like the United States, constituting a second structural change that led to the decline in the monetary hegemony of the latter. From these two new realities emerged general dissatisfaction with the privileged role of the dollar as an international currency. As long as other countries were willing to hold dollars, the United States had the freedom to make massive foreign expenditure for multiple purposes, financed by the peripheral countries of the system. As a result, the peak in the balance of payments and the sharp rise in public debt due to the military programs of that period meant that the dollar was increasingly overvalued compared with other currencies, such as the German mark and the yen, whose market was booming. In 1970, gold reserves began to deteriorate (*Figure 3*), and these were the first signs of a loss of confidence in the American currency. The macroeconomic transmission had already begun, so much that the devaluation of the system's reference currency caused the US domestic unemployment rate to rise.

Figure 3 - Official global gold reserves levels

Source: WGC (2014)
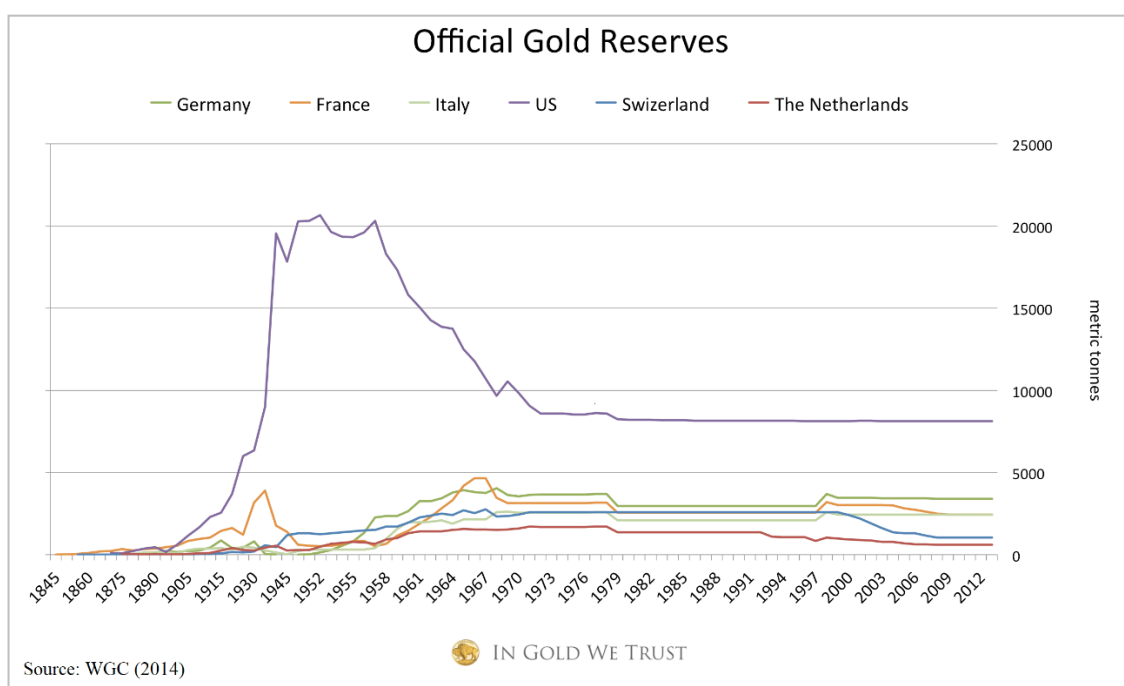
A reduction in the interest rate is what the FED opted for in order to buffer the unemployment phenomenon of that period. However, this move proved fatal as it allowed the dollar to continue to flow

out of the country to foreign central banks. The price of the dollar in the open gold market was now on the rise and the pressure on the official rate was unsustainable, so much so that a new devaluation of the dollar forced Japan and the Eurozone to break the balance of the Trilemma and allow their currencies to fluctuate without restrictions. This series of events put an end to the Bretton Woods system, whose participants were now redirecting themselves towards their new equilibrium.

3.2 Capital mobility and Financial Integration after Bretton Woods era

As previously explained in the section on the Bretton Woods era, one of the main innovations introduced by those agreements was the creation of the International Monetary Fund. Initially, it exercised strict controls on capital in order to prevent outflows and currency crises, thus guaranteeing a certain autonomy to governments in terms of active monetary policy. On the other hand, already in the 1960s, capital controls could not be contained so easily, so that IMF's operations were forced to adapt to a more dynamic context, breaking the balance that supported the previous system of fixed exchange rates.

Although fixed exchange rate regimes were reluctantly abandoned, and despite some countries trying to maintain or recreate such frameworks, the 1970s and 1990s were characterized by an apparent increase in capital mobility. Governments in industrialized countries no longer needed capital controls to maintain a fixed exchange rate anchor as such an anchor no longer existed. Since a floating exchange rate was able to adapt to the dynamic nature of financial markets, controls could be removed, and this was encouraging for the capital flows of all countries. The new configuration of the Trilemma that was emerging, with a strong emphasis on capital mobility, entailed costs and benefits for world market participants. Clearly, the increased ability to lend and borrow represents a loosening of constraints compared to a perfectly closed economy and provides many more benefits to global financial trade. This dimension allows for protection and mitigation of the effects of financial shocks, as well as allowing capital to aspire to higher returns than in the past.

However, this mobility of capital also raised concerns in other respects which became concrete. Policy makers might have considered their scope for action to be limited compared to the pursuit of other macroeconomic objectives that would have been at odds with the free flow of capital, as in the case of Europe or emerging markets. In addition, the risks of financial and balance of payments crises represented further obstacles to the adoption of free capital markets. The overly expansionist monetary policy of the United States, the core of the previous regime of the 1960s, represented a fundamental

impulse for the collapse of the Bretton Woods system, but not the only one. Although the previous macroeconomic policy had been useful to the OECD countries, the new economic magnitude assumed by Europe and Japan was too big for the previous regime because both no longer reflected the connotations of the peripheral countries and sought a more appropriate and balanced global architecture.

Since then, the global picture of the Trilemma has evolved substantially, with fundamental changes in its structure. After the elimination of gold convertibility in the early 1970s, a floating exchange rate regime became the norm, especially for industrialized countries, questioning what had been done previously and placing greater emphasis on the various debates on currency unions. The transition from a fixed rate regime with financial closure (as in the BW era) to one with opposite features has generated a devastating impact on market balances such as a high rate of inflation, an increase in interest rates, a supply shock and a significant loss of deposits by banks in favor of new funds.

As a further new trend, the developing financial openness culminated in the emergence of "neoliberalism" in the early 1980s, characterized mainly by free trade and deregulation of financial markets. In particular, it was a rather aggressive financial deregulation that brought out the most marked changes compared to the past, with the opening of savings and credit markets to competition, the facilitation of the entry of foreign banks and companies through the removal of restrictions on permitted banking activities and the privatization of public banks. Increased exchange rate flexibility and financial integration have allowed countries to exercise their monetary independence, in line with Trilemma's implications. The abolition of capital controls, albeit with some delay, also made a significant contribution to the increase in global current account deficits and surpluses, especially in US but even in the biggest industrialized lenders like Japan or Germany, well above the previous imbalances of the Bretton Woods era so that these new trends have significantly increased concerns about global imbalances.

These new developments have led nations to diversify their skills in order to be pragmatic towards this new market's dynamics. Indeed, financial openness has had much more considerable impacts on government policies' decisions than on financial regulation law with respect to the BW's one.

Compared to the standards of the previous regime, where current account imbalances were almost zero, the situation in the 1990s was very different: on the Western side, the US current account deficit in relation to GDP was around 6%; in Germany, the surplus was 7% of GDP; while in China, the current account surplus showed an exponential trend since 1995, with a peak in 2007. (*Figure 4*)

Figure 4 - Global Imbalances from 1980s to 2013 (as a percentage of world GDP)

Source: IMF (2014)
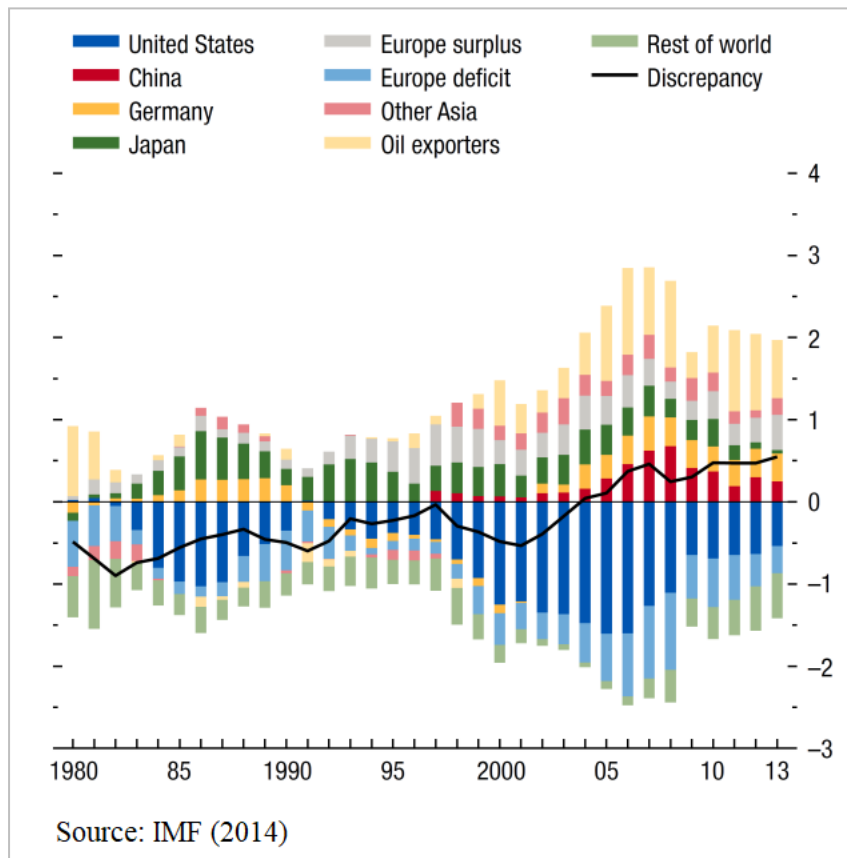
The mix of changes we have seen since the 1970s may be a plausible justification for the increase in global savings supply that explains both the excessive deficit seen in the US and the then relatively low level of long-term interest rates.

Financial integration combined with the move to a tighter exchange rate regime contributed to the creation of the Eurozone. The Mundell-Fleming Trilemma was a baseline to explain the pressures that cross-border capital flows exert on nation states.

The scenario in which a country cannot maintain, at the same time, an independent monetary policy, set its own exchange rate and be financially open, shows that financial openness imposes specific politic choices. One solution, offered by Mundell, is to neutralize any disruptions in international financial flows by harmonizing monetary policy and exchange rates.

Indeed, the increasing flexibility of the latter is a double-edged sword, as the resulting volatility can have

a negative impact on the costs of international trade in goods and assets. These considerations, together with the willingness of most current EU members to move towards greater integration in the 1990s, have led to the creation of a monetary union. As the concept of an optimal currency area proposed by Mundell suggests, membership of such a union guarantees precisely the strong links of economic and financial interdependence that the member countries have so longed for.

Moreover, the sacrifice of their monetary policy is less serious if the members of the area have similar reactions to external impacts. According to the logic of the Trilemma, in addition to maintaining the capacity to manage international pressures through exchange rate management, euro area Member States should also manage free capital within the euro area. The loss of their monetary independence and the rapid acceptance of the euro as a currency of value have been seen by observers as a stepping stone to a solid and prosperous Europe that is likely to balance the hegemony of the United States.

As widely described, the world was moving, and this also had an impact on developing economies. In peripheral countries, the numerous economic reforms had a very positive effects on foreign investment, reducing transaction costs and related risks. In the next chapter we will increase the focus on emerging markets, analyzing how increasing financial integration has facilitated the spread of financial crises in those countries where the pursuit of the objectives and constraints of the trilemma were difficult to apply due to multiple internal and external factors.

4. Emerging Markets' evolution

4.1 Relationship between financial integration and growth of developing countries

The take-off and rapid growth of Asian and South American markets have reduced the size of the most industrialized countries to about half of global GDP. Optimism and expectations were very high in the early 1990s, when it was generally assumed that increasing financial integration would accelerate growth in developing countries and facilitate income convergence, thus channeling global savings towards investment in developing countries with capital shortages. On the other hand, on a broader level, the relationship between economic growth and financial integration is still under discussion today. Contrary to the largely positive view of trade integration, economists have very divergent views on the effect of financial integration on a country's development. Generally speaking, having access to foreign savings can encourage investments, thereby widening the range of opportunities and making them more efficient, so as to contribute to the growth of the countries which benefits from them and which have given rise to them.

However, in practice, the international historical excursus does not provide a convincing evidence of a positive correlation between the two phenomena under discussion. In fact, in disagreement with the theory cited, economies like China have grown rapidly despite the limited degree of financial integration.

An interesting study on this subject, conducted by Aizenman, Radziwill and Pinto (2004), examined whether, as a result of increasing financial integration, there has been an increase in the extent to which the national physical stock of capital in developing countries has been financed by foreign savings. The study was based on building a self-financing index using a 10-year time horizon (1991-2001) for 22 OECD countries and 47 developing countries.

Once an estimate of the share capital in year t-10 had been derived using national income accounts, the next step was to add to this initial share capital the cumulative national investment for the following 10 years and divide it by the initial share capital plus the cumulative national savings over the same period. The results showed that the index had not changed much in the 1990s despite capital liberalization and that there was no growth surplus associated with increased external financing.

In relation to the above study, Prasad, Rajan and Subramanian (2007) have also examined the relationship between growth and integration during the 1990s, but from a different point of view.

The starting point of their investigation was twofold:

- unusual flow of capital from poor to rich countries
- puzzle allocation of Gourinchas e Jeanne[2]

Through the analysis of standard growth determinants over the period 1970-2000, the study identified a positive correlation between average current account balances and average growth rates in developing countries and noted that this correlation was driven more by savings than by investments. As an explanation for why savings are positively correlated with growth, they suggest that financial systems tend to be underdeveloped in developing countries.

As a result, not all savings are transformed into investments, since some of them are allocated abroad through current account surpluses (as in the case of Japan, China and Korea), thus generating an accumulation of foreign currency reserves, which we will discuss later in this chapter. This anomaly calls into question the view that the scarcity of savings to finance investment is the main obstacle to growth. The facts presented imply that, although there have been significant gains from financial integration, these are not necessarily due to access to the global savings pool.

4.2 Role of U.S. dollar into EM's economies

The role of the United States in the world economy, already central during the Bretton Woods era, was consolidated and expanded in terms of importance also in the following decades, defining the dollar as the main world currency. This predominance in the international trade and financial system has raised the level of attention to the importance of the dollar movements for the global economy and in particular for developing economies. In this regard, *Figure 5* shows how most trade, especially in EM, is invoiced in dollars, while *Figure 6* depicts the link between the real dollar and average GDP (on the left) and investment in emerging markets (on the right).

Based on these simple correlations, a stronger dollar, and therefore weaker EM currencies, is correlated with weaker GDP and weaker investment, which is at odds with what someone would expect from traditional trade channels.

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[2] Gourinchas and Jeanne's puzzle (2007) explains that net capital inflows into developing countries tend to flow to slower growing countries.

Figure 5 – Dollar dominance in trade invoicing

Source: National source, Kamps (2006), Goldberg and Tille (2009), Gopinath (2016), Castellares (2017), Labbe (2018), Giuliano and Luttini (2019)
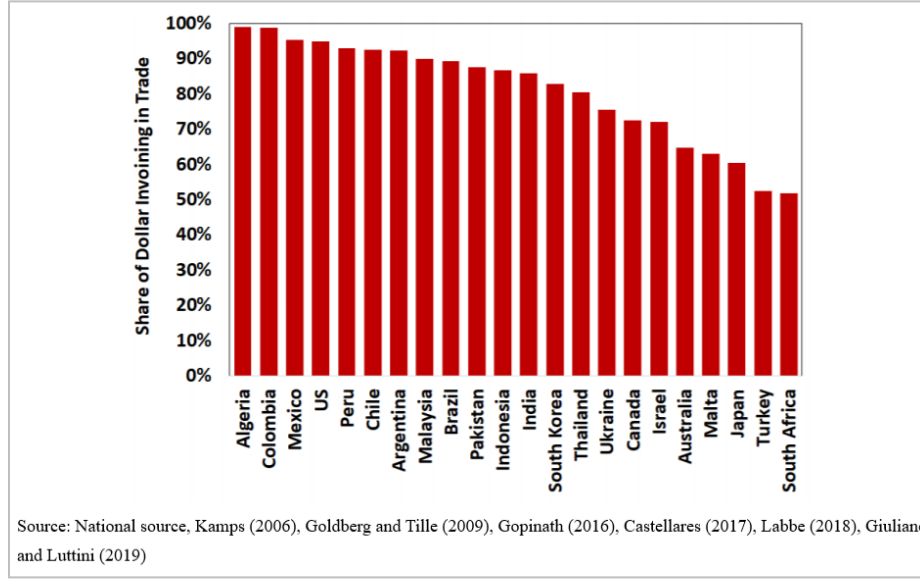
Figure 6– Dollar and EMs' economies business cycles

Source: National source and FRED (2019)
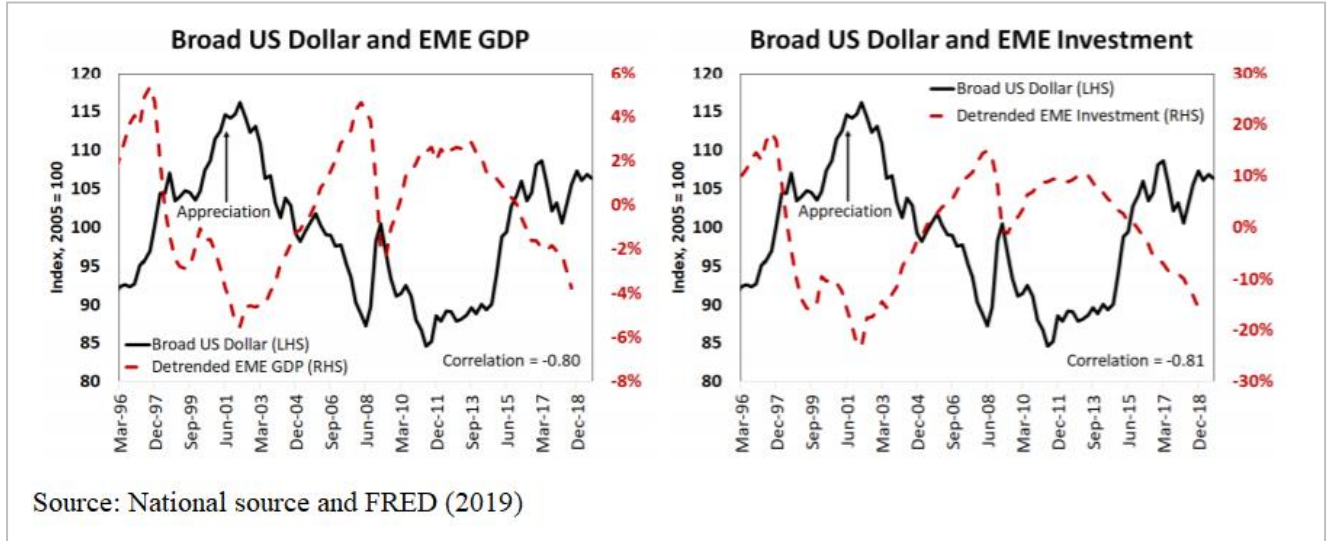
This relationship was the subject of a study conducted by Samer Shousha (2019), whose analysis was based on the use of a structural empirical model to quantitatively assess the effects of the movements of the dollar on the fluctuations of EMs' economic cycles. The model takes the form of a 1st order panel VAR thus set:

$$Ay_{i,t} = \eta_i + \sum_{k=1}^{p} B_k y_{i,t-k} + \epsilon_{i,t}$$

Where η_i is a country fixed effect, i denotes countries, t denotes period and

$$y_{i,t} = [yf_{i,t}, yh_{i,t}]$$

$$yf_{i,t} = [gdp_t^{US}, r_t^{US}, vix_t, reer_t^{US}], \quad yh_{i,t} = [gdp_{i,t}, inv_{i,t}, exp_{i,t}, imp_{i,t}, crt_{i,t}, r_{i,t}, reer_{i,t}]$$

where gdp_t^{US} denotes the U.S. GDP, r_t^{US} denotes the U.S. 2-year real interest rate, vix_t denotes the index of the implied volatility in S&P500 stock index option prices from the Chicago Board Options Exchange (CBOE), $reer_t^{US}$ denotes the broad trade-weighted U.S. real exchange rate, $gdp_{i,t}$ denotes real gross domestic product, $inv_{i,t}$ denotes real gross fixed capital formation, $exp_{i,t}$ denotes real exports $imp_{i,t}$ denotes real imports, $crt_{i,t}$ denotes real credit volume over the non-financial private sector, $r_{i,t}$ defines the country-specific interest rate and $reer_{i,t}$ defines the real exchange rate.

The model was estimated on a sample of 13 emerging markets (Argentina, Brazil, Chile, Colombia, Indonesia, Korea, Malaysia, Mexico, Peru, Philippines, South Africa, Thailand and Turkey), using quarterly data from 1996 to 2018. With a positive shock generating a 10% appreciation of the dollar value, the impulse response functions showed as implications a contraction in GDP, in investment and real credit, as well as an increase in sovereign risk in the countries under analysis. By breaking down the variance of forecasting errors, this study was also able to numerically define the contribution of each shock, showing that fluctuations in the dollar are responsible for about 21% of GDP and investment movements in developing markets and about 29% of credit fluctuations.

