

**CURRENCY CRISES IN LATIN AMERICA:
CASE STUDY OF MEXICO, BRAZIL AND ARGENTINA**

BY

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ABSTRACT

The discussion of currency crises has been one of the popular topics in international economics. Since many countries adopt financial liberalization, the impact of the currency crises has become more serious and more infectious to other countries. I examined three recent cases of currency crises in Latin America: the Mexican crisis in 1994, the Brazilian crisis in 1999 and the Argentine crisis in 2002 (According to the IMF paper, 2001). Although many economists now pay attention to the relationship between the problems of financial sector and currency crises, I focus on the unique pattern of Latin American currency crises, fixed exchange rate, overvaluation of the currency, deterioration of the external sector and capital outflow. From this pattern, I recommend real exchange rate, international reserves and current account deficit as effective indicators of currency crises in these countries. I also examined how much fixed exchange rate contributed to the control of inflation in these countries by OLS, and found that it contributed significantly to the reduction of the inflation.

1. INTRODUCTION

In the last half of the Twentieth Century, Latin America suffered repeatedly from currency crises, which caused serious economic damage to these countries. Economic growth often slowed down or contracted and people suffered from high inflation rates as well as high unemployment rates. As financial liberalization expands worldwide after the 1990's, currency crises have become more contagious to other countries and their impacts have become greater.

In this paper, first, I will discuss general ideas about currency crises, including the definition of currency crises and models of currency crises. Also, I will discuss currency regimes for a better understanding of currency crises in these countries since the type of currency regime determines the nature of the crises. Then, I will examine three recent cases of currency crises in Latin America; the Mexican crisis in 1994, the Brazilian crisis in 1999, and the Argentine crisis in 2001-02. In three cases, I find there is a unique pattern of currency crises which cannot be explained in popular currency crisis models. I discuss this pattern, and examine it by CART (Classification of Regression Tree).

The objective of this thesis is to examine what happened before and during the currency crises in Mexico, Brazil and Argentina, and find the leading indicators of currency crises in these countries.

2. CURRENCY CRISES AND CURRENCY REGIMES

2-1. Definition of Currency Crises

What are currency crises? Currency crises are generally defined as situations in which speculative attacks on the exchange rate value of the currency result in devaluation. The most famous ones after 1990 are the European currency crisis in 1992, the Mexican crisis in 1994, the East Asian Crisis in 1997, the Russian crisis in 1998, the Brazilian crisis in 1999 and the Argentina crisis in 2001-02. These crises not only caused serious economic depression to the effected countries, but also gave rise to turmoil in the international financial market. Many economists showed great concern and argued about them.

However, many currency crises occure frequently throughout the world though most of them are not paid much attention by economists and investors. According to the IMF working paper written by Andrea Bubula and Inci Okter-Robe, 160 currency crises happened during 1990-2001 (Bubula and Okter-Robe 2003, See Appendix1).

They defined currency crises using the exchange market pressure (EMP) index. This index is calculated as a weighted average of monthly percentage change in exchange rate vis-à-vis the anchor country and monthly variation in percentage points in the domestic interest rate:

$$I = \alpha_1 A + \alpha_2 B$$

(where A is percent change in exchange rate and B is interest rate variation.)

The weights α_1 and α_2 are set so that the volatility of each weighted-component is equal and their sum is equal to 1:

$$\alpha_1 + \alpha_2 = 1, \alpha_1^2 \text{variance}(A) = \alpha_2^2 \text{variance}(B)$$

Solving these two equations, one can obtain the weights as:

$$\alpha_1 = \frac{\sigma_B}{\sigma_A + \sigma_B} \text{ and } \alpha_2 = \frac{\sigma_A}{\sigma_A + \sigma_B}$$

(where, $\sigma_A = \sqrt{\text{variance}(A)}$ and $\sigma_B = \sqrt{\text{variance}(B)}$ are sample standard deviations for A and B.)

Crises are defined as period in which the EMP index exceeds its sample mean by at least three standard deviations (“Are Pegged and Intermediate Exchange Rate Regimes More Crisis Prone?” IMF Working Paper, Andrea Bubula and Inci Okter-Robe).

Also, Nestor Adrian Amado, Ana Maria Cerro and Osvaldo Meloni defined currency crises by means of a Market Turbulence Index (MTI) which is the sum of exchanges in three variables: the exchange rate, international reserves and the interest rates weighted by the inverse of their variability. The index stems from the idea that market pressure increases when exchange rate devaluates, when interest rates increase and when international reserves fall (Amado, Cerro and Meloni 2004).