We will continue our analysis with this latest aspect. The credit channel operates both through supply and demand in the global dollar market. Potential episodes of appreciation of the US currency are generally associated with the delevereging of global banks and a tightening of financial conditions.

On the demand side, borrowers significantly indebted in US dollars suffer a deterioration in their balance sheets as well as a decrease in their propensity to consume and invest. On the other hand, from the supply side, banks in industrialized countries involved in cross-border bank lending flows to local EM banks suffer from the depreciation of the local currency, as it increases the actual credit risk due to currency mismatches. Theoretically, these contractions should be more severe the higher the exposure of liabilities to the dollar, i.e. the higher the share of foreign currency debt in the total of the lending country. It is precisely the latter aspect that has most influenced the development of the trilemma in the new markets, preventing countries from being able to adopt configurations that include the adoption of floating exchange rate regimes.

4.3 Origins of EMs' crisis

Capital flows to emerging countries and transition economies have exploded since early 1970, reaching a net value of $228 billion in 1995[3]. The magnitude and volatility of these flows have both generated opportunities opening the doors of overseas markets to the primary financial market and complications in many ways. These flows consist basically of foreign direct investment (FDI), commercial lending, portfolio equity and debt flows.

In addition to the potential capacity to generate growth in beneficiary countries from flow types such as FDI, regardless of the results demonstrated above, the significant use of debt instruments generated by the new international credit lines is the topic we will explore in more detail (*Figure 7*). This new approach to financing has clearly generated imbalances in the financial situation of the beneficiary countries. The exposure of their balance sheets to foreign currency debt was now subject to fluctuations in the financial markets in terms of interest rates and the value of the US dollar as the most popular and traded currency.

Figure 7 – Total external debt in developing countries 1985-2002 in US$

Notes: HPC = Heavily Indebted Poor Countries (HIPC); LAC = Latin America & Caribbean countries; LMY = Low & middle income countries; LIC = Low income countries; and LMC = Lower middle income countries. Source: World Bank (2004).

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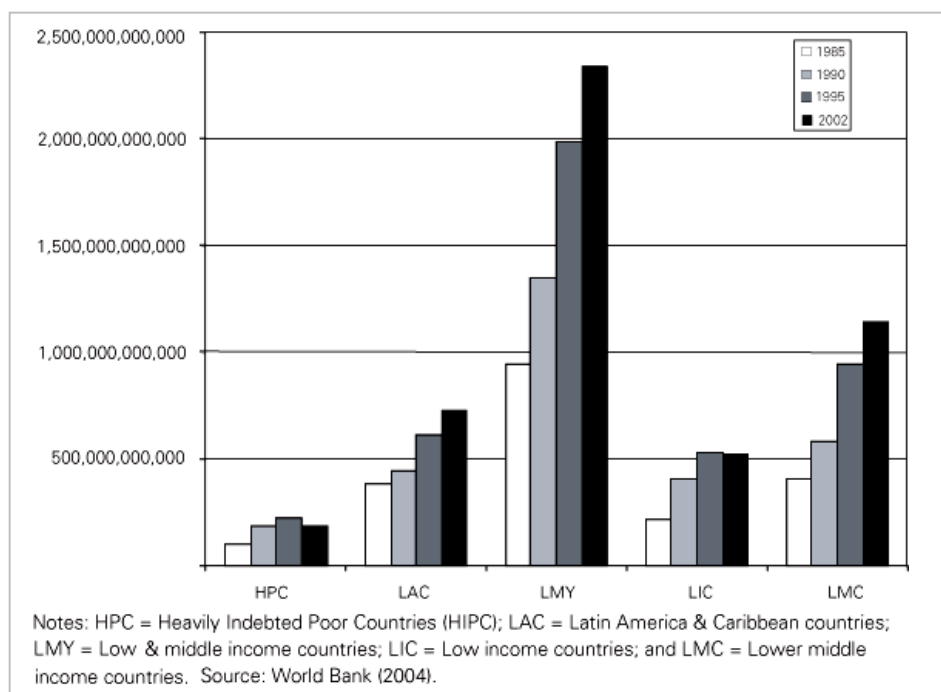
[3] Source: Patterns of Capital Flows to Emerging Markets, Zhaohui Chen and Mohsin Khan (1997)

In this regard, the "decade of lost growth" between 80s and 90s with reference to the debt crisis of emerging countries sees, as an emblematic example of this dependence on currency trends, the effects generated by the rapid but counterproductive disinflation implemented by the then President of the FED Paul Volcker, who implemented a restrictive monetary policy (called Volcker shock) raising the interest rate in order to intervene on the very high inflation that had been moving for years at a rate of 10% per year, but generating strong impacts in the exchange rate market. For this reason, it is of fundamental importance to underline that although floating exchange rate regimes were spreading more and more, emerging markets tried in vain to maintain a "certain" stability of the latter through anchored or fixed exchange rate regimes (such as the currency board in Argentina), precisely because of the potential consequences deriving from appreciation/depreciation of borrowed currencies that could have devastating impacts on the amount of the foreign debt held. This model reflected the inability of developing markets to borrow in their national currencies, as explained by the "original sin" hypothesis implemented by Eichengreen, Hausmann & Panizza in their 2003 study.

Their study defines the following parameters as determinants of "original sin:

- level of development
- monetary credibility
- level of debt burden
- exchange rate regime
- slope of yield curve
- size of investors' base

Of these, the greatest focus was placed on the second and fourth factors. Monetary credibility is generally demonstrated by inflation. Specifically, the ratio of domestic debt to total public debt is higher in countries with lower and less volatile inflation, which makes inflation likely to make public debt riskier. From a more international point of view, on the other hand, their studies show that if the fiscal and monetary authorities are prone to inflation, foreign investors will only lend in foreign currency, which will be protected against the risk of inflation and short-term maturities so that interest rates can be more easily adapted to any kind of inflation acceleration. The second factor on which they focused most attention was the exchange rate regime. As indicated by Hausmann and Panizza, in countries with a fixed regime there was great volatility in their domestic interest rate, while in floating regimes there was greater exchange rate volatility. These two aspects generated differences in the structure of the loans, showing that the adoption of the fixed exchange rate regime is the main reason for the dollarization of liabilities.

In this respect, the economic literature of Hausmann and Panizza (2005) contains several indications on the calculation of "original sin". Generally, these measures are mathematically defined as one minus the fraction of the securities denominated in own currency in relation to the relevant total. The measure of original sin can range between 0 and 1 and the higher this measure is, the more the country of reference will be subject to this problem. Therefore, clearly, a country that issues all its securities in foreign currency should coincide with a value of one. At the same time, a country that issues all its securities in its own currency should coincide with a measure of original sin equal to zero.

OSIN1

OSIN1 was the first formulation designed for the calculation of original sin and takes into account the ratio between the stock of international securities issued by a country in its own currency and the total stock of international securities issued by the country.

The index is presented as follows:

$$OSIN_i = 1 - \frac{Securities\ issued\ by\ coutry\ i\ in\ currency\ "i"}{Securities\ issued\ by\ country\ "i"}$$

However, there are two flaws in this index. The first one is that only securities are taken into account in the calculation, but not other types of debt. Secondly, this calculation ignores the effect of other financial instruments (such as derivatives) that were widely used to hedge exchange rate risk.

OSIN2

As a result of the problems mentioned above, a new version of the index has been produced. *OSIN2* consists of two intermediate measures: *INDEXA* and *OSIN3*. The problems of the previous version are now overcome as, unlike *OSIN1*, *INDEXA* accounts for bank loans in addition to bond debt while *OSIN3* accounts for financial instruments used to hedge the exchange rate. Below is the formulation and sub-formulations of the index in question:

$$OSIN2_i = max(INDEXA_i\ ;\ OSIN3_i)$$

where

$$INDEXA_i = \frac{Securities + loans\ issued\ by\ country\ \mathrm{i}\ in\ major\ currencies}{Securities + loans\ issued\ by\ country\ "i"}$$

$$OSIN3_{i\ =}\ max(\mathrm{INDEXB_i}\ ;\ 0)$$

where

$$INDEXB_i = 1 - \frac{Securities\ in\ currency\ \mathrm{i}\ (regardless\ of\ the\ nationality\ of\ the\ issuer)}{Securities\ issued\ by\ country\ "i"}$$

Taking the decade of the 1990s as the time horizon for data collection, the study of original sin suggests that the United States, United Kingdom, Japan, Switzerland and Europe (as financial centers) have been more successful in issuing securities in their national currencies than developing countries.

Tab 1: Measures of original sin by country grouping (simple average)

	OSIN1	OSIN1	OSIN2	OSIN2	OSIN3	OSIN3
Group	**1993-98**	**1999-2001**	**1993-98**	**1999-2001**	**1993-98**	**1999-2001**
Financial centers	0.58	0.53	0.34	0.37	0.07	0.08
Euroland	0.86	0.53	0.55	0.72	0.53	0.09
Other developed	0.90	0.94	0.80	0.82	0.78	0.72
Offshore	0.98	0.97	0.95	0.98	0.96	0.87
Developing	1.00	0.99	0.98	0.98	0.96	0.93
Latin American and Caribbean	1.00	1.00	1.00	1.00	0.98	1.00
Middle East and Africa	1.00	0.99	0.97	0.99	0.95	0.90
Asia Pacific	1.00	0.99	0.95	0.99	0.99	0.94
Eastern Europe	0.99	1.00	0.97	0.98	0.91	0.84

Source: Eichengreen, Hausmann, and Panizza (2002)

The capital flows that we have taken into account so far have actually generated far more important implications. Over time, an increasing proportion of countries with an "original sin" index equal to or close to one (*Tab 1*) have been exposed to deep financial crises, induced by multiple "sudden stops[4]" of such flows and the flight of "hot money[5]".

The stops of flows during the 80s and 90s, generally attributed to weak macroeconomic fundamentals, had both financial and real effects. The financial effects were the first to appear through the depreciation of the exchange rate, the decrease in international reserves and the reduction in asset prices, which combined slowed GDP and investment growth by an average of 4% on an annual basis. Of all the effects mentioned, the drainage of international reserves is the one that needs to be analyzed in greater detail.

Foreign exchange reserves are deposits of foreign currency controlled and managed by central banks and competent authorities and are mainly used as a means of defending domestic currency and for debt payment. Also called "reserve assets" in the balance of payments, they are capital assets and typically consist of foreign currency, foreign bank deposits, foreign treasury bills and short and long-term foreign government bonds. One of their crucial aspects is the influence that the monetary policy of the reference country has on their composition.

Central banks can intervene in the foreign exchange market through the management of foreign exchange assets and reserves to curb violent fluctuations in the value of the currency and speculative attacks. In fact, reserves can be interpreted as an element capable of absorbing the violence of shocks that could negatively affect a given currency. Several are the economic authorities at global level that decide to keep high the level of foreign currency reserves in order to devalue their own currency, a phenomenon also described as exchange rate manipulation, since it is the institutions, and not the market, that artificially modify the relations among the different currencies.

This type of intervention is defined "non-sterilized" since it is a policy that brings variations to the monetary base through the purchase or sale of foreign currencies or bonds with respect to one's own currency. For example, suppose that a central bank wants to stimulate the economic growth. It will tend

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[4] A sudden stop in capital flows is defined as a sudden slowdown in private capital inflows into emerging market economies, and a corresponding sharp reversal from large current account deficits into smaller deficits or small surpluses.

[5] Hot money is the flow of funds (or capital) from one country to another in order to earn a short-term profit on interest rate differences and/or anticipated exchange rate shifts. These speculative capital flows are called "hot money" because they can move very quickly in and out of markets, potentially leading to market instability.

to adopt expansive monetary policies that expand its balance sheet and result in a decrease in the value of the currency it issues, so that exports get cheaper.

Among the options available, the central bank may decide to purchase, for example, bonds denominated in foreign currency that it holds in the form of reserves. The bonds will be purchased in exchange for an extra supply of liquidity, which will be placed on the market. When the supply of domestic currency is increased against a fixed demand, the value of the currency itself will fall and at the same time the purchase of foreign currency (to buy bonds denominated in foreign currency) will increase its value. The result is that the exchange rate, i.e. the relationship between these two currencies, will depreciate but in a controlled manner.

As long as financial integration with industrialized countries ensures substantial cross-border inflows, the ability to meet their foreign currency obligations will not be particularly affected as part of these flows will be converted into reserves in order to pay the external debt.

However, emerging markets have underestimated the potential risks arising from such a strong relationship with foreign flows. In fact, the occurrence of "sudden stops" has undermined their ability to meet their commitments, triggering severe limitations on macroeconomic objectives that they can pursue. (*Figure 8*).

Figure 8 – EMs' crisis in function of net private capital flows trends
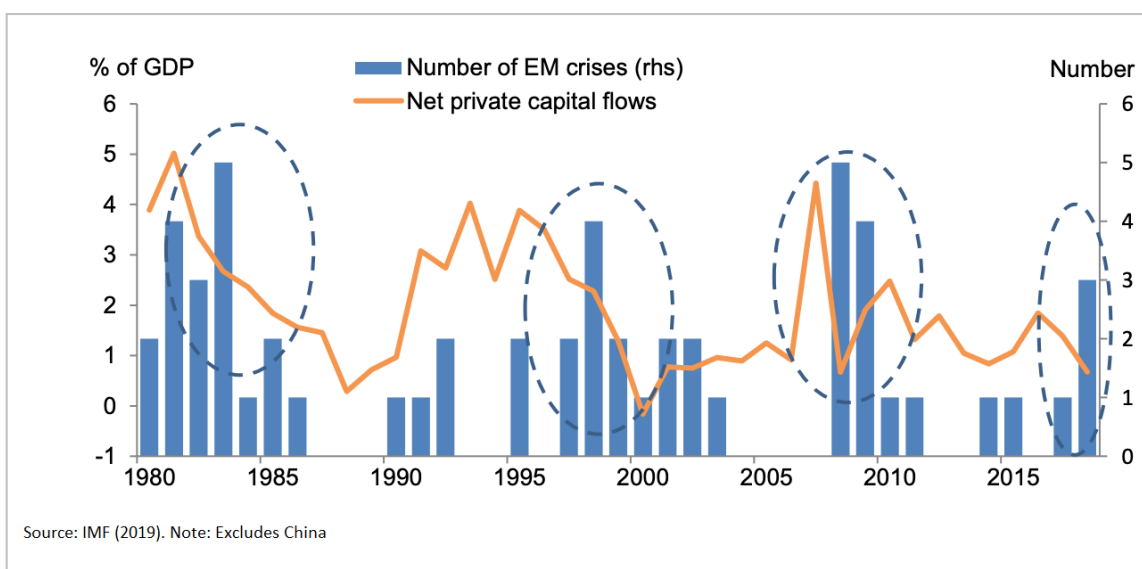
Sudden arrests are most often triggered by external factors. Capital flows suddenly stop when foreign funding available to borrower countries dries up unexpectedly and without warning, and the resulting effects vary according to the economic conditions of the affected countries, making them more or less vulnerable than others. In the case of emerging countries, there has been a generalized withdrawal, particularly of investors in short-term debt instruments.

One of the various reasons for this was a poor structure of the global financial architecture. Having an international lender of last resort that resembled the ECB in providing liquidity to the Eurozone countries or the FED in promoting the financial stability of the United States would certainly have been helpful. Such a role could have been played by the International Monetary Fund, but this would have required large-scale rescue operations and a significant variety of funding instruments to achieve acceptable results and consequently entailed significant funding and intermediation costs given the large number of countries involved.

Another strand of literature has analyzed global risk through changes in economic uncertainty as a determinant factor of sudden stops. Djigbenou and Sosa (2014) showed how foreign and local investors can react differently to internal and external shocks, generating asymmetric responses of gross capital flows. Similarly, Calderòn and Kubota (2012) showed how foreign investors are more likely to withdraw or stop financing countries with poor financial performance or slow domestic growth. Along with these reasons, credit should also be given to potential changes in credit risk aversion towards countries that are predominantly indebted in foreign currency, whose financial position was not entirely dependent on their actions.

However, the abrupt disruptions in cross-border flows exposed the affected emerging countries to potential currency crises as, once one of the main channels for creating savings was interrupted, doubts about the ability to have sufficient foreign exchange reserves to pay the debt were increasing considerably. Given the context, the possibility to manipulate their reserves in order to defend themselves against possible speculative attacks and the risk of default would have been a solution to the problem created.

However, intervening on the exchange rate by depreciating it as explained above would have made the external debt more expensive and therefore more difficult to repay, overexposing EMs' balances. The excess of domestic debt over the amount of reserves with which it should have been paid has so often led to the fiscal dominance of the countries in question, reducing the scope of their monetary policy. The

main consequence of this operational deadlock implied as only solution to fall back on existing foreign exchange reserves in order to meet external obligations and to delay exchange rate intervention as much as possible.

The financial collapse occurred when the balance of payments crisis, due to the drying up of foreign exchange reserves, inevitably pushed countries to let their currency fluctuate, as in the case of the peso in Mexico and the baht in Thailand, suffering an uncontrolled fall in the value of their currency as a result of the delay (*Figure 9-10*)
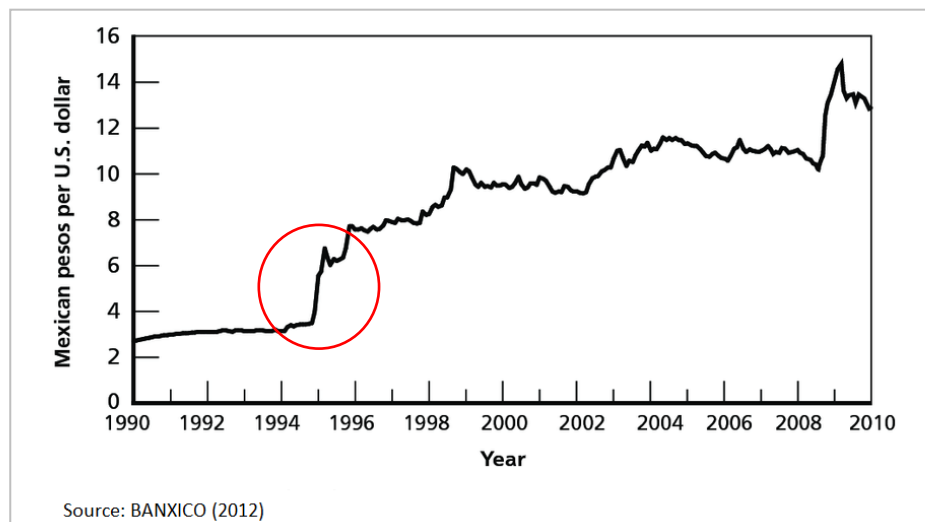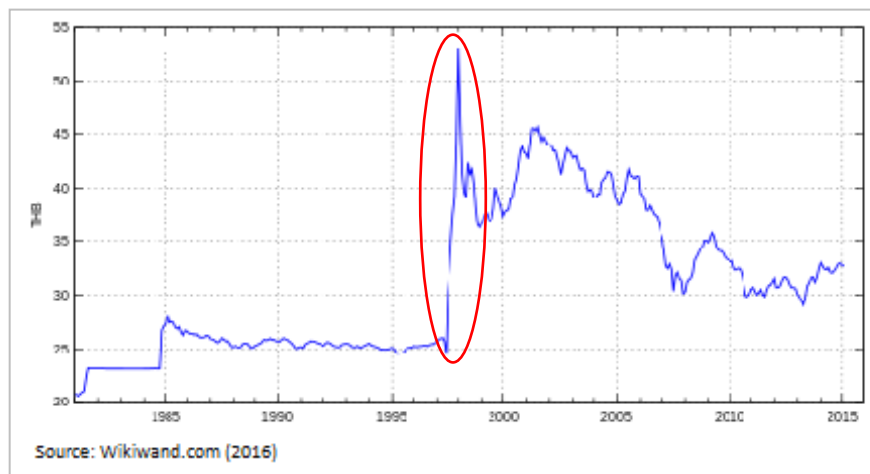
Figure 9 –USD/MXN exchange rate 1990-2010

Source: BANXICO (2012)

Figure 10 – USD/THB exchange rate 1985-2015

Source: Wikiwand.com (2016)

This cascade effects best reflect the concept behind the Mundell-Fleming Trilemma. The attempt to pursue all the proposed objectives in a polarized manner is in fact unfeasible unless controlled intermediate regimes or risk hedging instruments are adopted. Therefore, having a fixed exchange rate regime to avoid fluctuations in the value of debt and, at the same time, embracing the integration of financial markets with industrialized countries meant giving up own monetary independence, and vice versa. This is because there is no condition to operate in perfect capital markets, something we have witnessed happen with the boom and boost cycles' alterations.

In the next chapter, the focus of the document will shift to a detailed analysis of the various crises in transition economies, their reactions and the instruments used to defend their economies.

5. Crisis, solutions and considerations about EMs' behaviors and approaches

5.1 Fixed vs Floating exchange rate

The hard times of crisis that we have presented and through which many countries have passed, are the main reason to justify the great resilience that emerging markets have developed since the beginning of the millennium and that still distinguish them today. The growing budgetary exposure triggered by financial integration has contributed in a fundamental way to the importance that "financial stability" now assumes for every state.

The problem on the choice of the best exchange rate regime to adopt is far from recent, in fact it is after the collapse of the BW system that generates so much interest and his study becomes popular. This "dichotomy between regimes" has been the subject of studies since the 1950s with Friedman (1953) or Atish, Gulde, Ostry and Wolf (1997) or Devereux and Engel (1998), whose studies put under the magnifying glass the advantages and disadvantages of both approaches. More generally, they share the conclusion that the fixed exchange rate regime implies very low levels of inflation and monetary growth, while the flexible exchange rate is more attributable to production and employment volatility.

More specifically, however, Bergsten F., Davanne O. and Jacquet P. (1999) state that exchange rate stability in emerging countries can be regarded as an "international public good" since it facilitates the recycling of savings by the rich and the ageing of the population in developed countries towards capital-seeking developing economies.

Differently, Mundell has analyzed the characteristics of capital mobility with the exchange rate regime adopted, concluding that when a country adopts greater liberalization of capital, such as that which has taken place since the 1970s, the best combination with it would be to adopt a fixed exchange rate regime to avoid the effects of exchange rate fluctuations on the balance of payments. It was the attempt to avoid excessive price volatility and to attract foreign capital that drove many emerging markets to anchor their currencies, formally or otherwise, to the dollar or a basket of foreign currencies. This policy, at least theoretically, would have been due to economic growth for some time, but the fixed exchange rate is only sustainable if the inflation of the country in which the nominal peg (PEG) converges to that of the country to which it is still pegged. As you can imagine, such a scenario is very far from what actually happened, which fully justifies the problems of managing and adjusting the exchange rate that we presented at the end of the previous chapter.

In disagreement with this view, there is another study by Obstfeld, Ostry and Qureshi (2017) on the

predisposition of certain regimes to deal with financial crises. Through the analysis of a sample of 40 emerging markets they came to the conclusion that fixed exchange rate regimes are more likely to experience financial vulnerabilities, as well as faster growth in domestic credit and bank leverage. Moreover, their study also attributes to exchange rate stability a more amplified transmission of global financial shocks, the reasons for which seem to lie in the reduced autonomy of monetary policy, as experienced in the 1990s, and in the increased sensitivity of capital flows to changes in global conditions.

Frenkel, Schmukler and Servèn (2004) also took a different view, arguing that it would be perfect to adopt a floating exchange rate regime in the event of a lack of capital mobility, since their study seems to offer a certain degree of temporary monetary independence.

Instead, a study conducted by Ripoll (2004) differs, which, rather than defining which of the two regimes is better, presents several factors (i.e. degree of financial openness, capital mobility of the economy in question, level of inflation, internal and external bottlenecks, degree of flexibility of monetary and price/wage authority) that should be considered by each country before adopting any regime so as to include a subjective variable in the choice.

By virtue of such a vast and diverse literature, it is clear that there is in fact no optimal change to adopt and that this will vary according to the specific characteristics of a country. Therefore, although the exchange rate has certainly affected crises overseas, it is more reliable and truthful to consider the regime adopted as one of the causes of these crises and not as the main reason. Let me now turn to an overview of the periods of difficulty experienced in emerging markets and their characteristics

5.2 Similarities and differences among financial crises

At the end of the previous chapter we confirmed in a practical way the value of the constraints of the trilemma applied to emerging markets through the chain processes that occurred, announcing how such contexts would have generated many problems for the countries involved. Given the number of situations of financial stress, my study will focus on the analysis of the similarities and differences between them. After the first speculative attack on the Thai baht in July 1997, both currencies and asset prices across Asia have plummeted due to capital flight from Eastern markets once preferred by investors. This crisis, as well as the Latin American debt crisis of the 1980s and the Mexican crisis of 1994 had very negative consequences not only on their economies but also on other developing countries considered in a similar position. As for the similarities, the months leading up to each of the crises showed an increase in foreign

capital inflows. In this respect, *Figure 11* breaks down the capital flows considered in *Figure 10* and valid for all EM in those countries whose crises were most significant.

Figure 11 – Surges and composition of private capital flows before crises
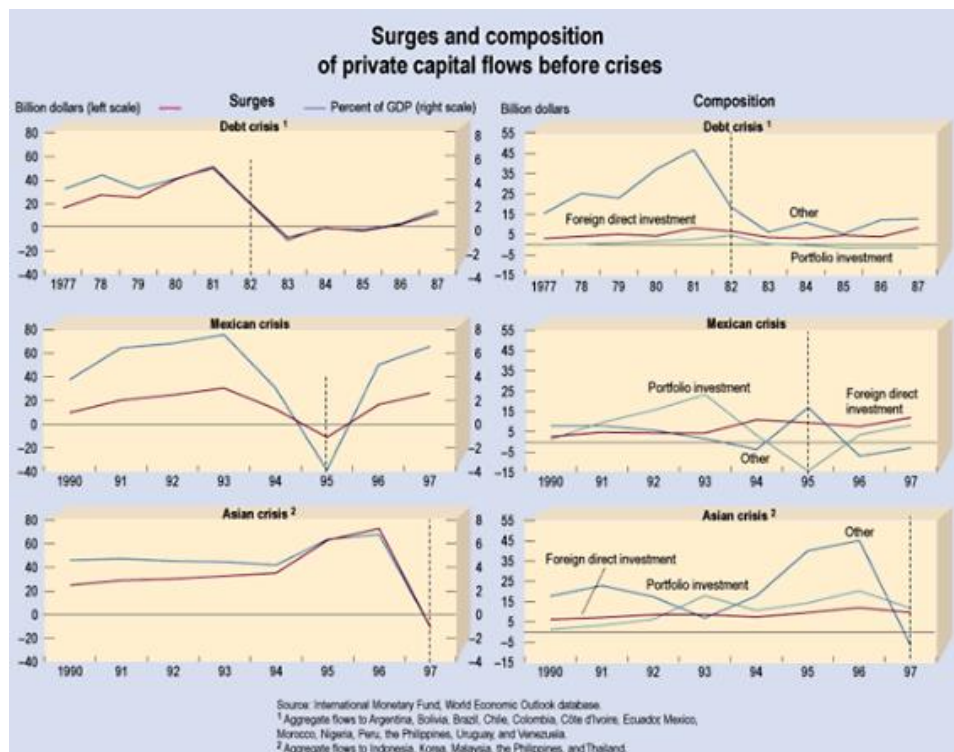
Between the first oil crisis in 1973 and the start of the debt crises in 1982, net private capital flows to developing markets amounted to about 1% of their GDP, reaching USD 165 billion. The resulting high levels of debt accumulated in those years, which then compromised their economies, are the result of their ability to borrow at very low and in some cases negative international interest rates, borrowed purely in dollars and priced at LIBOR spreads.

Although the foreign debt was only to some extent covered by their respective reserves in US dollars, the scarcity of hedging financial instruments in the market left borrowers at the mercy of exchange rate fluctuations. Marked by the periods of turbulence in the early 1980s, emerging countries only regained access to international financial markets in the early 1990s and only after joining the Brady Plan on foreign debt restructuring. The idea behind this plan was to issue bonds enabling commercial banks to exchange their claims on developing countries into negotiable instruments, allowing them to write off

non-performing debts from their balance sheets and replace them with a bond issued by the same creditor.

Since banks would exchange a non-performing loan for a performing bond, the responsibility of the debtor government becomes the payment of the bond, rather than the bank loan, thus reducing the risk of concentration for these banks. Despite the attempt at debt restructuring and the explosion of derivative products in the 1990s, currency exposures and unhedged interest rates also played a crucial role in the Latin American and Asian crisis. In fact, both some governments and private entities strongly increased their exchange rate exposures just before the respective crises. An example of this was the Mexican government, which in the months leading up to the 1994 crisis went from issuing debt securities denominated in pesos, called "CETES[6]", to issuing short-term debt securities indexed to the US dollar, called "Tesobonos[7]"

On the same wavelength, currency exposure has also played a decisive role in the Asian market. Domestic interest rates in countries with a fixed or pegged exchange rate, such as Thailand, have recorded higher percentage values than those guaranteed by foreign interest rates (600-700 basis points of difference between US interest rates and interest rates on bath loans), prompting many companies to finance their businesses through the issue of securities and borrowings in foreign currency. Although, as described above, the derivatives markets were booming, Latin American and Asian borrowers deliberately neglected the possibility of hedging even large currency exposures with suitable instruments, both because the derivatives market was not adequately structured given the immature times and because the purchase of offshore products would have increased the cost of borrowing abroad.

 Another common feature of the crises under review was the weakness of financial systems and regulatory regimes, as both the controlled financial systems of the 1970s and the liberalized financial systems of the 1990s had serious structural weaknesses.

During the 1970s, many emerging markets maintained tight links with external financial operations, managed and directed the allocation of credit from domestic institutions and had ceilings on both loan interest rates and deposits. However, due to the control exercised over banking/financial operations, there was little scope for diversification and a large proportion of portfolios were experiencing an increasing

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[6] The Mexican Federal Treasury Certificates, known by their acronym CETES, which stands for Certificados de la Tesoreria de la Federación, are investment instruments offered by the Federal Government through the Ministry of Finance and Public Credit (Spanish: Secretaría de Hacienda y Crédito Público) and the Bank of Mexico (Spanish: Banco de México, Mexico's central bank).
[7] Short-term peso-denominated treasury bills with a guaranteed repayment denominated in U.S. dollars issued by Mexico's Treasury

number of non-performing loans. The same banking/financial controls also had a significant impact on the prudential supervisory systems of the countries concerned, whose imprudence in accumulating savings and the resulting currency collapse led to the deterioration of portfolios.

At the same level, all crises have taken investors by surprise. Despite the considerable issue of "foreign debt", Mexico's decision to let the peso fluctuate was unexpected, since the debt restructuring and interest rate stability processes implemented after the crisis of the 1980s were conveying more optimism to the market. Equally, investors were taken by surprise by the scale and intensity of the Asian crisis, since they were reassured in part by the strong growth prospects that the expansive trend in share prices suggested, in part by the cautious fiscal policies they were adopting and in part by the security that the credit institutions, although undercapitalized, had regarding potential state interventions in the event of their insolvency.

Moreover, to ensure an even more confident climate, between 1995 and 1997, loan and bond yield spreads declined for most Asian economies, no sovereign credit ratings were downgraded and spreads for euro bonds in Indonesia, Malaysia, the Philippines and Thailand fluctuated in particularly narrow ranges. This situation continued until the depth of the Korean situation became known, where cross-border capital flows reached 9% of GDP, triggering a wave of speculative attacks on the Hong Kong dollar.

Another similarity between crises has been the extension of their spill-over effects to similar or related countries. "Contagion" is the term used to indicate the tendency of financial upheavals to move rapidly across borders. However, although contagion is a common element in crises, there are and have been several channels that have facilitated the spread of economic problems. Considering the devaluation of the Thai baht, commercial channels have provided a natural channel for financial contagion. The fall of the baht in 1997 made Thai exports cheaper for foreign buyers, implying a reduction in foreign demand from other Asian countries such as Indonesia. The natural consequence of this was an increase in its current account deficit, which was supposed to cover more foreign borrowing, but by virtue of the sudden stops introduced earlier forced it to turn to foreign exchange reserves leaving less US dollars to defend its rupee.

This process has made Indonesia, as well as other Asian countries similar to it, more vulnerable in the eyes of investors who have launched speculative attacks about the possible devaluation of the local currencies of the countries affected. The trade channel has, however, also had an effect on imports. The

devaluation of the bath has also automatically increased the cost of imports, which have reduced the amount from countries such as Laos and similar countries, increasing their current account deficits and putting pressure on their currencies as well.

On the same level, another channel of propagation of the contagion was the "bandwagon effect". Based on models of self-realization of expectations, this effect explains the seemingly irrational behavior observed in South American currency crises, justifying the trend that saw liquid foreign investors as less willing to lend to Latin American markets after a currency crash.

In support of this thesis, following the depreciation of the Mexican peso, the still solid foreign banks have become reluctant to lend to countries like Argentina. Investors have treated the Mexican crisis as new information about countries that seemed to have similar fundamentals to Mexico, lowering their expectations about the possibility of repayment of Argentina's foreign debt. This case also reflects the ability of information asymmetries in economic markets to influence the behavior of entire continents. The results have led to a, albeit brief, serious financial crisis in other similar countries to Argentina such as Brazil and Chile.

The "contagion" issue is also a watershed between the similarities and differences of the emerging market crises under our analysis. Commercial and financial channels, bandwagon effects and financial volatility have been valid for both the Latin and Asian economic crises, but the effects of the former have been milder than those of the latter. The ties between Mexico and the United States and the commitment of the Clinton government have made America a sort of lender of last resort for the South American countries, reducing liquidity problems and concern about debt repayments through the rapid containment of Mexican bond spreads with those of other Latin bonds.

On the contrary, despite the IMF's efforts, Asia has not been able to benefit from the same guarantee lines. A justification for this difference was attributed to the ratio of domestic credit to GDP which was lower in South America (*Figure 12*) (20% of GDP in Argentina, 40% in Mexico and 50% in Brazil) than in Asia (100% of GDP in Malaysia, Singapore and Thailand, 60% in Korea) at the time of the respective crises, so that Latin America had more room to raise interest rates without generating a large amount of defaults.

Figure 12 – Net Domestic credit to private sector
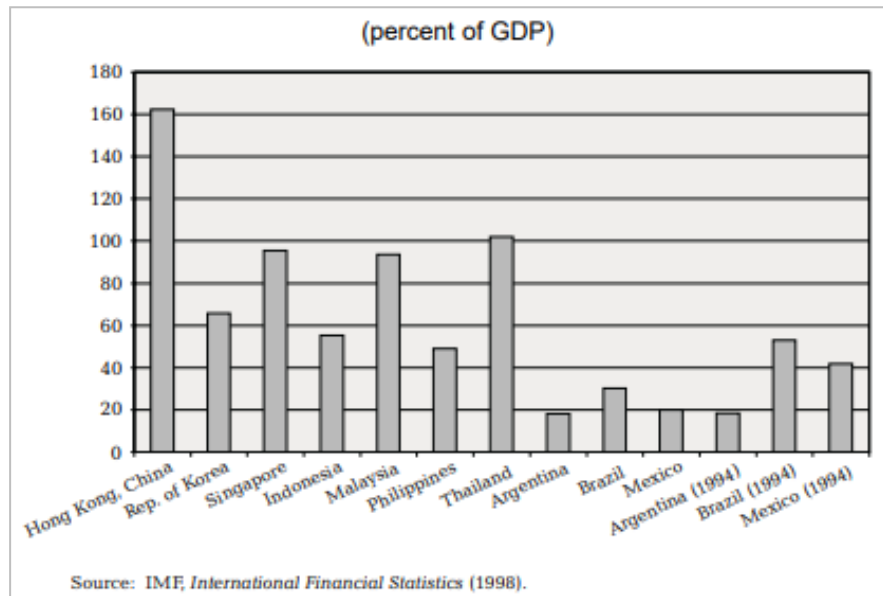
(percent of GDP)

Source: IMF, *International Financial Statistics* (1998).

The global economic context in which the crises developed was also different. In the months leading up to the Latin debt crisis of the 1980s, the industrialized countries were increasingly on the brink of recession. In fact, GDP growth slowed down significantly, from an average rate of 4% in 1978 to about 1% three years later, resulting in a slowdown in world trade as well. In reaction to these dynamics, emerging countries that were not oil exporters also experienced a slowdown in growth and exports, as well as a deterioration in terms of terms of trade.

At the same time, however, their debt service payments rose sharply when developed countries were forced to raise interest rates in the late 1970s in an attempt to control inflationary pressures. Quite the opposite environment was the world economy in the 1990s, which was much more favorable to overseas economies and a time when world trade grew by more than 6% per annum and both inflation and nominal interest rates in mature markets fluctuated at very low levels. As asset yields in more developed markets declined, emerging markets became more attractive to foreign investors and risk premiums also declined due to the development of greater investor risk tolerance.

The last difference between the crises to be mentioned is the effect generated on their development strategies. On the eve of the crisis of the 1980s, many countries were implementing import-substitution strategies supported by high custom duties, supporting this strategy with policies that set low interest rate caps on bank deposits and loans, directing them towards priority sectors. At that time capital controls

were still in place and external borrowing was mainly required by the public sector to finance budget deficits. This approach discouraged exports both directly, with taxes and credit availability limits, and indirectly, to the extent that exporters had to use expensive domestically produced goods. These practices have provided wide evidence of the shortcomings of the closed economy and import substitution model, which has acted as a stimulus to move towards greater freedom of commercial and financial transactions, fiscal conservatism, structural reforms and a wider role for the private sector. In contrast, neither the Mexican nor the Asian crisis produced a comparable change of strategy in the following decade. In fact, after the crisis in Mexico, many South American countries strengthened their willingness to maintain an economy that was as open as possible, an approach that guaranteed them re-access to the global financial market in less than a year. On the Asian side, however, the crisis has led to a re-evaluation of economic development models, marking the need for a more resilient, transparent and well-regulated financial system as a prerequisite for full liberalization of the capital account. This has shown how emerging countries are leaving aside better institutions to protect the most fragile segments of societies in order to create a lasting consensus for global integration.

5.3 International reserves, Swap lines and Macroprudential policies as response

The resilience to which we have referred is in line with the defense responses that emerging states have adopted in order to rebalance the instabilities of their economies, by virtue of what they have suffered, and the mistakes made in the tough times. In this respect, in order to preserve and control their welfare to the best of their ability, many emerging markets have decided to adopt and use preventive measures and instruments such as the precautionary accumulation of reserves, swap lines with industrialized countries and macroprudential policies. While the former is a natural consequence of what happened in the 1990s with the drainage of reserves, the latter two instruments found their development following the 2008 global financial crisis. In this section we will examine these two approaches in detail to better understand their reasons and internal dynamics.

5.3.1 Building up IR

As from 1999, global foreign exchange reserves were 3.5 times higher than at the end of 1960 and about 50% higher than in 1990, reflecting about 6% of world GDP at the end of the 20th century. If we analyze this in detail, almost all the increase in reserves has been recorded in developing countries, in fact the

growth of international reserves belonging to emerging countries is impressive when compared with the trend in industrialized countries (*Figure 13*), recording an increasingly growing trend for developing countries in contrast to a much more stable trend for industrialized ones. Much of this accumulation, mostly in dollars, was recorded in Asian markets following the respective crisis of '97.

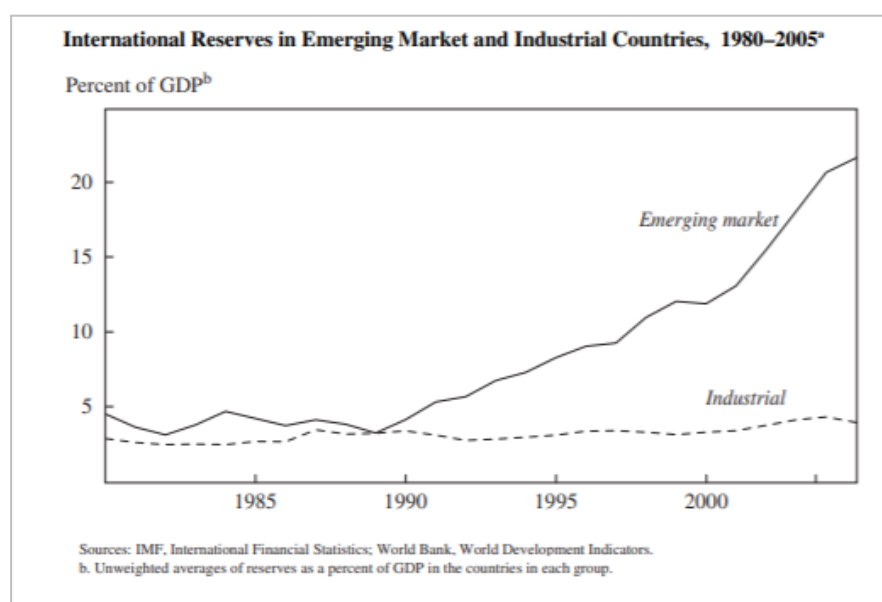*Figure 13 – International reserves trend comparison between EMs and Industrialized countries*

Table 2 and *Figure 14* provide important information on the build-up of foreign exchange reserves in emerging countries and their weight on the balance sheets of the relevant countries. The first row of the table shows the cumulative net inflow of capital as a percentage of the increase in reserves in the period 2000-2005, which reflects a particularly marked increase in reserves compared to the past, showing that about 40% of the increase in reserves was financed on average by capital inflows. Specifically, it shows that Asia focused more on net exports to accumulated reserves than on average, while Latin America recorded current account deficits which, due to a smaller increase in reserves than Asia, was financed by a higher percentage of capital inflows. A broader way of looking at reserves is in the context of the external balance sheet of the countries under review. Indeed, two lower boxes show the composition of assets and liabilities that have been traded in the financial accounts of developing markets over the period under review. More than 60% of the accumulation of foreign assets is made up of reserves but, on the other hand, foreign direct investment (FDI) reflected almost 70% of the new liabilities accumulated by
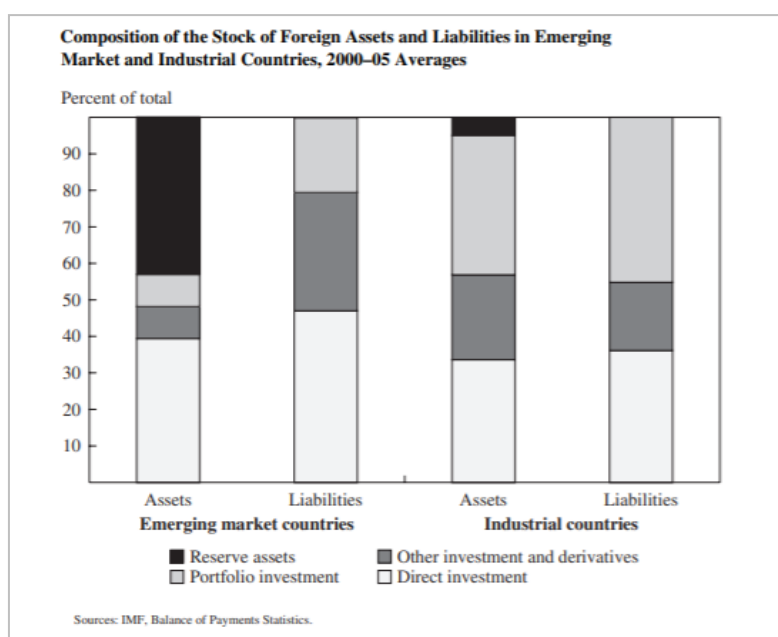
these countries. *Figure 14* compares the external BS of developing and developed countries. The data shows that the share of reserves in gross foreign assets is more than eight times higher in emerging markets than in industrialized ones, while the share of FDI in their liabilities is almost twice as high.