Generally, currency crises are defined by one of the following ways:

- A. large depreciation of exchange rates
- B. large depreciation and loss of foreign reserves
- C. large depreciation, reserves loss and hike of interest rates
- D. large depreciation and hike of interest rates

In my paper, I use Andrea Bubula and Inci Okter-Robe’s definition for identifying the currency years for Mexico, Brazil and Argentina. Although several alternative definitions for identifying crisis years exist, I did not use definitions based on foreign reserves owing to the noise contained in such data. During the study’s sample period of

1990-2001, using Andrea Bubula and Inci Okter-Robe's procedure, currency crises occurred in 1994 for Mexico, in 1990 and 2001 for Argentina and 1997 for Brazil.

2-2. Models of Currency Crises

There are several popular ways of classifying currency crises. Major crises models are three generation-models: first-generation models, second-generation models and third-generation models.

First-generation models were developed by Krugman, who focused on the fiscal and monetary causes of crises. In these models, unsustainable money-financed fiscal deficits led to a persistent loss of international reserves and ultimately ignited a currency crash (Krugman 1979). These models are mostly developed to explain the crisis in Latin America in the 1960's and 1970's (Kaminsky 2003).

Second-generation models focus on the governments' decisions. When the government is facing conflicting targets like a high unemployment rate, the government compares the benefits from changing the exchange rate versus defending it. If in case the cost of keeping exchange rate is too high, the government is likely to abandon fixed exchange rate regime. So the government decision plays a decisive role for inducing currency crisis in second-generation models, while it is not a key factor in first-generation models. Second-generation models, which were developed by Flood, Garber and Obstfeld, became widely recognized after the first-generation models failed to explain the European Monetary System crises in 1992-1993 (Flood and Garber 1984, Obstfeld 1994, Amado, Cerro and Meloni 2004).

Third-generation models focus on the problem of the banking system. The Asian currency crisis in 1997 was the starting point for third-generation models. At that time, Asian economies did not face fiscal imbalances nor had any incentives to abandon the pegged exchange rate. Besides, all countries were facing excess lending in their financial markets, and financial intermediaries played a central role in the crisis. Neither of first-generation models nor second-generation models failed to explain fully about Asian currency crisis, thus third-generation models appeared to explain it.

More, recent literature identifies other models such as liquidity crises and sovereign crises. Liquidity crises are caused by a sudden stop or massive reversal in capital inflows, and are called sudden stop models (Amado, Cerro and Meloni 2004). Sovereign crises are concerned with the ability or the willingness of a country to service the debt (Kaminsky 2003).

In the case of currency crises in Mexico, Brazil and Argentina, which model is most appropriate? Kaminsky classified the Mexican crisis in 1994 as a third-generation model in her paper (Kaminsky 2003). However, massive capital outflow was another main factor for the Mexican crisis, which means it also can be explained by sudden stop model. So, it's not appropriate to explain the Mexican crisis by third-generation model only. Usually, currency crises come from several factors and their causes are not simple enough to explain by one model. For example, Amado, Cerro and Meloni investigated currency crises in Argentina from 1885 to 2003, and argued in their paper that fiscal imbalance is always an important factor, therefore, means first generation models are appropriate, however, there are some factors associated with second-generation models

and third generation models as well (“Currency Crises in Argentina: An Empirical Investigation”).

Also, there is controversy regarding the definition of generation models themselves. Especially, the concept of third-generation models has not clearly defined yet. Krugman and others emphasized on moral-hazard-driven lending while Chang and Velasco focus on liquidity problem of financial intermediaries (Krugman 1999, Chang and Velasco 1998).

Thus, it is not appropriate to explain recent currency crises of Mexico, Brazil and Argentina by existing generation models. I will examine the peculiar patterns of these crises by examining each case deeply and explain them by analysis with a non-parametric statistical technique.

2-3. Currency Regimes

It is useful to know about the currency regimes before discussing currency crises. There are broadly two types of currency regimes; pegged regimes and floating regimes. In the case of pegged regime, the government determines the exchange rate and maintains it by intervention to the market. In the case of floating regime, exchange rate is determined by the market, i.e. the balance of demand and supply of the currency.