Tab 2 - Reserves accumulation and financial accounts in EMs

Reserves Accumulation and the Financial Account in Emerging Market Countries, 2000–05ᵃ

Percent

Item	All emerging market countries	Asia	Latin America
Net capital inflows as share of change in reserves	40.6	36.6	137.0
Composition of the increase in gross foreign assets			
Direct investment	8.8	5.6	20.9
Portfolio investment	8.7	8.7	13.0
Other investment	22.3	11.7	36.0
Reserve assets	60.2	73.9	30.0
Composition of the increase in gross foreign liabilities			
Direct investment	67.9	63.3	104.0
Portfolio investment	20.9	28.2	6.8
Other investment	11.2	8.5	−10.8

Source: IMF, Balance of Payments Statistics.
a. The data come from the standard presentation of the Balance of Payments Statistics. Net capital inflows are computed as the sum of the financial account over the period 2000–05. Reserve assets include foreign exchange reserves, monetary gold, special drawing rights, and the reserve position in the International Monetary Fund.

Figure 14 – EMs' and ICs' asset and liabilities foreign stock composition

Composition of the Stock of Foreign Assets and Liabilities in Emerging Market and Industrial Countries, 2000–05 Averages

Percent of total

Assets Liabilities | Assets Liabilities
Emerging market countries | **Industrial countries**

■ Reserve assets   ■ Other investment and derivatives
□ Portfolio investment   □ Direct investment

Sources: IMF, Balance of Payments Statistics.

Going beyond the quantitative aspect of the subject and analyzing the origins of the phenomenon of hoarding currency reserves, the literature offers two major opinions on the subject. The first opinion sees as the main reason and driver of the phenomenon a modern incarnation of mercantilism (Dooley, Folkerts-Landau and Garber, 2003), so that this accumulation of reserves is considered as a by-product of the export promotion necessary to create better jobs in order to absorb the abundant labor present in traditional sectors. Although theoretically valid, this interpretation remains questionable. Indeed, the history of Korea and Japan suggests the near absence of accumulation of foreign exchange reserves by two of the largest mercantilist countries in Asia during the rapid growth phase, as does the prevalence of export promotion through preferential financing in targeted sectors.

The Asian market crisis of the late 1990s, where a natural hoarding of reserves by the aforementioned countries reversed the trend, is a different matter. However, this new accumulation of reserves is only partially attributed to mercantilism, as many people claim that the phenomenon of self-insurance also plays a fundamental role in dealing with the growing fragility of the banking system, which is also the other opinion on the matter.

Before moving on to the analysis of the second motivation, it is necessary to specify how the mercantilist hoarding of one country can induce the competitive hoarding of other countries in order to prevent and cancel out any competitive advantage obtained by the first as well as dissipate most of the competitive gains (Aizenman and Lee, 2008), an opinion that is also supported by the analysis of Cheung and Qian (2009) about the interdependence of the demand for foreign exchange reserves between Asian countries.

 As already mentioned, "self-insurance" is regarded as an alternative opinion and more credited for the accumulating trend of international reserves. At the end of chapter 4 I presented in detail the origins and mechanisms that led to the collapses of the emerging Latin American and Asian currencies, specifying how important the so-called "sudden stops" have been in these events. The magnitude and speed of the reversal of capital flows have shocked many observers, given the impacts on economies not considered vulnerable because they are protected by sound fiscal policies, a very high degree of openness to international trade or solid growth prospects.

In the face of this, currency crises have highlighted the hidden budgetary vulnerabilities of developing countries, forcing their markets to revise their risk forecasts and to implement their defense systems "self-assured" against a new reckless drainage of capital flows, leading them to collapse again.

However, self-insurance has different interpretations. The first sees these as stabilizers of production

(Ben-Bassat and Gottileb, 1992; Aizenman and Lee, 2007), since they are able to reduce the probability of a drop-in production induced by a sudden stop and/or reduce the depth of the production collapse when the stop materializes. Another interpretation is that given by Rodrik (2006) who, based on the logic of Guidotti-Greenspan's reserve adequacy rule, exposes how the accumulation of reserves serves to limit the costs generated by the reversal of cross-border capital inflows. Different, on the other hand, is the vision of Aizenman and Marion (2004) which sees the hoarding of reserves as a stabilizer of tax expenditures in emerging countries, which in conditions of volatile production, inelastic demand for tax disbursements or high tax collection costs could exploit a combination of international reserves and foreign debt that would limit consumption and reduce sovereign spreads.
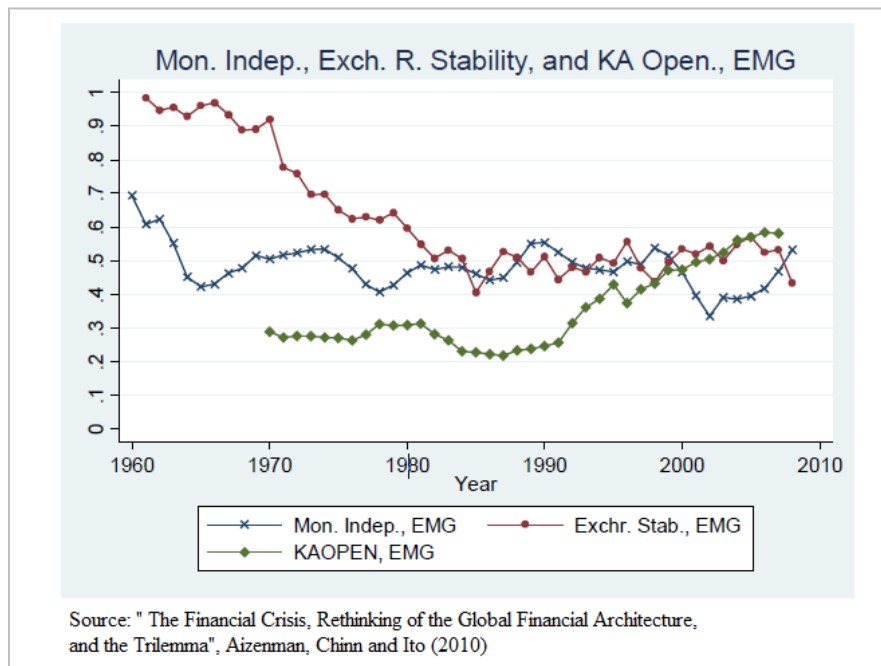
However, our interest is placed more on the arguments of Obstfeld, Shambaugh and Taylor (2010) that link the accumulation of reserves to three factors associated with changes in the configurations of the Trilemma since the mid-1990s: the adoption of active policies to develop and increase the depth of domestic financial intermediation through a broader domestic banking and financial system than GDP; the in-depth analysis of internal intermediation with an increase in external integration; the "fear of fluctuation" that manifests itself in the tight management of the exchange rate in order to stimulate trade or to mitigate the shocks that destabilize balance sheet balances in the presence of liabilities in dollars or the provision of a transparent nominal anchor for inflationary expectations.

This is because reserve hoarding has had historical implications for the way emerging countries approached the objectives of the trilemma following their currency crises, as it allowed them to achieve all three objectives proposed by the trilemma in the form of intermediate regimes at the same time, but with constraints (*Figure 15*). This thesis is supported by the study conducted by Aizenman, Chin and Ito (2010), which, using the indices already introduced in CAP 2, plotted the trend of the Trilemma configurations of emerging markets over an extended period of time, of which since 1994 (beginning of currency crises) reflects what my thesis expressed.

Precautionary accumulation is the perfect answer to block the cascade effect suffered by emerging countries due to sudden stops and high external debt. Owning reserves that cover more than their foreign debt exposure allowed countries to shake off the so-called "fear of fluctuation" because, given the high amount of reserves, only part of them would have been used to repay foreign bonds, while the rest would have given back room for managing the monetary policies of the countries in question to protect themselves against speculative attacks that would have depreciated the national currency in an unmanageable way. A controlled exchange rate regime, partial monetary independence and financial

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integration less open to certain types of inflows have undoubtedly strengthened the position of emerging countries in the global market by favoring their rise now less subject to external influences.

Figure 15 – EM's Trilemma configurations following Aizenman, Chinn and Ito indexes

Source: " The Financial Crisis, Rethinking of the Global Financial Architecture, and the Trilemma", Aizenman, Chinn and Ito (2010)

The accumulation of foreign exchange reserves by emerging economies has continued for several years at an unprecedented pace, remaining at very high levels. However, its effectiveness and validity have been much debated over time.

Financing a prolonged and large accumulation brings with it not only positive effects but also potential problems, with impacts on central bank and banking balance sheets and even on non-bank private sector balance sheets. Undesirable effects that could limit its usefulness include the following: fiscal costs of interventions; future monetary imbalances; financial sector imbalances; implications for financial intermediation.

Holding costs are by their nature cyclical and are related to the relationship between domestic and international interest rates. If one-year interest differentials between domestic and US Treasury bonds were particularly low, countries could even benefit from positive carrying costs as happened in China in 2006 (Mohanty and Philip Turner, 2006). On the contrary, in case of positive differentials, holding costs would reverse and imply high holding costs. However, a massive accumulation of reserves normally

increases the underlying liquidity position of the banking system. To the extent that banks hold such liquid assets, they might consider themselves in a better position and recklessly expand credit levels and, in turn, expose themselves to potential major interest rate fluctuations. In terms of financial imbalances, however, one problem lies in potential currency appreciation resulting from a stronger position due to higher foreign exchange reserves. This could attract large capital inflows in the short term that would push equity prices upwards.

This effect, in turn, could be accentuated by the perception of one-way speculation on the national currency, leading to greater currency substitution and uncovered debt operations. Finally, with regard to the implications for financial intermediation, the excess liquidity mentioned above could lead to the use of non-market instruments for its absorption. For example, the transfer from Asian banking systems to their respective central banks of deposits at interest rates below market rates, the reserve requirements imposed by Malaysia or the introduction by Indonesia of taxes on interest paid by banks have encouraged financial disintermediation and resource allocation.

It is for these and other reasons that the literature contains several reserve adequacy ratios in order to set benchmarks that can be used to make currency hoarding as efficiently as possible. *Figure 16* shows the evolution of these indices over time.

Figure 16 – Evolution of reserve adequacy measures

Period	Evolving adequacy measure	Influential contributors
1950s-1980	Months of imports; dealing with trade volatility	Triffin, Heller
Late 1990s-early 2000s	Short term external debt/IR, dealing with sudden stop of capital flows	Guidotti-Greenspan
2000s	M2/IR, dealing with sudden capital flight from domestic assets	Calvo Obstfeld, Shambaugh & Taylor
2000s	Hybrid; increasing with external debt/GDP, M2/GDP, country risk, and foreigners' shareholdings.	Wijnholds and Kapteyn Aizenman, Lee and Rhee
2000s	Provided a calibration cum estimation that allows estimating "optimal IR" as a function of the costs and probability of sudden stops	Garcia and Soto Jeanne & Ranciere Jeanne

Source: "Managing Financial Integration and Capital Mobility" (Aizenman & Pinto, 2011)

In the Bretton Woods context, where international reserves acted as a buffer against trade uncertainty, the adequacy of reserves was measured in months of imports with a rule of thumb that considered "four" months as the ideal. Such an approach was suitable for a world with limited financial integration where trade openness was the main channel for external shocks. In fact, this rule left room for the "cost-benefit" calculation of Heller's (1966) "buffer stock model", in support of exchange rate regimes that were becoming increasingly fluctuating or otherwise managed. In its analysis, the optimal level of reserves was determined in the context of a trade-off between their opportunity cost and the risk of an external imbalance leading to a costly adjustment and assumed that the optimal level of reserves should minimize the sum of these two costs. A problem with traditional models of calculating the optimum level of reserves is that the objective function maximized by government authorities is only vaguely related to well-being, which leaves room for ambiguity in the definition and measurement of variables. In *Appendix 1* I therefore present a model developed by Olivier Jeanne of the IMF, which takes welfare into account but also retains the basis of the previous literature.

With the numerous changes that have occurred in the 1990s, the shift in role between trade and financial flows as the dominant type of market has made previous adequacy ratios no longer exactly consistent. In this respect, the best candidate for such a role was taken by the Guidotti-Greenspan rule advanced in 1999 which saw as an adequate level of reserves held an amount corresponding to short-term foreign debt[8]. According to this rule, such a level would have provided the central bank of the reference country with the necessary liquidity to meet potential foreign exchange demand in the event that a sudden halt in capital flows hampered external refinancing of the debt in the short term. In line with Rodrik and Velasco (1999) and Hutchinson and Noy (2006), the expected benefit of using the Guidotti-Greenspan rule is around 1% of GDP if the ideal reserve holding reduces the annual probability of a sudden reversal of capital flows by 10% and if the exit cost of a financial crisis is around 10% of GDP.

The last indicator of adequacy, in terms of time and novelties introduced, is the one proposed by Obstfeld, Shambaugh and Taylor (2010). Their study found that liquid liabilities of the banking system measured on M2 provide an adequate indicator of internal exposure to such liquidation shocks. A higher ratio of foreign exchange reserves to M2 should provide a more "consistent" buffer, potentially reducing both the negative effects on the real exchange rate of a sudden arrest and the likelihood of a crisis induced by it.

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[8] Total external debt with original or residual maturity of less than one year plus interests due

5.3.2 After the Global Financial Crisis

The global financial crisis of 2008 and the subsequent Eurozone crisis confirmed that no country is immune from exposure to costly financial instability. However, countries with more mature institutions and deeper fiscal capacities can gain resilience and greater stability through ancillary instruments such as swap lines or macroprudential policies. This is why these types of instruments only became popular after the global crisis, when emerging countries had gained more strength and knowledge than in previous decades.

In principle, swap lines between major economic powers and smaller counterparties can replace or supplement the accumulation of reserves as self-insurance against potential crises. The FED's activation of such swap lines to major emerging countries such as Brazil, Korea, Singapore and Mexico are in line with the views that the dollar shortage experienced by the Eurozone and other OECD countries during the GFC put these countries in the position of "too big and too expensive to fail" from the point of view of the United States and that such provision would have given beneficiaries elastic access to the US dollar liquidity needed for their US dollar exposures. To the extent that swaps provide the international liquidity needed during emergencies, central banks can reduce interventions on their reserves and drain them.

An unprecedented supply of $120 billion in swap lines available to some emerging markets by the FED in 2008 gave an important signal to the financial market, but the selectivity of access and moral hazard involved suggested to the market the limited applicability of these agreements. Swaps act as a stabilizer of market concerns about the risk of losing control due to delevereging pressures, thus avoiding downward pressure on international reserves and the exchange rate to replace the need to accumulate reserves. This was the case with Korea, for example, which benefited from these financial instruments to avoid the accumulation of 60 billion reserves, and related costs, in order not to repeat the same dynamics of the crisis of '97.

The "moral hazard" mentioned above refers to the uncertainty about the duration of these lines and the persistent concern that, in the absence of them, the initial level of reserves is not enough to prevent the dynamics of the crisis, paradoxically inducing a new currency accumulation. Therefore, although the benefits of such agreements between industrialized and developing economies are clear, they depend on whether or not there are fiscal backstop mechanisms in place to support their use and potential consequences, leading such swaps to play only a secondary role with respect to reserves.

Alongside the opening of swap lines as explained so far, the conditions of strong global instability

suffered during and after the global financial crisis have contributed to the development of another "defense system" to protect the welfare of economies, the "macro-prudential policies". Before 2007, there was general consensus in central banks on most of the monetary policy and supervisory strategies to be adopted in order to avoid what had already happened in the past.

However, the global economic downturn has called into question all the basic policy strategies used to manage the economy up to that point, bringing new focus precisely on macro-prudential regulation and macro-supervision geared towards systemic risk rather than the riskiness of individual financial institutions, in order to promote a healthy economy. The "systematic nature" of the risk for which such policies are adopted concerns the general objective of mitigating cycles in financial market and domestic credit conditions, which represent some of the main channels for the propagation of economic shocks.

Indeed, due to the unprecedented and extensive quantitative easing policies and the persistent political uncertainty in advanced economies, many of them have still been subject to high volatility in short-term capital flows, which, if not treated appropriately, could result in an amplified cycle of appreciation of the currency, as well as more favorable credit conditions that would accumulate new risks in countries' balance sheets.

The following can be included in the broad set of interventions that can be linked to the concept of "macroprudential policies": adequate disclosure, capital requirements, liquidity requirements, timely corrective actions, close monitoring of sovereign risk procedures, close supervision of financial institutions, increased resources and responsibilities for supervisors. Obviously, the proposed alternatives leave a lot of room for interpretation, as these items can be separated into other minor interventions, whose application varies according to the conditions and characteristics of the country.

In virtue of what said above, I am presenting in principle an empirical study that supports the thesis that the adoption of such an instrument actually benefits the countries that use it. In this regard, Bruno and Shin (2014) provide a framework linking capital flows, exchange rate and leverage, as well as a case study on the impact of macroprudential rules in emerging markets. By formulating a model of the international banking system in which global banks interact with local banks, they highlight how the banking leverage cycle is the determining factor in the transmission of financial conditions through banking sector capital flows. Specifically, banking leverage cycle is defined as to be the procyclicality among bank leverage, assets and GDP that accordingly move together impacting financial subsectors. Secondly, they show the conditions under which local currency appreciation is associated with increased

leverage, thus ensuring a clear link between financial stability and exchange rates. Finally, through a panel of 46 countries, they manage to find support in the model's forecasts, presenting the emblematic case of Korea. In fact, since 2010, Korea has introduced a series of macro-prudential policies aimed at building greater resilience against external financial shocks, in particular to defend the country's vulnerability to the reversal of capital flows to the domestic banking sector and the consequent "disruption" of internal financial conditions.

For a comparative set of countries, the results suggest that the sensitivity of capital flows to South Korea to global conditions has decreased in the period since the adoption of macroprudential policies, providing empirical evidence to support their benefits.

6. Empirical Analysis

In accordance with what has been said so far, I now give an empirical imprint to the document by numerically analyzing the various topics presented in the previous chapters. By the way, the purpose of this section is to outline a methodology that will allow us to characterize and evaluate in a simple and intuitive way the choices that countries have made with respect to the trilemma in the period following Bretton-Woods. The first part of this document introduces the "Trilemma's indices", which measure the degree of achievement of each of the three political objectives related to the trilemma, namely monetary independence, exchange rate stability and financial integration. These indices make it possible to trace the evolving configurations of the international financial architecture and, alongside them, the level of reserves/GDP of each country under analysis will also be taken into account, given its fundamental importance in global macroeconomic choices. I will then present some studies on the combinations of Trilemma choices adopted by analyzing their convergence or divergence from the average of specific markets, and then go into detail with studies on the factors that influence them. My analysis will focus on developing countries, but industrialized and non-emerging countries will also be important, thanks to potential comparisons among these macro-realities.

As for the data that will be analyzed, the Monetary Independence Index (MI) is now available for 172 countries from 1960 to 2019; the Exchange Rate Stability Index (ERS) for 181 countries from 1961 to 2019; the Financial Openness Index (KAOPEN) for 181 countries from 1970 to 2018; and the Reserves/GDP for 264 countries from 1960 to 2019. (Data sources in *Appendix 2*)

6.1 Indexes

Below, I present the construction of the three Trilemma's indexes (Aizenman, Chinn and Ito, 2009) and their characteristics.

Monetary Independence (MI)

The annual mutual correlation of monthly interest rates between the home country and the base country is the representative measure of the degree of monetary independence.

Using money market rates[9], the index for the degree of monetary independence is defined as:

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[9] The data are extracted from the IMF's International Financial Statistics (60B..ZF...). For the countries whose money market rates are unavailable or extremely limited, the money market data are supplemented by those from the Bloomberg terminal and also by the deposit rates series from IFS.

$$\text{MI} = 1 - \frac{corr(i_i, i_j) + 1}{2}$$

where i refers to the country of origin and j to the base country. For clarity, the maximum and minimum values of the index are 1 and 0 respectively[10]. The higher the index is, the greater the independence of monetary policy. Using simple correlation coefficient can be misleading in case both the home and base countries are exposed to common external shocks. For example, there is a relationship of dependency between US and Canadian interest rates that now tend to move together. This is due not so much to the fact that US monetary policy influences Canadian monetary policy, but rather to evidence that both economies are affected by common external shocks.