The most important merit of pegged regime is that it reduces exchange rate risk. Also, for most developing countries, a pegged regime gives their currency more credibility by the anchor currency such as US dollar thus controls inflation rate. On the other hand, under the pegged regime, the government will have more difficulty in adopting monetary policy. For example, under the pegged regime, domestic interest rates

are more influential to international interest rates thus the government will have difficulty in controlling domestic interest rates. Also, the intervention to the exchange rate market changes the amount of monetary base thus they have to sterilize to reduce the effect of intervention to the domestic market. Another disadvantage is that pegged regime often causes overvaluation of the currency thus they tend to lose their competition in export market and their external balance will likely worsen.

One of the most important benefits of floating regime is the government has more flexibility in managing monetary policy. Since the exchange rate is determined by the market, overvaluation of the currency hardly happens thus they can keep market competitiveness. However, floating regime brings about exchange rate risk, and this might curb foreign investment. Also, under the floating exchange rate, developing countries often have difficulty in controlling inflation since floating exchange rate is likely to bring about import inflation.

Exchange rate regimes can be classified more precisely. Jeffrey A. Frankel divided exchange rate regimes into nine categories as follows:

1. Free floating: define as an absence of regular intervention in the foreign exchange market
2. Managed float: define as a absence of a specific target for the exchange rate
3. target zone, or band: define as a margin of fluctuation around some central parity
4. Basket peg: define as fixing, not a single foreign currency, but to a weighted average of other currencies
5. Crawling peg: define as a pre-announced policy of devaluing a bit each week

6. Adjustable peg: define as fixing the exchange rate, but without any open-ended commitment to resist devaluation in the presence of large balance of payments disequilibria
7. “Truly fixed” peg: defined as fixing with a firm and lasting intention of maintaining the peg
8. Currency board: defined by three characteristics: fixing not just by policy but by law, backing increases in the monetary base one-for-one with foreign exchange reserves, and allowing balance of payments deficits to tighten monetary policy and thereby adjust spending automatically
9. Monetary union: defined as the adoption of a foreign currency as legal tender; this includes the special case of dollarization

(Frankel 1999)

Which currency regime was in place in Mexico, Brazil and Argentina respectively before the crises? In the case of Mexico, a crawling peg was implemented before the crisis in 1994. Under the crawling peg regime, the Mexican government kept the exchange rate vis-à-vis the dollar in a narrow target band, but the upper limit of the band was raised slightly every day by a pre-announced amount, allowing for a gradual nominal depreciation. Argentina had adopted currency board regime for more than 10 years until the crisis happened in 2002. The monetary base was 100 percent backed by foreign reserves (with some flexibility in certain circumstances) and full convertibility of the peso at parity with the US dollar was legally guaranteed. In the case of Brazil, the government kept the exchange rate strictly as one real to one dollar so it applied to “truly

fixed” peg. So, in every country, the governments took a kind of fixed exchange rate system to control notable hyper-inflation.

3. THREE CASE STUDIES OF CURRENCY CRISES

3-1. The Currency Crisis in Mexico

During the 1980's, the Mexican economy was stagnant owing to external debt problems. GDP growth rate often showed negative figures, and the inflation rate was as high as around 100 percent at annual rate. The Mexican government struggled to recover its economy. They changed its economic policy from state-owned economy to market-oriented economy, and adopted drastic economic reforms such as trade liberalization and privatization. Regarding the currency, the government adopted the crawling peg exchange rate system to control inflation. The government kept the exchange rate vis-à-vis the dollar in a narrow target band, but the upper limit of the band was raised slightly every day by a pre- announced amount, allowing for a gradual nominal depreciation.

Carlos Salinas, who became president in 1988, implemented further liberalization including re-privatization of the banking system and succeeded in its economic recovery. Since 1989, GDP growth rate increased to about 4 percent and the inflation rate dropped significantly to around 20 percent at annual rate. He also succeeded in solving the external debt problems by adopting the Brady Plan¹, which enabled Mexico to exchange

¹ Named after U.S. Treasury Secretary Nicholas Brady. In this plan, debtor countries issue Brady Bonds in exchange for commercial bank loans. Since they were tradable and came with some guarantees, in some cases they were more valuable to the creditors than the original sovereign bonds. Brady Bonds were created in March 1989 and issued by mostly Latin American countries after many of these countries defaulted on their sovereign debt in the 1980's (Wikipedia).

its sovereign debt into tradable instruments. Thus, Mexico regained international credibility, and was admitted as a first Latin American member of OECD (the Organization for Economic Cooperation and Development). Mexico also launched the trade union with the US and Canada, called NAFTA (North America Free Trade Agreement). Mexico began to attract foreign investors and a large amount of foreign capital surged into Mexico.