Yet, for countries that have experienced hyperinflation, the regression coefficient turns out to be quite unstable. Nevertheless, correlation coefficients will be used for simplicity. The base country is defined as the country with which the monetary policy of origin is most closely related (Shambaugh, 2004).

The following are considered to be base countries: Australia; Belgium; France; Germany; India; Malaysia; South Africa; United Kingdom; and the United States. For the countries and the respective years for which the data used by Shambaugh are available, we will use his information directly, while for all other base countries the data will be allocated on the basis of the IMF Annual Report on Exchange Rate Agreements and Exchange Restrictions (AREAER) and the CIA Factbook.

Exchange Rate Stability (ERS)

To measure the exchange rate stability index, the annual standard deviations of the monthly exchange rate between the country of origin and the base country shall be calculated and included in the following formula for the normalization of that index between 0 and 1:

$$\text{ERS} = \frac{0,01}{0,01 + stdev(\Delta(\log(exch_{rate})))}$$

The simple application of this formula could potentially create a downward distortion of the index, i.e. it would emphasize the "flexibility" of the exchange rate especially when it usually follows a narrow band where it fluctuates but is rarely revalued or de-valued. In order to avoid such distortion, a threshold is

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[10] The index is smoothed by applying the three-year moving averages encompassing the preceding, concurrent, and following years ($t-1$, t, $t+1$) of observations.

applied to the exchange rate movement. If the monthly rate of exchange remains between the bands +/- 0.33%, then the exchange rate is considered to be "fixed" and is given the value "1" for the ERS index. Specifically, and in line with Shambaugh's approach, the choice of bands fixed between +/- 0.33% comes from the +/- 2% band set for the annual rate. In addition, in order to avoid anchorage breaks due to sporadic realignments, any exchange rate that undergoes a percentage change of 0 in 11 months out of 12 is considered fixed.

When there are, for example, two revaluations in three months, then these are considered as a single event and, in the absence of further exchange rate changes in the following months, that year is considered as a fixed exchange rate year. Larger values of this index reflect a more stable movement in the exchange rate than the base country currency. In closing, any one-year stake is set aside because they are most likely unintentional.

Financial Openness/Integration (KAOPEN)

Measuring the extent of capital controls is extremely difficult. There are many measures to describe the extent and intensity of these controls[11] but, nevertheless, it is generally recognized that such measures are not able to fully capture the complexity of capital controls in the real world. However, I will use the Chinn and Ito Capital Account Opening Index (2006, 2008), also called KAOPEN, for the financial openness measure of my analysis. This index is the first major standardized component of the variables indicating the presence of multiple exchange rates and bases its information on the restrictions contained in the IMF Annual Report and the Exchange Agreements and Exchange Restrictions (AREAER) such as: restrictions on current account transactions; restrictions on capital transactions; export earnings restitution requirements. Given the reported restrictions, a de jure capital opening index is required. The choice of a "de jure" measure is motivated by the willingness to examine countries' policy intentions, contrary to "de facto" measures which are also susceptible even to other macroeconomic effects. KAOPEN is also normalized between 0 and 1 and higher values than this index indicate that a country is more open to cross-border capital transactions.
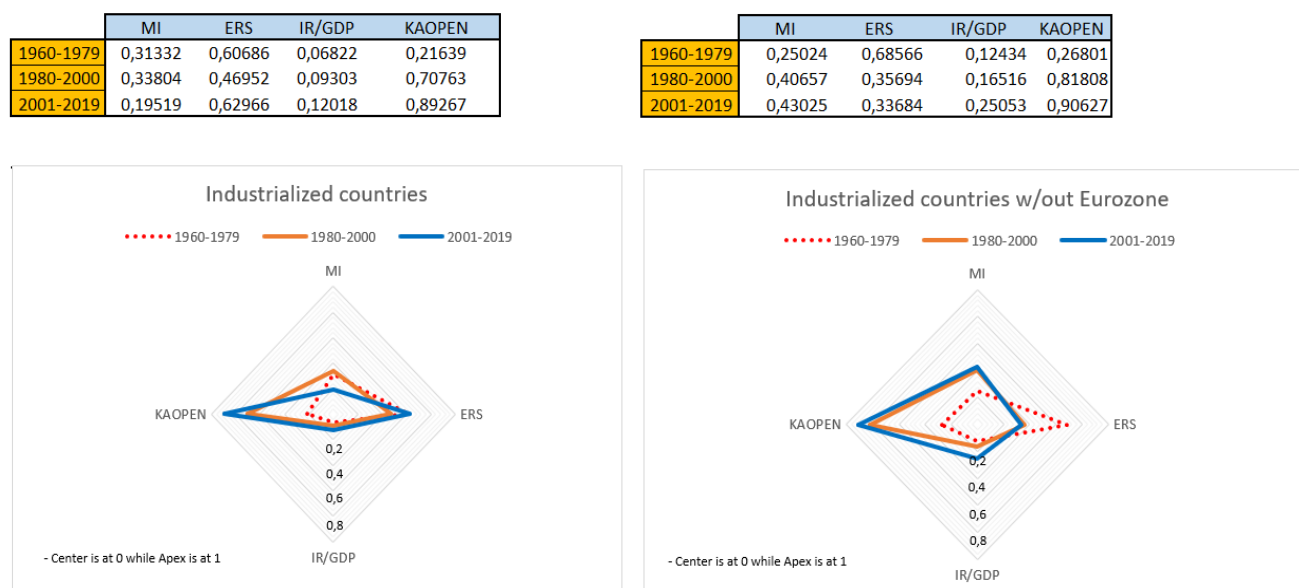
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[11] See Chinn and Ito (2008), Edison and Warnock (2001), Edwards (2001), Edison et al. (2002), and Kose et al. (2006) for discussions and insights of various measures on capital restrictions.

Tracking summary

By comparing various indices, the time horizon analyzed counts 60 years, from 1960 to 2019, divided into three strategic macro-groups in order to best represent the changes of these according to historical events: the first subgroup is 1960-1979, which takes into account the period immediately after the end of Bretton Woods until the eve of boom and boost period; the second subgroup is 1980-2000, reflects the crisis period; the third subgroup is 2001-2019, which represents the period of rebirth and adjustment of emerging policies by virtue of past experiences to last year.

In the same way, as shown in *Figure 17*, I made a further distinction, this time not temporal but market-based[12], extending our analysis to the following markets: industrialized markets; industrialized markets without Eurozone countries; emerging markets; non-emerging markets; Latin-American economies; and Asian economies.

Figure 17 – Indexes tracking

	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,31332	0,60686	0,06822	0,21639
1980-2000	0,33804	0,46952	0,09303	0,70763
2001-2019	0,19519	0,62966	0,12018	0,89267

	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,25024	0,68566	0,12434	0,26801
1980-2000	0,40657	0,35694	0,16516	0,81808
2001-2019	0,43025	0,33684	0,25053	0,90627

	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,20862	0,59456	0,03370	0,11172
1980-2000	0,39711	0,42992	0,07091	0,28032
2001-2019	0,40301	0,46822	0,19978	0,43727

	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,21358	0,75876	0,04603	0,14018
1980-2000	0,43158	0,56317	0,11009	0,24312
2001-2019	0,43018	0,56208	0,16385	0,41465

Emerging Markets

Non-Emerging Markets
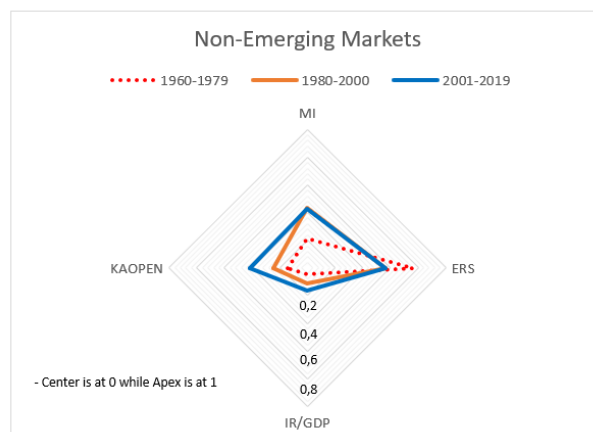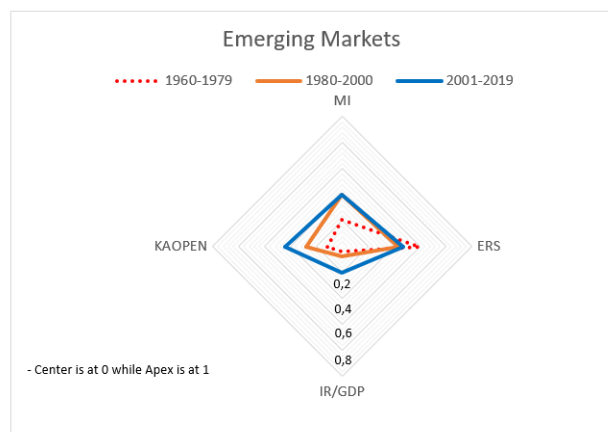
	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,27052	0,67103	0,04742	0,15382
1980-2000	0,47371	0,47682	0,07974	0,29671
2001-2019	0,39719	0,45723	0,13483	0,53248

	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,23835	0,64543	0,09564	0,16802
1980-2000	0,40460	0,46091	0,14445	0,49555
2001-2019	0,38784	0,38738	0,28970	0,43029

LATAM Countries

Asian Economies
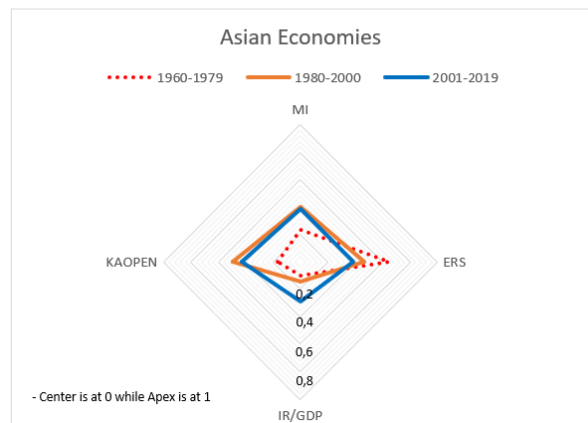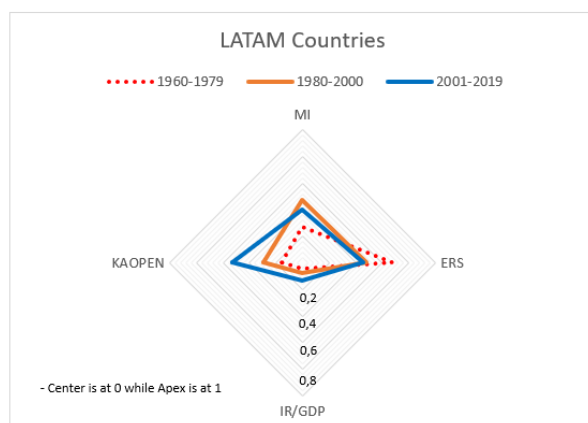
The configurations of each market are represented through a generalized diamond graph, where the tips reflect the three Trilemma indices (MI, ERS, KAOPEN) and the IR/GDP and the origin has been normalized to represent a minimum and maximum value (0,1). The combined data and charts show how industrialized countries, without the Eurozone, and emerging markets have progressively oriented their policies towards greater financial integration and monetary independence, with a more marked transition in industrialized countries that have tripled their KAOPEN value in 60 years.

The scenario offered by non-emerging developing countries, on the other hand, is more particular, as

they have certainly oriented their macroeconomic policies towards greater financial openness, but they have also recorded more stable levels of monetary independence and exchange rate stability since 1980.

In this respect, it is interesting how in the emerging markets, beside an exponential growth in the level of reserves which for both markets has quadrupled with respect to their respective initial observation, a drastic reduction in the ERS index in the second time subgroup related to crises is observed. As explained in the previous chapters, this reduction is justified by the significant impact of the South American and Asian crises on the currencies of their respective countries, which, initially reluctant to abandon fixed or pegged exchange rate regimes, loosened their currency constraints by allowing their currencies to fluctuate more.

In this way, the exchange rate stability index has naturally decreased, but with some differences. For emerging markets, after lower ERS values in the second period, we see an adjustment of this value in the last subgroup as a sign of how this type of market has regained strength in terms of national currency after past experiences and as sign of an adjustment process towards the so-called "equilibrium values". On the contrary, non-emerging markets do not reflect these adjustment processes, but rather remain fixed on relatively high index values, a sign that they are not yet ready for such a transition. In the last subgroup, we also find the first evidence of the concept of "intermediate regimes" explained above.

Since the 2000s, emerging markets have reflected a more balanced combination of the values of each index, each one settling at around 0.45 each. This benchmark represents average levels of exchange rate stability and financial integration without renouncing a monetary independence, that comes close in value to that of the industrialized countries leaving aside the Eurozone countries.

Likewise, it is important to note that this policy mix corresponds to a substantial increase in the IR/GDP ratio from the first sub-group to the last, which has shown a percentage increase not seen in any other sub-group, reflecting the fact that precautionary reserve hoarding has given these countries greater freedom of action. The reserve ratio is also an important tool for a more visceral analysis of developing markets.

In fact, by splitting these markets into Asian and Latin American economies, although the latter already reflects a positive growth trend in reserves, we see how Asian markets takes on the connotations of an almost exponential one in their IR/GDP index. In the period 2000-2019, the Asian index reached the highest value among all the subgroups considered, with China playing a significant role in this accumulation, ranking for several years now at first place among the countries in the world with the

largest amount of foreign exchange reserves, recording a record current reserve value of US$3,132,890[13].

At the same time, the Asian economies are distinguished by more comparable levels of the three indices, although they are lower than the Latin American ones. These, on the contrary, observe a more gradual financial openness that now takes on higher values than their Asian counterparts. Moreover, after the downsizing of the 1980s, they observe a reduction in the degree of MI while maintaining a relatively stable level of ERS in recent years.

The last noteworthy detail is the impressive difference that can be seen when comparing the graphs concerning the industrialized countries with and without Eurozone countries. Given a very high KAOPEN value for both scenarios, what catches the attention is the much lower level of monetary independence and much higher level of exchange rate stability observed in the scenario including European countries, which underlines the efforts made by these countries in pursuing EU directives as monetary union.

Figure 18 – Global Indexes Trends

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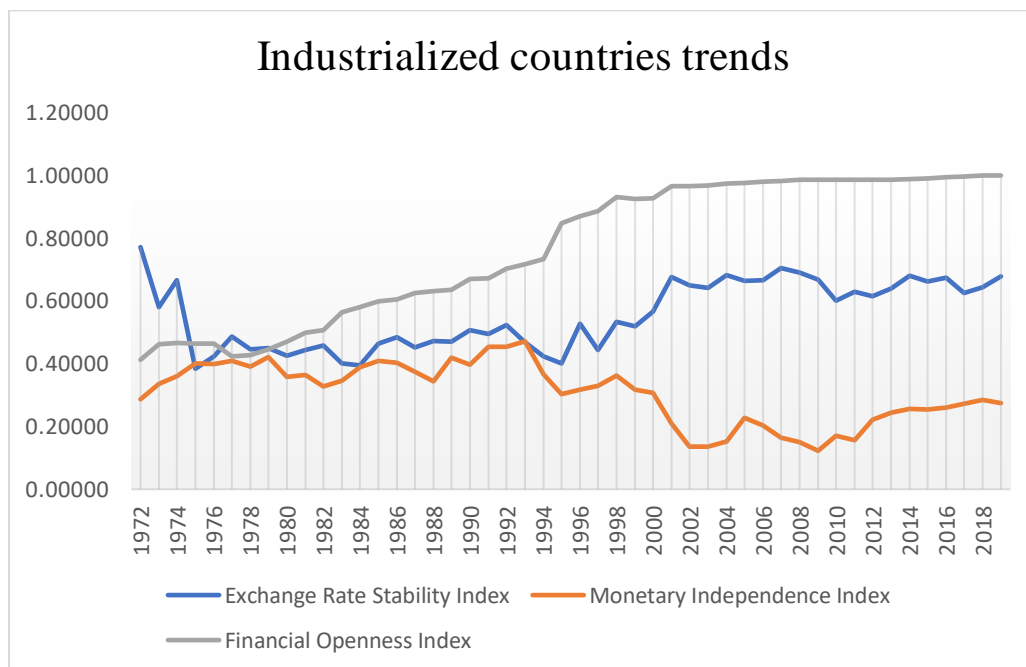
[13] Source: fred.stlouisfed.org

Emerging countries trends
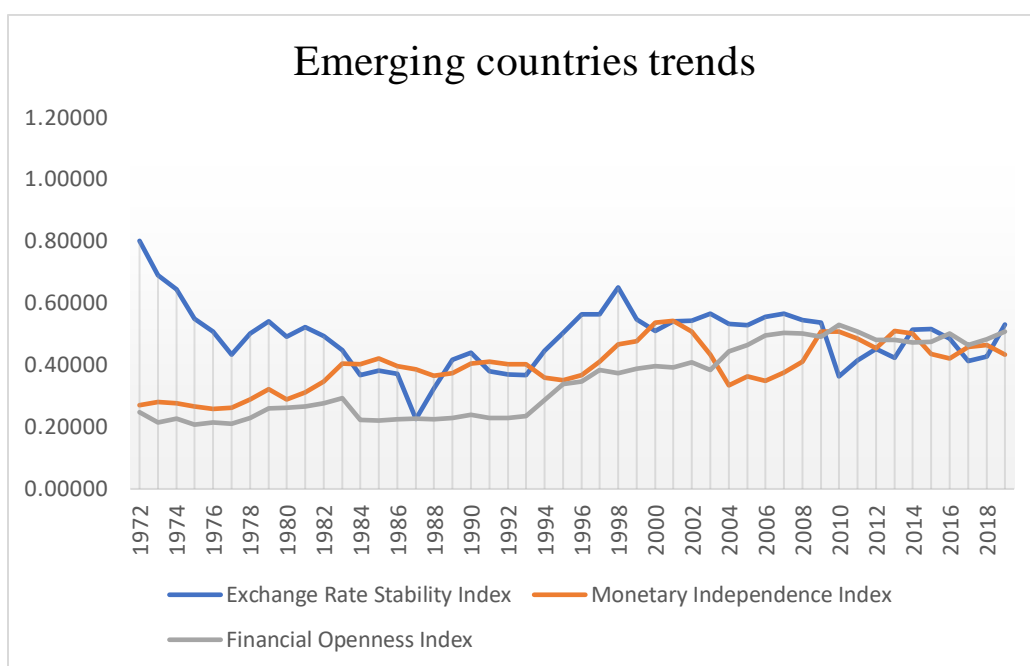
By changing the chart format, we can see the evolution of the Trilemma indices from a different point of view, as *Figure 18* reflects for the two main market types net of IR/GDP and for the time horizon 1972-2019. These graphs represent more clearly the two different approaches that industrialized and emerging countries have had with respect to Trilemma's choices. For the industrialized economies, given the growth in financial integration, the discussion focuses on the two remaining indices. MI and ERS reflect diametrically opposed paths, with exchange rate stability prevailing over monetary independence thanks once again to the introduction of the euro in 1999, that shifts the political choices of rich countries towards KAOPEN and ERS. This implies that this type of market orients on average the balance of the Trilemma in function of only two of the three choices available.

The experience for emerging markets is significantly different. Among the three objectives, until 1990 the greatest political efforts were focused on exchange rate stability, despite a downward trend in the long term. In the following years, the importance of exchange rate stability was added to the importance of monetary independence, with financial integration growing steadily thanks to the release of constraints on capital control already in the previous decade. Unlike industrialized countries, since the 2000s, emerging ones have proposed a new approach that involves all available Trilemma policy choices and converge on the same level of intermediate intensity (defined as the size of the index value).

6.2 Measure of divergence

In support of how developing countries are adopting not only the same macroeconomic choices, but also, to the same extent, I analyze in detail how the individual countries of a given sub-sample move with respect to the average of it. For this reason and in order to effectively quantify this convergence, I introduce a new index[14] "d_{it}" that measures the extent of the divergence between all the indices of Trilemma with respect to the sample average. The index is thus calculated:

$$d_{it} = \sqrt{(ERS\_r_{it})^2 + (MI\_r_{it})^2 + (KAOPEN\_r_{it})^2}$$

where $X\_r_{it} = \frac{X_{it}}{\overline{X}}$ for X=ERS, MI e KAOPEN of each country in year t and $\overline{X}_t$ is cross-country average of X in year t, which considers the time horizon 1976-2016. For the calculation of d_{it} I consider again the following subgroups: industrialized countries including EU and non-EU countries; emerging markets; non-emerging markets. The greater the value of d the greater the divergence of political choices compared to those of the sector, while the lower the values of d the more commonly countries move because the smaller the deviations from the average sub-sample will incur.

Figure 19 – "d" Trends
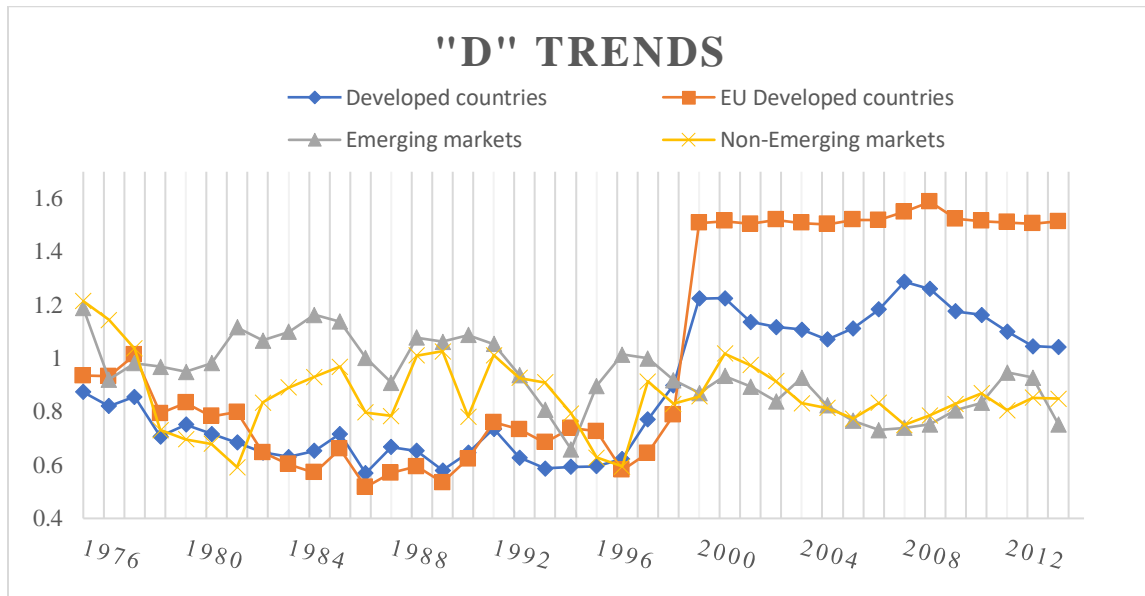
Figure 19 shows several interesting observations on the degree of policy divergence between the various groups of markets, whose trends are derived from the average of the belonging countries' *ds*. Over the last two decades, the divergence index of industrialized countries including EU countries has risen sharply as a result of the different combinations that the European Monetary Union has adopted compared to the average of the remaining developed countries, a concept that creates even more consistency and coherence to our previous analyses. In fact, I split the index for developed countries, taking out EU developed ones so as to highlight even more the impact of the events of 2000 and how EU policies significantly orient the behavior of the countries involved towards a common direction regardless of the surrounding context, as evidenced by the flatness of the index *d* from 2000 to the present day even through the global crisis of 2008. In the same period, the emerging countries recorded the lowest values, reaching a value of divergence from the average of the subgroup of only 0.75 in 2015, with the exception of periods of crisis with foreseeable peaks of divergence resulting from the numerous economic shocks that have occurred. This demonstrates the above, showing how the emerging countries are orienting themselves towards values of increasingly similar trilemma indices. Another interesting matter is that there is a decrease of *d* on the eve of the South American debt crisis, the Mexican crisis and the Asian crisis.

For a more detailed analysis that tries to dissect the factors influencing the divergence index, I now propose two types of analysis: the first aims to capture regional effects or characteristics that could have influenced *d*; the second focuses on the relationship between *d* and foreign exchange reserves of generic emerging markets.

6.2.1 Regional Insights

Breaking down the emerging market index *d* of *Figure 19* by geographical subgroups, the main features emerging from *Figure 20* are that South American emerging countries had a higher in value and longer in time degree of divergence before they showed a downward trend and stabilized around 0.8. This is mainly due to the duration and number of South American crises compared to Asian crises, given that the difficulties in Latin America began with the debt crisis in 1982 and ended with the Argentinean crisis in 2001. Similar is the case for African countries, given the high number of significant fluctuations in the index. It is probable that in this case, the main reason behind these anomalous movements lies on the commercial, financial and political instability of some member countries as well as the economic and development differences that are recorded from one area to another and that constrain them from adopting

common policies. The Asian countries, on the other hand, are different. I suppose that the lower number of economic shocks experienced and the considerable presence of commercial and financial links among them have had a positive influence in the concentration and political decisions, increasing the cost of renouncing the coordination of regional policies. For example, the ASEAN (Association of South-East Asian Nations), which has the main purpose of promoting cooperation and mutual assistance among member states to accelerate economic progress and increase the stability of the country, certainly ensures greater balance and constraints to the freedom of maneuver of the acceding countries, directing their actions.

Figure 20 – Regional "d" Trends

CONTINENTAL "DS"
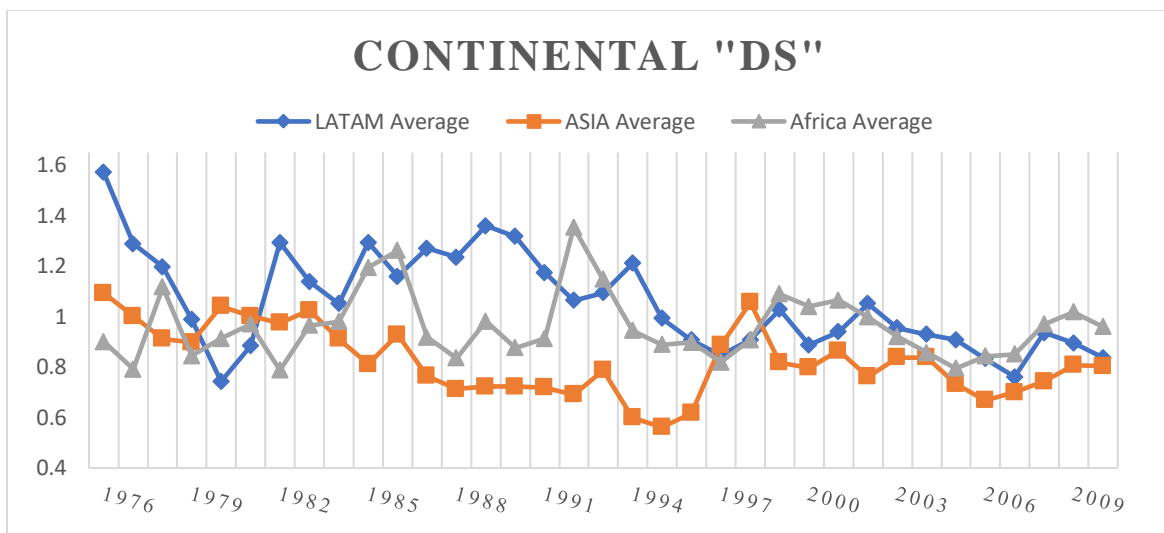
6.2.2 *d*-IR/GDP Regression

I now introduce an analysis of my intuition that focuses on the relationship between the divergence/convergence of emerging countries in terms of Trilemma's choices and the phenomenon of hoarding reserves. For this reason, it is worth mentioning the importance assumed by the precautionary increase in foreign exchange reserves in the context of the loosening of ERS constraints in favor of greater monetary independence that I observed during the period of greater development of emerging markets and afterwards. This leads us to reflect on how the hoarding of reserves provides countries with more room to manage their macroeconomic policy, widening the possibility of their choices so that they can better adapt to a given economic environment. My analysis is carried out first under a macro-point

of view, investigating whether the freedom of maneuver guaranteed by greater reserves implies greater divergence in the choices of trilemma adopted (H0) or stimulates countries to operate in a similar way (H1), and then under a micro-point of view that investigates the values of specific geographical areas to capture their insights and give them an explanation. For this reason, I implement a linear regression calculation on a sample of emerging markets slightly lower than the one used at the beginning for a new time horizon from 1976 to 2018, considering the 3 different geographical bands (South America, Asia and Africa) used for the study of the index d, but now composed of 4 countries each so as to have a panel as balanced as possible.

Hypothesis to test:

H0: Higher levels of international reserves imply higher degree of divergence "d"

H1: Higher levels of international reserves imply lower degree of divergence "d"

The regression line is represented as follows:

$$d_{it} = \alpha_0 + \alpha_1 IR_{it} + \varepsilon_{it}$$

where d represents the vector of divergence indices of country i for each year t calculated with respect to the average of the whole sample, *IR* represents the vector of IR/GDP indices of country i for each year t and ε represents an i.i.d. error term.

Figure 21- Panel regression

	LATAM				AFRICA				ASIA			
	Argentina	Brazil	Mexico	Chile	South Africa	Morocco	Nigeria	Tunisia	South Korea	Malaysia	Philippines	Thailand
Independent variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	0,69742 (5,43E-09)	1,27090 (2,40E-20)	1,61405 (6,46E-13)	1,14479 (3,93E-11)	1,02838 (2,66E-19)	0,78420 (4,88E-12)	0,85736 (6,46E-07)	0,51985 (4,76E-09)	0,79174 (1,94E-09)	3,35646 (6,33E-12)	0,88979 (4,37E-17)	1,24185 (1,01E-16)
IR/GDP	0,78154118 (0,0000280)***	-3,19041547 (0,0002013)***	-5,28252122 (0,0099660)***	-0,36014342 (0,6693570)	-1,78245049 (0,0645282)*	0,80842265 (0,1171025)°	0,88558658 (0,5486932)	1,31719402 (0,02879991)**	0,08636284 (0,8936545)	-5,98884790 (0,0000023)***	-1,55408499 (0,0006394)***	-1,62107134 (0,0000274)***
Observations F-statistic	43 0,000028	43 0,000201	43 0,009966	43 0,669357	43 0,064528	43 0,117103	43 0,548693	43 0,028799	43 0,893654	43 0,000002	43 0,000639	43 0,000027

Note: °p<0,015, *p<0.10, **p<0.05, ***p<0.01.

Figure 21 shows the panel of coefficients and p-values generated by linear regression calculations for all emerging countries, which are organized in geographical areas as mentioned above. First, what emerges from our study is the goodness of the sampling of our data. In fact, 9 out of 12 countries record very low levels of significance (p-value < 0.01 or 0.05) or still acceptable (p-value < 0.10 or 0.15), of which the 3 not significant coincide with one for each geographical area. Because of this, no region has been invalidated and I can discuss my analysis further. Restricted to significant data only, it emerges that 6 out of 9 countries actually have negative correlation coefficients, which means that higher levels of foreign exchange reserves correspond to lower levels of divergence. This implies the rejection of our H0 in favor of H1, since the greater freedom of macroeconomic choice guaranteed by a precautionary accumulation of reserves actually helps emerging countries to converge towards choices that are very similar to the average in terms of indices and values rather than diverge from the average by adopting combinations of different choices or of different intensities. This suggests that regardless of the relative economic conditions in which a country finds itself, an intermediate regime that stabilizes indices around 0.45 in value represents the best Trilemma scenario to follow for the type of emerging market. This is further supported by the composition of our sample, which takes into account countries from different continents that are subject to different influences and constraints than others. Another support to my thesis is also given by a study conducted by Aizenman, Chinn and Ito (2008) which showed how intermediate levels of trilemma indices guarantee a lower volatility of output for the type of countries in question. I now move from macro to micro analysis by specific geographical area.

With regard to South American countries, 3 out of 4 have negative correlation coefficients except for Argentina (bearing in mind that Chile is not significant). A probable justification lies in the turbulent vicissitudes that this country has experienced since 1980 on, where it counts 5 of the 9 total defaults of its history, against the total 9 defaults of Brazil or the 8 of Mexico which, however, are spread over almost two centuries. It should also be noted that Mexico has the highest correlation coefficient among South Americans, probably due to the fact that the process of adjustment between reserves and intermediate regimes takes place following the Mexican crisis of 1984 and therefore much earlier than the other countries under discussion whose major crises are recorded close to the new millennium. Turning our attention to the countries of the African continent, we note that the situation is diametrically opposed to the other two. Here, the correlation coefficients go against the trend previously mentioned about H1, given that positive values are recorded for 3 out of 4 countries except South Africa (bearing in mind Nigeria is not significant). A plausible reason could be that the African continent has a lower average IR/GDP index (0.093) than South America (0.183) and Asia (0.198), implying that it hasn't been

a reserves precautionary accumulation of intensity equal to the other realities considered in order to have the same margin of action in terms of Trilemma's choices in order to adapt to the intermediate trend that was developing. Of the African countries, it is worth mentioning South Africa, which compared with the others has both a negative correlation and a value very similar to South American and Asian countries, since it is the closest to them in terms of development, wealth and integration. The last part of my analysis focuses instead on emerging Asian countries. These reflect what we have seen with the Latin markets, since 3 out of 4 countries have negative correlation coefficients, but the justifications for this are different. In the previous paragraph I analyzed how the influence of *ASEAN* has benefited the convergence of member countries towards similar policies. The countries with negative correlation coefficients are Thailand, Malaysia and the Philippines, all participants in the trade and financial agreement introduced. Consequently, given a declining divergence index and the exponential growth of Asian foreign exchange reserves, it was expected that for these three countries H1 holds. In contrast, South Korea has a positive correlation similar to Argentina, but with a different interpretation. Analyzing the IR/GDP and South Korean trends, it emerges that Korea actually differs significantly in terms of higher *d* values than ASEAN members, which means that it is detached from common Asian practices to adopt a more personal approach than the average. In any case, considerations about South Korea results are arguable since its regression results are not significant.

Concluding Remarks

At the beginning of my paper, I provided a very specific theoretical framework about the mechanisms and limits imposed by the Mundell-Fleming Trilemma. This theory is still valid today, but key market developments and numerous crucial historical events have undoubtedly led to its derivations and exceptions. It has been seen how the onset of financial integration brought about a momentous turning point in the post-World War II concept of open macroeconomics, bringing with it numerous changes to which the world's markets had to adapt for the development of their economies. It is precisely financial integration that formally gave rise to the object of my study, namely the evolution of the Mundell-Fleming Trilemma in emerging markets, a thesis that has been fully satisfied and which today bears witness to a very profound derivation of the basic theory. It has been seen how the different approach taken towards exchange rate regimes, the huge foreign capital flows to this new type of expanding market, as well as the debt crises together with the currency collapses resulting from the sudden arrests have laid the foundations for the new conformation of the Trilemma's choices empirically demonstrated. In fact, the introduction of indices reflecting each of the macro-political choices provided much clearer information about their trend over time. Industrialized countries have always kept Trilemma's theoretical constraints alive, focusing their political efforts first on financial integration and monetary independence, by virtue of having greater control of their currency in fluctuating exchange rates, and then diverging towards less monetary independence to the benefit of exchange rate stability now imposed by the introduction of the Eurozone.

Completely different is the evolution that has emerged for developing markets. In their case, financial integration was also a pillar for their economies, since it was seen as the main channel of development and affirmation in the global market. However, at first a great deal of effort was devoted instead to maintaining a fixed exchange rate regime that would allow them to guard against any market fluctuations that could damage them given the very high flow of foreign capital coming in, whose sudden arrests, however, significantly altered their stability leading them to collapse. The periods of crisis outline the new approach of emerging countries with respect to Trilemma's choices, thanks to the introduction and resolutive use, first of all, of a precautionary accumulation of reserves as a response to previous debt problems and then with the introduction of other instruments such as swap lines with industrialized countries and more macroprudential policies. With greater emphasis on the hoarding of foreign exchange reserves, the combination of these instruments has over time guaranteed greater freedom of action to developing countries, which have been able to loosen their exchange rate stability constraints so as to

regain moderate monetary independence and thus interrupt the overwhelming influence of industrialized countries. This greater guaranteed freedom has led these countries to deviate from the pure basic theory of exclusivity of at least one of the three proposed political objectives, concentrating in a more balanced manner on financial integration and greater monetary independence while maintaining moderate exchange rate stability. Starting from the new millennium, therefore, a trilemma configuration that considers all the theoretical objectives proposed and whose relative indices assume a converging trend towards intermediate regimes of similar intensity emerges. Through the introduction of a divergence index, I have supported this new approach by demonstrating that developing countries are those that behave as closely as possible to their market average and therefore have lower divergence values, claiming that this convergent trend is a strategy that the majority has undertaken. I found a motivation for this trend both from specific regional characteristics, which favored similar behavior, and from the common precautionary hoarding of currency reserves since the 1980s. My regression study has shown that higher levels of reserve ratios correspond to lower levels of divergence, demonstrating how the greater freedom guaranteed by these has favored such behaviors.

My paper confirms what was previously introduced by the study of Aizenman, Chinn and Ito, where the convergence phenomenon was only in its beginning and is now confirmed by my analysis with a wider time horizon. In conclusion, by virtue of what has resulted in the evolution of the market and instruments, it is likely that with a longer future time horizon and the development of more instruments available, the average level of balance of Trilemma's choices will grow more and more, strengthening the intensity of its indexes and aspiring to full control of its choices.

Appendix 1

In this section I present a framework by Olivier Jeanne of the IMF for a cost-benefit analysis of the optimal level of reserves to hold in order to best face capital account crises. The model treats a small open economy vulnerable to crises, which are defined as the loss of access to external credit associated with a drop-in production. The economy in question is populated by a representative consumer holding a certain amount of foreign assets. Its wealth can be invested in two ways: liquid international reserves; illiquid asset. Foreign exchange reserves bring benefits in terms of crisis prevention and mitigation but also an opportunity cost compared to the more profitable illiquid investment. The optimal level of reserves will depend on these parameters:

- "L" – the size of the capital flow expressed in terms of potential output
- "Δ" – the output loss in a crisis expressed in terms of potential output
- "δ" – the opportunity cost of accumulating reserves
- "σ" – the relative risk aversion of domestic consumer
- "π" – the probability of a crisis (which is endogenous to the level of reserves if they have a role in crisis prevention)

Assumptions

The model assumes three time periods t=0, 1, 2, where t=2 represents the long term, t=1 represents the time during which a crisis could occur and t=0 represents the initial period. During the initial period the representative consumer in the small open economy adjusts its reserves to the risk of a crisis in the period t=1 by structuring its external assets and liabilities. This time structure respects the Heller's original approach but does not preclude a more dynamic interpretation of the model. It is assumed that the consumer allocates wealth net of external liabilities, identified with "W_0", in two kind of assets: liquid bonds or reserves (R_0); illiquid activity (I). The latter type of activity can be considered negative if the consumer issues a long-term external liability (D = - I). The welfare of the representative consumer is given by the following formula:

$$(1) \quad U_t = E_t \left[u(C_1) + \frac{W_2}{1+r} \right],$$

where $u(C_t)$ represents an increasing concave consumption function, W_2 represents the consumer's net foreign wealth at the beginning of the period 2 and r represents the rate at which foreign wealth can be

exchanged between periods. Therefore, the consumer wants a level of consumption C^* in the period $t=1$ that meets the first order condition:

$$(2)\ u'(C^*) = 1.$$

Reserves are the only form of assets that can be sold in the period $t=1$ and are therefore more liquid than assets. Conversely, illiquid assets cannot be sold in $t=1$ but bring a higher return in the long run ($t=2$). The difference between the return on reserves and the return on illiquidity reflects the opportunity cost of the former, i.e. the price the consumer has to pay to keep the assets liquid.

Period t=0. The consumer allocates wealth net of foreign liabilities between reserves and the illiquid asset:

$$(3)\ W_0 = R_0 + I$$

Period 1. An external liability "L" comes due. Then, the consumer repay$s$ L and consumes C_1 under the budget constraint:

$$(4)\ Y_1 + L' + R = C_1 + L + R'$$

where Y_1 reflects the domestic output, L' is a new debt issued in period $t=1$, $R = (1+r)*R_0$ is the stock of reserves at the beginning of the period and R' reflects the stock of reserves at the end of the period.

Period 2. The consumer's net foreign wealth is equal to output in period $t=2$ plus the net return on net foreign assets:

$$(5)\ W_2 = Y_2 + (1+r)^2 * (1+\delta)* I + (1+r) * (R' - L')$$

In the period $t=1$ the economy can be in two types of state which differ in the level of production and the consumer's access to external credit:

- "no-crisis" state: the output is at its potential, $Y_1 = Y$ and the representative consumer has complete access to the external credit (no restrictions on L')
- "crisis" state: the output is below its potential, $Y_1 = Y - \Delta Y$ and the representative consumer has no access to the external credit ($L' = 0$)

Thus, the state of crisis corresponds both to a drop-in production and a sudden stop in capital flows. As

the equation *(4)* shows, the negative impact can be mitigated by the depletion of reserves ($R' = 0$). In the process of normalization, it is assumed $Y = 1$ so that the cost of production of a crisis ΔY and the depth of the sudden stop L are expressed in terms of potential production. It is also assumed that the optimal consumption level is equal to potential output ($C^* = Y$), so that there is no foreseeable trade deficit in the period t=1. Remember that the ex-ante probability of a crisis is indicated by π In order to determine whether the reserves could generate benefits in terms of prevention, it is assumed that the probability of a crisis occurring reflects a down-warding function of the ratio of reserves to short-term debt, represented by the following equation:

$$\textit{(6)}\ \pi(R) = F\left(v - a * \frac{R}{L}\right)$$

where $F(x)$ is an increasing function, v represents an index of vulnerability to a crisis and a represents a parameter indicating the benefit of prevention. In the calibration of the model a "probit specification" will be used, which implies that $F(x)$ is the cumulative distribution of a normal function.

The optimal level of reserves

The following equation *(7)* represents the loss function, equivalent to the opportunity cost of reserves plus the cost of the expected service in the event of a crisis, minimized by the optimal level of reserves:

$$\textit{(7) Loss} = \delta * R + \pi(R) * f(R)$$

where $f(R)$, the welfare cost of a crisis, is increasing with the size of the crisis itself (L and ΔY) and decreasing with the level of reserves (R). Equation (7) captures the trade-off between the opportunity cost of reserves ($\delta * R$) and their benefits in terms of crisis prevention ($\pi(R)$) and crisis mitigation ($f(R)$). The representative consumer bears the opportunity cost in each period but pays the social cost of a crisis with a frequency $\pi(R)$. In these terms, equation (7) thus summarizes the average cost of crises and the average cost of insuring against those crises. For low reserve levels, the gains from increased reserves, in terms of crisis prevention and mitigation, dominate the opportunity cost, while the opposite applies to high reserve levels.