However, this large capital inflow caused an economic bubble. From December 1988 to November 1994, credit from local commercial banks to the private sector rose in real terms by 277 percent (Gil-Diaz 1998). Also, the current account deficit became a serious problem. Owing to the trade liberalization and fixed exchange rate, imports accelerated and the current account deficit increased significantly to the level of more than 5 percent per GDP after 1991.

In addition, political shocks occurred one after another in 1994, the election year of the Mexican president. First, a rebellion in the southern province of Chiapas officially occurred on January 1, 1994, the day when NAFTA took effect. In March, the most-likely-to win candidate of the ruling party, Luis Donaldo Colosio, was assassinated. In June, the prominent businessman, Alfredo Harp, was kidnapped. In September, another prominent official, Jose Francisco Ruiz Massieu, was assassinated.

This damaged the credibility of Mexico and began the flight of capital. Also, the rise of the US interest rate accelerated capital outflow from Mexico (Whitt 1996). To prevent the depreciation of the currency, the central bank intervened to the financial market, and foreign reserve decreased enormously. The government also raised interest rates to maintain the exchange rate, which caused the stagnation of the economy. Still,

people feared that the Mexican government would abandon the crawling peg exchange rate system, and capital flight didn't stop.

Finally, foreign reserves dropped to a critical level of 6 billion dollars in December 1994, and Mexico became unable to maintain the exchange rate. The new Mexican government, led by the president Zedillo, announced the adoption of the floating exchange rate system on December 22, 1994. By the end of December 1994, the Mexican peso depreciated 35 percent from the value of the previous month. At that time, Mexico was issuing sovereign bond, called tesobonos, which assured the payment in dollar terms, and 10 billion dollars of tesobonos was slated to mature in the first quarter of 1995. International markets feared the default of the Mexican government. However, with financial aid from the US and IMF, Mexico narrowly escaped from default.

The Mexican economy experienced a severe depression in 1995. GDP growth rate dropped significantly to negative 6 percent, which was the deepest GDP drop Mexico had ever experienced in 50 years. Currency depreciation accelerated inflation and the CPI annual increase rate was as high as 35 percent in 1995.

However, the Mexican economy showed recovery after 1996, led by the increase of export. GDP growth rate showed more than 5 percent from 1996 to 1998, and inflation rate reduced gradually to 9 percent at annual rate in 2000.

3-2. The Currency Crisis in Brazil

Brazil was long suffered from hyper-inflation. The cause of the Brazilian inflation was regarded to be an inertial inflation phenomenon. Prices were adjusted on a daily basis according to changes in price indexes and to the exchange rate of the local

currency. Brazilian government adopted measures for controlling inflation one after another. But they couldn't solve it until the implementation of the Real Plan.

The Real Plan was introduced by Fernando Henrique Cardoso, Minister of Finance in Itamar Franco Government on July 1, 1994. The main element of the Real Plan was price control by fixed exchange rate system. A new official currency, the real, was introduced and its value was fixed to be one real to one dollar. The main difference from the previous inflation policies was that the Real Plan was based on the de-indexation and didn't depend on general price freeze. The Real Plan also included fiscal reforms to decrease notable government debt and opening economy.

The Real Plan proved to have the most successful result in controlling inflation in Brazilian history. The monthly inflation rate dropped from 45 percent during second quarter of 1994 to less than 1 percent in 1996. The fall in inflation benefited mostly to lower income group since they had limited access to indexed savings and their nominal wages had been lagging behind the inflation. Domestic demand increased led by the consumption of lower income group, and economic activity boomed strongly. GDP growth rate showed a figure as high as positive 6 percent in 1994 and 4.2 percent in 1995.

However, the Real Plan affected the external balance negatively. Owing to the real appreciation of the currency and opening economy, imports accelerated rapidly. The trade balance, which had been surplus until 1994, turned into deficit in 1995, and current account deficit increased. Also, Brazilian government was unable to reduce government spending, and public debt remained high. Since the government adopted a high interest rate to maintain the value of the currency, the government suffered from huge of interest payments for public debt.