Figure 22 – Total loss and optimal level of reserves
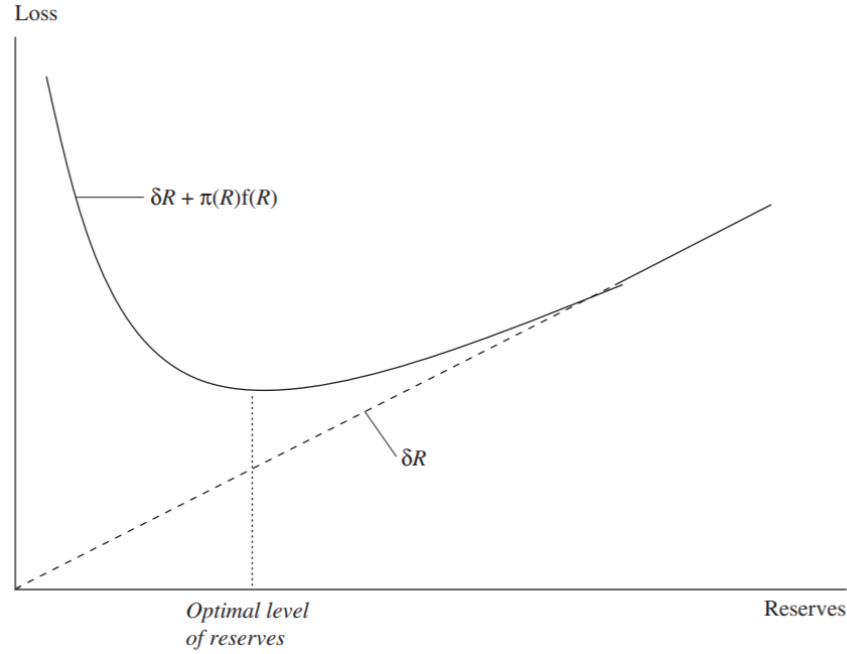
The first-order function for maximizing the loss function is described in this way:

$$(8)\ u'* [C^* - (R_{medium} - R)] = 1 + \frac{\delta}{\pi}$$

where $R_{medium} = L + \Delta Y$ is the "full insurance" level of reserves, i.e. the sufficient minimum level of reserves that guarantees a desired level of consumption in the event of a crisis. As expected, this condition implies that the optimal level increases as the probability of a crisis increases and decreases as the opportunity cost decreases. If the representative consumer has a constant relative risk aversion σ, then the optimal condition changes in this way:

$$(9)\ R = L + \Delta Y - \left[1 - \left(1 + \frac{\delta}{\pi}\right)^{-\frac{1}{\sigma}}\right]$$

The Equation (9) reflects how the optimal level of reserves is calculated as the short-term external debt plus the cost of exiting a crisis minus the opportunity cost of holding reserves. Since this optimal level does not have a closed expression in the general case where the probability of a crisis is endogenous, it is minimized with the following formula:

$$(10) \quad Loss = \delta * R + F\left(v - a * \frac{R}{L}\right) * f(R)$$

All other things being equal, taking into account the benefits of crisis prevention lead to an increase in the optimum level. This represents an important difference compared to the case where the probability of the crisis is exogenous since the optimal level can now exceed the full insurance level. Crisis prevention could make it optimal for a country to hold more reserves than it is willing to spend in a period of financial stress.

Appendix 2

- Trilemma indexes time series source: https://sites.google.com/site/aizenmanpage/

- Reserves and GDP time series source: https:/data.worldbank.org/

- Markets classification: (see note 14 for the criteria)

Industrialized Markets	Emerging Markets	Asian Markets	Non-Emerging Markets
Canada	Argentina	China	Bhutan
Austria	Brazil	India	Guatemala
Belgium	Chile	Indonesia	Honduras
Denmark	China	Japan	Papua New Guinea
Finland	Estonia	Malaysia	Sri Lanka
France	Greece	Philippines	Togo
Germany	India	Singapore	Zambia
Ireland	Lebanon	South Korea	
Italy	Malaysia	Thailand	
Netherlands	Mexico		
Norway	Morocco		
Portugal	Nigeria	**LATAM Markets**	
Spain	Philipines	Argentina	
Sweden	Romania	Brazil	
Switzerland	Russia	Chile	
United Kingdom	South Africa	Colombia	
Australia	South Korea	Ecuador	
Japan	Thailand	Jamaica	
New Zealand	Tunisia	Messico	
Singapore	Uruguay	Perù	
Israel	Vietnam	Trinidad	
		Venezuela	

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Department of *Business and Management*

Course of *International Financial Economics*

Mundell-Fleming Trilemma: Evolution in Emerging Markets

(Summary)

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1. Introduction

In the early 1960s, the macroeconomic policy model of the Keynesian open economy was extended individually by Robert Mundell and Marcus Fleming, whose goal was to systematically incorporate the role of capital flows into it. Fleming's contribution was concerned with examining the consequences of a country's choice of exchange rate regimes on the effectiveness of fiscal and monetary policies, arguing that the monetary policy was more effective under conditions of exchange rate fluctuations in absolute terms and in relation to a fiscal policy action of a certain magnitude. Instead, Mundell's contribution focused on how the orientation of monetary policy inwards or outwards depends on the type of exchange rate regime, showing how in an extreme case of perfect capital mobility the fiscal policy would be ineffective in restoring internal balance. Rudiger Dornbush decided in 1976 to codify Fleming's framework and Mundell's political analysis into what he called the Mundell-Fleming Model, which would later become known as the "Mundell-Fleming Trilemma" in the macroeconomic literature.

2. Theoretical framework

Trilemma's theoretical framework states that it is impossible to pursue all these three goals at the same time: monetary independence; exchange rate stability; financial integration (as free flow of capital).

Figure 1 – Trilemma combinations
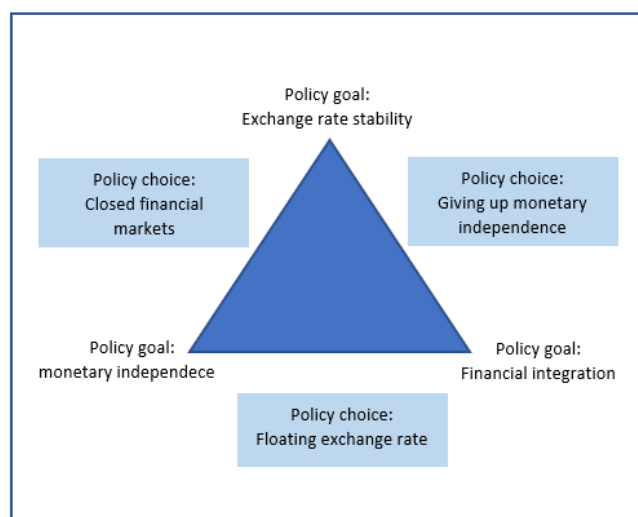
The specific technicalities of the individual options create conflicts between them because of their mutual exclusivity. To help us understand this compromise, we refer to *Figure 1*, where, in addition to the above-mentioned summits, all combinations of choices according to a given macroeconomic policy are presented. First, consider the scenario in which a fixed exchange rate regime is combined with perfect

capital mobility, typical of Eurozone or Currency Board member states. In a scenario where domestic and foreign government bonds are perfect substitutes, a credible fixed exchange rate implies that the national interest rate is equal to the foreign interest rate by virtue of the parity condition of the uncovered interest rate. Against this background, the central bank's desire to increase the money supply would generate downward pressure on the national interest rate, which in turn would induce investors to sell domestic bonds in search of a higher yield from foreign bonds. Because of these arbitrage forces, the central bank is faced with both an excess demand for foreign currency for the purchase of foreign bonds and an excess supply of domestic currency against it. Now, according to the fixed exchange rate assumed at the beginning, it will be necessary an intervention in the foreign exchange market to meet the public demand for foreign currency at the official exchange rate by the central bank which, as a result, will sell foreign currency to the public. In this process, the central bank recovers the oversupply of domestic money that is triggered by its own attempt to increase the money supply. The result is that the central bank loses control of the money supply, which is gradually adapting to the demand for money. An instrument of monetary policy transmission, such as an open market operation, only changes the composition of central bank balance sheets between domestic and foreign assets, without generating any effect on the monetary base and the domestic interest rate. This implies that, in a context such as that of a small open economy, the determination of the domestic exchange rate is relegated to the country in which the exchange rate is pegged.

A small open economy willing to maintain its financial integration can regain its independence in monetary policy by giving up the fixed exchange rate regime in favor of a variable exchange rate regime. This new combination shifts our analysis to the scenario presented on the lower side of the triangle in *Figure 1*. In a flexible exchange rate regime, the expansion of the money supply has a negative effect on the interest rate reducing it, and consequently generates an outflow of capital in search of a higher foreign return. For this reason, in a flexible regime that includes financial integration, the monetary policy of the country in question takes on greater importance and value than in the previous case. In fact, a greater supply of money reduces the interest rate, thus increasing national investments and, at the same time, weakens the national currency, which allows the economy to expand through increased net exports. An alternative way to regain monetary independence from a small open economy is to opt for a stable exchange rate regime at the expense of financial integration. This combination again shifts our analysis to the latest macroeconomic scenario offered by the left side of the triangle, which can be achieved through closed financial markets and an anchored exchange rate regime. Giving up financial integration means avoiding arbitrage between domestic and foreign securities, shifting the national interest rate from

the foreign one. Monetary policy operates in a similar way to a closed economy, where in the short term the central bank has control of the money supply and monetary expansion causes a reduction in the domestic interest rate.

3. Historical overview of global context, from 1960s to the new millennium

From the Second World War to the early 2000s, the emergence of new political forces, the development of the global context and new economic market relations have influenced the status that the Trilemma has assumed from time to time. The harsh lesson of the monetary chaos that reigned in the period between the two World Wars was the key to achieve a communion of intent among the main industrialized countries of the Western world regarding the creation of a system of rules and procedures for the control of international monetary policy. In fact, the Bretton Woods agreements of 1944 represent a compromise between the plans presented by the United States, which gave priority to the stability of the currency, and that of the United Kingdom, which focused on obtaining more space for monetary independence. It is clear that the many countries involved in the agreement were in one of the scenarios proposed by the "Trilemma", where the freedom of capital flows was at the expense. The compromise that formed the glue between the two visions was the consideration of gold as a lifeline for the Bretton Woods system, the same gold that was subject to rules reinforcing the autonomy of the central banks. The main points valid for all parties of the agreement can be summarized as follows: all currencies of the relative parties of the agreement had to be convertible into gold; central banks had to maintain a stable exchange system with the dollar; the creation of the International Monetary Fund with the task of monitoring monetary stability in order to restore open and multilateral international trade. Bretton Woods period showed the fastest growth of any modern exchange rate regime and the macroeconomic performance framework was further strengthened by a lower production variability of the member countries, generally lower exchange rates and interest rates exceptionally stable. In this context, it is essential to explain the role played by capital controls. The vision of the Bretton Woods system suggested that the use of such controls was essential to reconcile political autonomy with exchange rate stability.

Capital controls have been a practical tool for making credit controls effective despite the costs they entail, given their role as the usual tool that central banks assume. Central banks have used various credit controls and reserve requirements to fight inflation or, on the contrary, to increase production while keeping their relative interest rates stable. By operating in this way, the domestic interest rate has remained consistent with the remaining world rates and central banks have acquired the necessary autonomy to achieve their national unemployment and inflation targets. Although the alternative policy

described above shows that capital controls are complementary to credit controls, their indispensability must still be recognized, because without such restrictions companies could have simply borrowed funds from abroad to circumvent the controls. When capital controls were used to make credit controls effective, the spread between national and international interest rates remained close to zero. Getting back to the gold role, theoretically, the greater the gap between the price of gold on that market and the central bank price, set at USD 35 per ounce, the more interesting it was to address domestic economic issues by buying gold at a fixed price and then selling it on the open market. It came to the point where the possession of dollars was more valuable than the possession of gold. As long as other countries were willing to hold dollars, the United States had the freedom to make massive foreign expenditures for multiple purposes, financed by the peripheral countries of the system. As a result, the peak of the balance of payments and the sharp increase in public debt due to the military programs of that period meant that the dollar was increasingly overvalued compared to other currencies. In 1968, all efforts of the central government of the Bretton Woods system failed with the establishment of the two-tier gold market, forcing the United States to suspend gold sales to governments trading in private markets. The natural consequence of these actions was the increase in the price of gold well above the official price, causing the depletion of U.S. gold reserves due to the actions of some countries that continued to strengthen theirs. The dollar price in the market was then rising and the pressure on the official rate was unsustainable, so much so that a new devaluation of the dollar forced Japan and the Eurozone to break the balance of the Trilemma and allow their currencies to fluctuate without restrictions. This series of events put an end to the Bretton Woods system, whose participants were now redirecting themselves towards their new balance.

The governments of industrialized countries no longer needed capital controls to maintain a fixed exchange rate anchor as such an anchor no longer existed, a situation that encouraged capital flows from all countries. In fact, since the 1960s, capital controls could not be contained so easily, so that IMF operations were forced to adapt to a more dynamic environment, even though fixed exchange rate regimes were reluctantly abandoned and despite some countries were trying to maintain or recreate such frameworks. The new configuration of the Trilemma that was emerging, with a strong emphasis on capital mobility, entailed costs and benefits for global market participants. Clearly, the increased ability to lend and borrow represents a loosening of the constraints of a perfectly closed economy and provides many more benefits to global financial trade. This dimension protects and mitigates the effects of financial shocks, as well as allowing capital to aspire to higher returns than in the past. However, this mobility of capital has also raised concerns in other respects such as limited scope for action compared

to other policy objectives or risks of financial and balance of payments crises. After the elimination of gold convertibility at the beginning of the 1970s, a floating exchange rate regime became the norm, especially for industrialized countries, calling into question what had been done previously and placing greater emphasis on the various discussions on currency unions. The shift from a fixed rate regime with financial closures (as in the BW era) to one with opposite characteristics has generated a devastating impact on market balances such as a high rate of inflation, an increase in interest rates, a supply shock and a significant loss of deposits by banks in favor of new funds.

The growing financial openness culminated with the emergence of "neoliberalism" at the beginning of the 1980s, mainly characterized by free trade and aggressive deregulation of financial markets through the opening of savings and credit markets to competition, facilitating the entry of foreign banks and companies through the removal of restrictions on permitted banking activities and the privatization of public banks. Increased exchange rate flexibility and financial integration have allowed countries to exercise their monetary independence in line with Trilemma's implications. The abolition of capital controls, albeit with some delay, has significantly contributed to the increase in global current account deficits and surpluses and to increase concerns about global imbalances arising, especially in the United States but also in major industrialized lenders such as Japan or Germany. Compared to the standards of the previous regime, where current account imbalances were almost zero, the situation in the 1990s was very different: on the Western side, the US current account deficit in relation to GDP was about 6%; in Germany, the surplus was 7% of GDP; while in China, the current account surplus has shown an exponential trend since 1995, with a peak in 2007. Financial integration, combined with the transition to a tighter exchange rate regime, has also contributed to the creation of the Eurozone and the Mundell-Fleming Trilemma was a starting point to explain the pressures that cross-border capital flows exert on nation states. The scenario in which a country cannot maintain, at the same time, an independent monetary policy, set its own exchange rate and be financially open, shows that financial openness requires specific policy choices. One solution, offered by Mundell, was to neutralize any disruptions to international financial flows by harmonizing monetary policy and exchange rates. In a monetary union context, the sacrifice of their monetary policy is less serious if the members of the area have similar reactions to external impacts. According to the logic of the Trilemma, in addition to maintaining the ability to manage international pressures through exchange rate management, euro area member states should also manage free capital within the area. The loss of their monetary independence and the rapid acceptance of the euro as a currency of value have been seen by observers as a springboard towards a solid and prosperous Europe, which could balance the hegemony of the United States.

4. Emerging Markets' evolution

Capital flows to emerging countries have exploded since the beginning of 1990, reaching a net value of 228 billion dollars in 1995. The scale and volatility of these flows have generated opportunities that have opened the doors of foreign markets to the primary financial market but also several complications. These flows essentially consist of foreign direct investment (FDI), commercial loans, portfolio equity flows and debt flows. This latest new approach to financing has clearly generated imbalances in the financial situation of the beneficiary countries. The exposure of their balance sheets to foreign currency debt has now been subject to fluctuations in the financial markets in terms of interest rates and the value of the US dollar as the most popular and traded currency. For this reason, it is important to note that although variable exchange rate regimes were becoming increasingly widespread in industrialized economies, especially emerging markets have tried to maintain exchange rate stability through fixed or pegged exchange rate regimes, precisely because of the potential consequences of changes in borrowed currencies that could have devastating impacts on the amount of foreign debt held. In this context, it is clear that the macroeconomic decisions of emerging markets in terms of the Trilemma have therefore been oriented towards financial openness and exchange rate stability.

This model reflected their inability to borrow in national currencies, as explained by the "original sin" hypothesis put forward by Eichengreen, Hausmann & Panizza in their 2003 study, which defines the level of development, monetary credibility, debt level, exchange rate regime, yield curve slope and investor base size as its determinants. Specifically, in countries with a fixed regime there was great volatility in their domestic interest rate, while in floating regimes there was greater exchange rate volatility, a difference affecting the structure of the loans and showing that the adoption of the fixed exchange rate regime is the main reason for the dollarization of liabilities. A measure of original sin was also introduced in the same study through the use of certain indices that reflected the intensity of the phenomenon. In fact, these indices called OSIN1/2/3 vary from 0 to 1 and the higher this measurement is the more the target country will be subject to this problem. *Tab 1* shows the trend of the original sin value in years for different types of market. The flows of capital discussed so far have actually generated implications much more important. Over time, a growing percentage of countries with an index of "original sin" equal or close to one have been exposed to deep financial crises, induced by multiple and simultaneous "sudden stops" of such flows and the flight of "hot money", intended as the flow of funds (or capital) from one country to another in order to earn a short-term profit on interest rate differences and/or anticipated exchange rate shifts.

*Tab 1: Measures of original sin by country grouping (simple average)*

	OSIN1	OSIN1	OSIN2	OSIN2	OSIN3	OSIN3
Group	**1993-98**	**1999-2001**	**1993-98**	**1999-2001**	**1993-98**	**1999-2001**
Financial centers	0.58	0.53	0.34	0.37	0.07	0.08
Euroland	0.86	0.53	0.55	0.72	0.53	0.09
Other developed	0.90	0.94	0.80	0.82	0.78	0.72
Offshore	0.98	0.97	0.95	0.98	0.96	0.87
Developing	1.00	0.99	0.98	0.98	0.96	0.93
Latin American and Caribbean	1.00	1.00	1.00	1.00	0.98	1.00
Middle East and Africa	1.00	0.99	0.97	0.99	0.95	0.90
Asia Pacific	1.00	0.99	0.95	0.99	0.99	0.94
Eastern Europe	0.99	1.00	0.97	0.98	0.91	0.84
Source: Eichengreen, Hausmann, and Panizza (2002)						

Capital flows suddenly stop when foreign funding available to borrower countries dries up unexpectedly and without warning and the resulting effects vary according to the economic conditions of the countries affected, making them more or less vulnerable than others. In the case of emerging countries, there has been a general withdrawal of investors in short-term debt instruments. One of the various reasons for this was the poor structure of the global financial architecture, due to the lack of a lender of last resort resembling the ECB in providing liquidity to the Eurozone countries or the FED in promoting financial stability. Other strands of literature also attribute as a cause the different reaction of foreign and local investors to internal and external shocks or, instead, how foreign investors are more likely to withdraw or stop financing countries with poor financial performance or slow internal growth. As long as financial integration with industrialized countries guaranteed substantial cross-border inflows, the ability to meet their foreign currency obligations was not particularly compromised as part of these flows were converted into reserves to pay the foreign debt. However, the emerging markets underestimated the potential risks arising from such a strong relationship with foreign flows. In fact, the occurrence of "sudden stops" undermined their ability to meet their commitments, triggering serious limitations on the macroeconomic objectives they can pursue. The abrupt disruptions of cross-border flows have exposed the emerging countries under interest in potential currency crises because one of the main channels for creating savings got interrupted and doubts about the ability to have sufficient foreign exchange reserves to pay the debt considerably increased. In this context, the possibility of manipulating their reserves to defend themselves against possible speculative attacks and the risk of default would have been a solution

to the problem created. In fact, consisting of foreign bank deposits, foreign treasury bills and short/long-term foreign government bonds, these are used by central banks and competent authorities primarily as a tool for defending domestic currency and for debt payment. Central banks can intervene in the foreign exchange market through the management of assets and foreign exchange reserves in order to curb violent currency fluctuations and speculative attacks, as they are able to absorb the violence of shocks that could adversely affect a particular currency. Suppose, for example, that a central bank wants to stimulate economic growth. It will tend to adopt expansionary monetary policies that expand its balance sheet and lead to a decrease in the value of the currency it issues, so that exports become cheaper. At the same time, central banks may decide to purchase bonds denominated in foreign currency that they hold in the form of reserves and which will be purchased in exchange for an additional supply of liquidity that will be then placed on the market. When the supply of domestic currency is increased against a fixed demand, the value of the currency itself will decrease and, at the same time, the purchase of foreign currency (to buy bonds denominated in foreign currency) will increase its value with a "controlled" depreciation of the exchange rate. However, intervening in that context on the exchange rate by depreciating it through a monetary policy operation, moving towards more monetary independence, would have made the foreign debt more expensive and therefore more difficult to repay the overexposed emerging balances, a trade-off in full accord with the Trilemma's principle of exclusiveness.

The excess of domestic debt compared to the amount of reserves with which it should have been paid has so often led to the fiscal dominance of the countries in question, reducing the scope of their monetary policy. The main consequence of this operational deadlock saw as the only solution to fall back on existing foreign exchange reserves to meet external obligations and to delay exchange rate intervention as much as possible. The financial collapse occurred when the balance of payments crisis, due to the drying up of foreign exchange reserves after the stops, inevitably pushed countries to let their currency fluctuate, as in the case of the peso in Mexico and the baht in Thailand, suffering an uncontrolled fall in the value of their currency as a result of the delay (*Figure 2*). This cascade effects best reflect the concept behind the Mundell-Fleming Trilemma. The attempt to pursue all the proposed objectives in a polarized manner is in fact unfeasible unless controlled intermediate regimes or risk hedging instruments are adopted. Therefore, having a fixed exchange rate regime to avoid fluctuations in the value of the debt and, at the same time, embracing the integration of financial markets with industrialized countries meant giving up monetary independence, given the scarcity of reserves and the large currency exposure of the debt induced by sudden stops experienced. This is because there is no condition to operate in perfect capital markets, something we have witnessed happen with the boom and boost cycles' alterations.

Figure 2- USD/MXN exchange rate 1990-2010 and USD/THB exchange rate 1985-2015
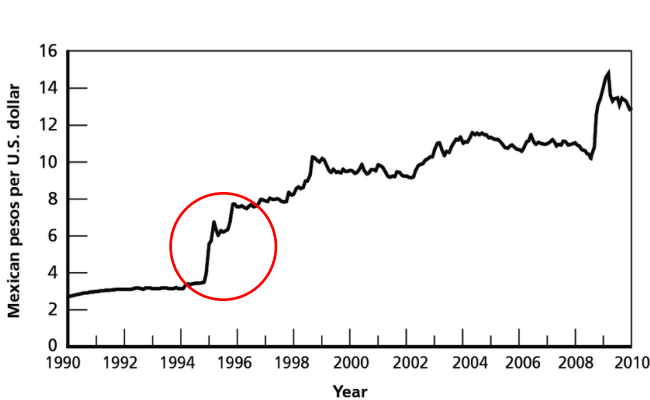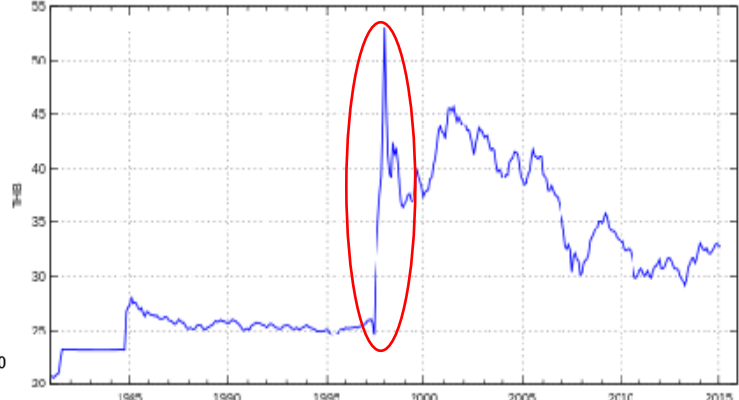
Source: BANXICO (2012)   Source: Wikiwand.com (2016)

5. Crisis, solutions and considerations about EMs' behaviors and approaches

Given the high number of financial stress situations experienced by emerging markets, my study will focus on analyzing similarities and differences among them. In terms of similarities, the months leading up to each of the emerging crises saw a large increase in foreign capital inflows, a large proportion of which were debt flows. The reason for this increase lies in one of the market constants of those years, namely the offer of cheaper short-term dollar-indexed debt securities issued mainly to Mexico with "Tesobonos" and Thailand. Latin American and Asian borrowers deliberately neglected the possibility of hedging even large currency exposures with appropriate instruments, both because the derivatives market was not adequately structured yet in that period and because the purchase of those products would have increased the cost of loans abroad. Another similarity is how all crises took investors by surprise. Despite the considerable problem of "foreign debt", Mexico's decision to let the peso fluctuate was unexpected, as the debt restructuring and interest rate stability processes implemented after the crisis of the 1980s were conveying more optimism to the market. Likewise, investors were taken by surprise by the extent and intensity of the Asian crisis, as they were reassured in part by the strong growth prospects that the expansionary share price trend suggested, in part by the cautious fiscal policies they were adopting and in part by the confidence the banks had in potential government intervention in the event of insolvency. The theme of "contagion", defined as the extension of the spillover effects that crises have generated on surroundings similar countries, is a watershed between the similarities and differences of crises in emerging markets. Although contagion is a common element in crises, there have been several channels that have facilitated the spread of economic problems. In the case of the devaluation of the Thai baht, commercial transmission channels have made Thai exports cheaper for foreign buyers, implying a

reduction in foreign demand from other Asian countries such as Indonesia. This caused an increase in its current account deficit which should have covered the increase in foreign debt but, due to sudden arrests, forced the country to turn to currency reserves leaving less US dollars to defend the rupee. This process has made Indonesia, as well as other Asian countries similar to it, more vulnerable in the eyes of investors who have launched speculative waves on the possible devaluation of the local currencies of the affected countries. Moreover, the trade channel also had an effect on imports. The devaluation of the baht also automatically increased the cost of imports, which reduced the relative amount for countries like Laos and similar, increasing their current account deficits and also putting their currencies under pressure.

Differently, a valid channel of spread of contagion for South American countries has been the "bandwagon effect", which explains the apparently irrational behavior observed in their currency crises, justifying the trend that saw liquid foreign investors as less willing to lend to Latin American markets after a currency collapse. In fact, as a result of the depreciation of the Mexican peso, foreign banks that were still solid became reluctant to lend to countries like Argentina or Brazil, as investors treated the Mexican crisis as new information about countries that seemed to have similar fundamentals to Mexico, lowering their expectations about the possibility of repayment of foreign debt from the other sides. Although the commercial and financial channels were valid for both the Latin and Asian economic crises, the effects of the former were milder than those of the latter. In fact, as the first difference between the crises we see the ties between Mexico and the United States with the Clinton government's commitment to make America a sort of lender of last resort for South American countries, reducing liquidity problems and concern about debt repayment through the rapid containment of Mexican bond spreads compared with those of other Latin securities. On the contrary, Asia could not benefit from the same guarantee lines despite the IMF's efforts, considering as justification for this difference the ratio of domestic credit to GDP which was lower in South America compared to Asia at the time of the respective crises, so that Latin America had more room to raise interest rates without generating a large amount of defaults. The global economic context in which the crises developed was also different. In the months leading up to the Latin debt crisis of the 1980s, industrialized countries were increasingly on the brink of recession, recording a significant slowdown in GDP growth. The opposite context was that of the world economy in the 1990s, much more favorable to foreign economies, with an increase in world trade of over 6% per year and lower levels of inflation and nominal interest rates. With declining asset yields in the more developed markets, emerging markets became more attractive to foreign investors and risk premiums also decreased due to the development of greater risk tolerance on the part of investors.

In view of what they experienced during the currency crises and in order to better preserve and control their welfare, many emerging markets have decided to adopt and use preventive safety measures and instruments such as precautionary accumulation of reserves, swap lines and macroprudential policies. While the former is a natural consequence of what happened in the 1980s and 1990s with the drainage of reserves, the other two instruments have found their development after the 2008 global financial crisis. The magnitude and speed of the reversal of capital flows that caused the currency crises highlighted the hidden budgetary vulnerabilities of developing countries, forcing their markets to revise their risk forecasts and put in place their "self-sufficient" defense systems against a new reckless drainage of capital flows that would lead them to collapse again.

However, precautionary accumulation of foreign reserves has different interpretations. Aizenman and Lee (2007) see this hoarding of reserves as a stabilizer of production while Rodrik (2006) as a limiting tool for the costs generated by the reversal of cross-border capital inflows. However, my focus is more on Obstfeld, Shambaugh and Taylor's (2010) arguments that link reserve accumulation to the "fear of fluctuation" that manifests itself in rigorous exchange rate management to stimulate trade, mitigate destabilizing balance sheet shocks with dollar liabilities or provide a transparent nominal anchor for inflationary expectations. Precautionary accumulation is the perfect answer to block the knock-on effect that emerging countries suffer from sudden arrests and high external debt. The possession of reserves that cover more than their exposure to foreign debt has allowed countries to shake off the so-called "fear of fluctuation" because, with more reserves, only a part of them would be used to repay foreign securities, while the rest would give back space to the management of the monetary policies of the countries in question to protect themselves from speculative attacks or propose development actions. In this way, we moved towards a stable but more flexible exchange rate regime, greater monetary independence and a financial integration less open to certain types of inflows, converging towards intermediate levels of trilemma that included the possibility of being able to simultaneously pursue all the objectives proposed by the theory. The accumulation of foreign exchange reserves by emerging economies continued for several years at an unprecedented rate, remaining at very high levels. However, its effectiveness and validity have been much debated over time, since the financing of a prolonged and substantial accumulation brings with it not only positive effects but also potential problems such as: the fiscal costs of interventions; future monetary imbalances; financial sector imbalances and the implications for financial intermediation, all of which had to be solved by calculating the optimal level of reserves. The global financial crisis of 2008 and the subsequent Eurozone crisis confirmed that no country is immune from exposure to costly financial instability. Therefore, given potential reserve problems, emerging

countries with more mature institutions and deeper fiscal capacities have gained more resilience and stability thanks to auxiliary instruments such as swap lines or macroprudential policies. In principle, swap lines between major economic powers and smaller counterparties can replace or supplement the accumulation of reserves as self-insurance against potential crises. The activation by the FED with an unprecedented offer of $120 billion to major emerging countries such as Brazil, Korea, Singapore and Mexico is in line with the view that the shortage of dollars experienced by the Eurozone and other OECD countries during the global financial crisis put these countries in the position of "too big and too expensive to fail" from the US point of view and that such a provision would have given to the beneficiaries elastic access to the dollar liquidity needed for their dollar exposures by reducing the interventions on their reserves. Swaps act as a stabilizer of market concerns about the risk of losing control due to delevereging pressures, thus they avoid downward pressure on international reserves and the exchange rate to replace the need to accumulate reserves. The swap lines are linked to a "moral risk" that refers to the uncertainty over the duration of these lines and the persistent concern that, in their absence, the initial level of reserves would not be sufficient to avoid the dynamics of the crisis, paradoxically inducing a new accumulation of currency. Therefore, the creation of reserves depends on whether or not there are fiscal backstop mechanisms to support their use and the potential consequences, leading swaps to play only a secondary role with respect to reserves.

The new millennium has also led to the development of another "defense system" to protect the welfare of economies, the "macroprudential policies". Before 2007, there was a general consensus in central banks on most of the monetary and supervisory policy strategies to be adopted as to avoid what had already happened in the past. However, the global economic recession called into question all the basic policy strategies used until then to manage the economy, bringing a new focus precisely on systemic risk-oriented macroprudential regulation and macro-surveillance rather than on the riskiness of individual financial institutions. The "systematic nature" of the risk for which such policies are adopted concerns the general objective of mitigating financial market cycles and domestic credit conditions, which represent some of the main channels for the propagation of economic shocks. In fact, due to the unprecedented quantitative easing policies and the persistent political uncertainty in advanced economies, many of them are still subject to high volatility in short-term capital flows. These, if not treated appropriately, could lead both to an amplified currency appreciation cycle and to more favorable credit conditions that would accumulate new risks in the countries' balance sheets. The wide range of actions that can be linked to the concept of "macroprudential policies" may include adequate disclosure, capital requirements, liquidity requirements, timeliness of corrective actions, close monitoring of

sovereign risk procedures, close supervision of financial institutions and similars. Obviously, the alternatives proposed leave much room for interpretation, as these items can be divided into other minor interventions, whose applications varies according to the conditions and characteristics of the country.
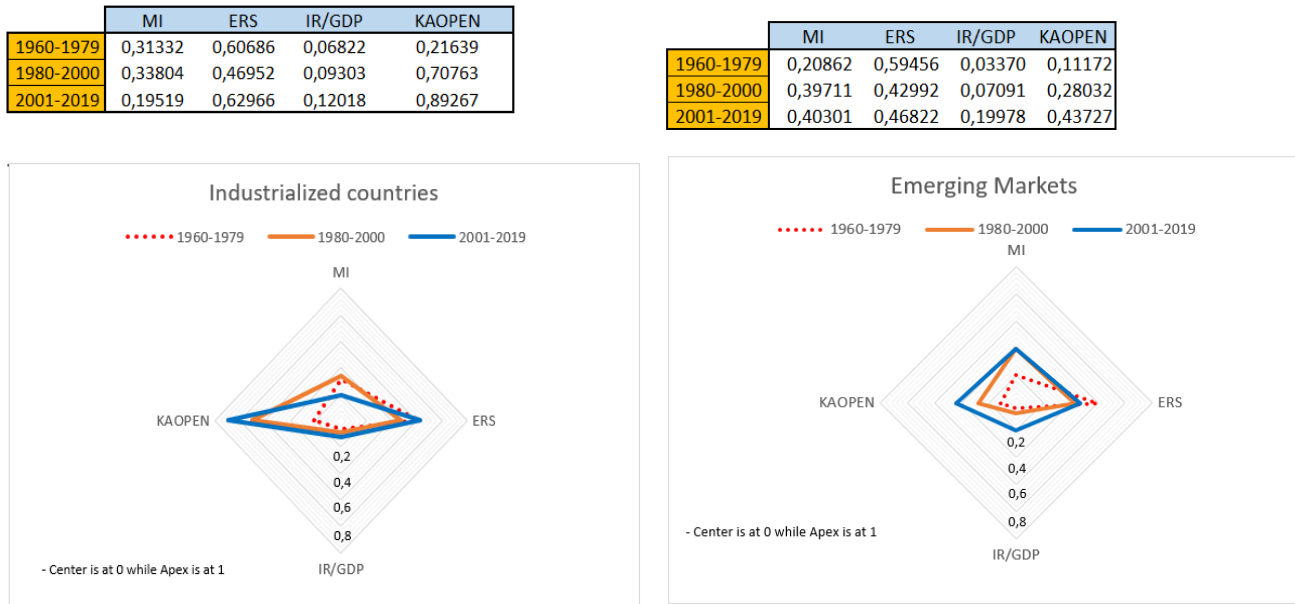
6. Empirical Analysis

The empirical work carried out in this thesis follows a very precise logic, that starts from the analysis and representation of Trilemma combinations adopted by emerging markets and not, in order to investigate in depth the behavior of specific types of market analyzing the triggering causes. The macroeconomic goals provided by the theoretical framework of Trilemma have been represented under the form of indices by Aizenman, Chinn and Ito (2009) in order to analyze values and trends over time. These correspond to: ERS index for exchange rate stability; MI index for monetary independence; KAOPEN index for financial integration intended as free mobility of capital. Starting from these indices, I broaden the time horizon of the analysis previously considered in their study in order to capture new market dynamics, splitting that time in different sub-horizons with specific features and representing the results through diamond charts normalized between 0 and 1 that count as fourth vertex the IR/GDP index, in support of the phenomenon of hoarding of reserves that has played a crucial role in the evolution of emerging markets.

The graphs in *Figure 3* show the data of the two most important types of markets, but my analysis also considered other subtypes of markets such as industrialized countries without Eurozone ones, Asian and South American emerging markets, non-emerging markets. The combined data and graphs show how industrialized countries and emerging markets have progressively oriented their policies towards greater financial integration with a more marked transition in the former, which have tripled their KAOPEN value in 60 years. On the other hand, the discussion on monetary independence is different, since industrialized countries are recording a strong decrease in terms of MI due to the birth of the European Monetary Union and its conservative policies, while an opposite trend is registered for emerging markets. About the latter, it should also be noted a drastic reduction in the ERS index in the second subgroup related to crises, a decrease justified by the significant collapse of South American and Asian currencies. In general, the industrialized countries always present over time a Trilemma scenario based on 2 of the 3 objectives (KAOPEN and ERS as latest), while the emerging countries have developed in the last 20 years an approach that includes all the objectives simultaneously. Indeed, the ERS values show a positive adjustment in the last subgroup to support how this type of market has regained strength in terms of the national currency after past experiences. This, together with a significant progressive increase in the

IR/GDP index and the aforementioned increase in MI, represented the period of adjustment of emerging markets towards intermediate Trilemma regimes, which sees countries pursuing all the macroeconomic objectives proposed by the theory with values of each index settling around 0.45 on average.

Figure 3 – Indexes Tracking

	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,31332	0,60686	0,06822	0,21639
1980-2000	0,33804	0,46952	0,09303	0,70763
2001-2019	0,19519	0,62966	0,12018	0,89267

	MI	ERS	IR/GDP	KAOPEN
1960-1979	0,20862	0,59456	0,03370	0,11172
1980-2000	0,39711	0,42992	0,07091	0,28032
2001-2019	0,40301	0,46822	0,19978	0,43727

By virtue of this convergence towards intermediate levels, I then investigated the behavior assumed in terms of Trilemma's choices that the countries of a given type of market adopt with respect to the average of the same. For this reason, I introduced a new divergence index "d" to measure this behavior. The tracking of the index shows how emerging countries have recorded on average lower "d" values over the last 15 years ($\bar{d} = 0,82$) than all other types of market, demonstrating that this convergence is not simply the result of balancing different behaviors but rather that they have been acting in the same way and to the same extent in the last years. Given the importance of the accumulation of reserves for the loosening of the stringent constraints of ERS in favor of greater MI and thus ensuring greater freedom of action for emerging countries in their choices, I investigated the relationship between the "d" index (dependent variable) and IR/GDP (independent variable). *Figure 4* shows, first of all, the goodness of the sample data, avoiding any problem about the randomness of the results. Secondly, the graph shows how there is on average a negative correlation between the two variables, meaning that greater reserves correspond to lower levels of divergence and therefore asserting how the greater freedom of action guaranteed by the precautionary hoarding of reserves has actually stimulated emerging countries to reach the intermediate regimes through similar Trilemma's approaches of similar intensities. More evidence of negative

correlation emerges from South American and Asian countries, while African countries present contrasting results, probably due to a lower average IR/GDP index (0.093) compared to South America (0.183) and Asia (0.198), demonstrating a precautionary accumulation of reserves of not the same intensity as the other realities considered so as to have the same margin of action in terms of Trilemma's choices to adapt to the intermediate trend that was developing. It should also be noted that Mexico has the highest correlation coefficient among South Americans, probably due to the fact that the process of adjustment between reserves and intermediate regimes took place after the Mexican crisis of 1984 and therefore much earlier than the other countries under discussion. In contrast, the Asian countries with negative coefficients correspond to those involved in the Asian trade and financial agreement called ASEAN, which means that, despite the reserves, regional aspects have also helped the countries to work in a similar way.

Figure 4 - Panel regression

	LATAM				AFRICA				ASIA			
	Argentina	Brazil	Mexico	Chile	South Africa	Morocco	Nigeria	Tunisia	South Korea	Malaysia	Philippines	Thailand
Independent variables	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
Constant	0,69742 (5,43E-09)	1,27090 (2,40E-20)	1,61405 (6,46E-13)	1,14479 (3,93E-11)	1,02838 (2,66E-19)	0,78420 (4,88E-12)	0,85736 (6,46E-07)	0,51985 (4,76E-09)	0,79174 (1,94E-09)	3,35646 (6,33E-12)	0,88979 (4,37E-17)	1,24185 (1,01E-16)
IR/GDP	0,78154118 (0,0000280)***	-3,19041547 (0,0002013)***	-5,28252122 (0,0099660)***	-0,36014342 (0,6693570)	-1,78245049 (0,0645282)*	0,80842265 (0,1171025)°	0,88558658 (0,5486932)	1,31719402 (0,02879991)**	0,08636284 (0,8936545)	-5,98884790 (0,0000023)***	-1,55408499 (0,0006394)***	-1,62107134 (0,0000274)***
Observations F-statistic	43 0,000028	43 0,000201	43 0,009966	43 0,669357	43 0,064528	43 0,117103	43 0,548693	43 0,028799	43 0,893654	43 0,000002	43 0,000639	43 0,000027

Note: °p<0,015, *p<0.10, **p<0.05, ***p<0.01.

Concluding Remarks

The evolution of the Trilemma Mundell-Fleming in emerging markets has been subject to multiple challenges over time, facing numerous crises but showing resilience to emerge with greater stability and balance. The current intermediate regimes represent a unique feature from a theoretical point of view and see the precautionary hoarding of foreign exchange reserves as a determining factor in the definition of this new scenario since they have allowed countries to manage their macroeconomic policies more freely, stimulating their choices and relative intensities towards the average of the market they belong to. By virtue of a natural potential development of the market and other useful instruments such as derivatives or macroprudential policies, along with a strengthening and economic consolidation of emerging countries, I suppose that the intermediate level is meant to grow more and more, guaranteeing this type of market an ever-increasing intensity of its policies.