Also, high interest rates restrained investment and affected negatively to macro economy. GDP growth rate decelerated to 2.8 percent in 1996 and 3.2 percent in 1997. Unemployment rate increased from 4.6 percent in 1995 to 7.6 percent in 1997. High interest rates also negatively affected fiscal balance since it increased the interest payments of the government debt.

In addition, the Russian currency crisis in 1998 attacked Brazilian economy. Investors feared that it might affect Brazil since it was suffering not only from government deficit but also current account deficit. Moody's, credit rating service, downgraded Brazilian long-term bond from B1 to B2, and the credibility of Brazil declined. Foreign capital withdrew from Brazil as much as 50 billion dollars after the Russian crisis. Thus, the Brazilian economy plunged and its GDP growth rate dropped to 0.1 percent.

The final blow was the debt moratorium announced by Minas Gerais, one of the major states in Brazil, on January 6, 1999. It accelerated the capital flight from Brazil and the government was unable to keep the fixed exchange rate. On January 15, 1999, Brazil declared the implementation of the floating exchange rate system. After the adoption of the floating exchange rate system, the real dropped significantly to nearly 2.2 per dollar in March.

However, the government tackled the currency crisis quickly with tax reforms and budget cuts. The government also succeeded in getting the cooperation from 26 state governors at the end of February and financial aid from IMF in March. Thus, the devaluation of the currency stopped and Brazil regained international credibility. Brazil could issue sovereign bonds in the international financial market at the end of April,

which meant Brazil took only three months to return to the international financial market, much shorter than the case of Mexico. Though Brazil was affected by the currency crisis of Argentina in 2001, it recovered quickly and maintained moderate economic growth after that.

3-3. The Currency Crisis in Argentina

Until the 1980's, Argentina suffered from poor macro-economic performance. GDP growth rate often showed negative figures, inflation rate was as high as over a thousand percent at annual rate, and the external debt problem remained a burden for the country. To cope with this situation, President Carlos Menem, who succeeded ex-president Raul Alfonsin in July 1989, changed from government-oriented economy to market-oriented economy. He adopted several reforms including trade liberalization and privatization. He accepted the Brady-plan, which enabled Argentina to exchange its external debt into tradeable instruments, and succeeded in solving major external debt problems. To control hyper-inflation, he introduced a currency board arrangement called the convertibility plan in April 1991. The monetary base was 100 percent backed by foreign reserves (with some flexibility in certain circumstances) and full convertibility of the peso at parity with the US dollar was legally guaranteed.

As a result of the convertibility plan, the inflation rate dropped significantly, price stability was assured, and the value of the currency preserved. Argentina regained international credibility and attracted foreign investments, which helped the economic expansion of Argentina. The Argentine economy became buoyant, and GDP growth rate showed as high as 9.6 percent in 1992, which was called "a miracle of la Plata."

However, this economic expansion had negative side effects on social issues such as increased unemployment and unequal income distribution. Unemployment increased from 6.1 percent in 1991 to 15 percent in 2000 as the fixed exchange rate increased foreign competition and forced local companies to invest in more advanced technologies that required less labor. Income distribution worsened, too. The bottom 20 percent of the population decreased its participation in national income from 4.6 percent in 1991 to 4.1 percent in 2000, while the top 20 percent increased its share from 50.4 percent to 51.4 percent (Wikipedia, electronic dictionary). Also, government spending remained high and corruption was rampant. Since the convertibility plan precluded the government from printing money for financing, the government debt increased enormously. Not only central government but also local government suffered from public debt, and they published state bonds as complementary currencies to finance their debt.

External shocks also affected Argentine economy. The first was the Mexican crisis of 1994, resulting in a liquidity crunch that drove interest rates sharply higher, stalling economic growth and spurring unemployment. The next was the Brazilian crisis of 1999, which affected Argentina even more severely than the Mexican crisis, since Brazil was the largest trade partner for Argentina. Because of the Brazilian crisis, the Brazilian real depreciated sharply, and Argentina lost competitiveness in international market. As a result, Argentine economy stalled and subsequently contracted.

In 1999, new President Fernando de la Rúa took over the government and tackled economic problems. He requested IMF financial aid, and got several stand-by credits. Also, he cut public workers' wages to reduce government spending. However, he was

unable to regain economic stability and the confidence of investors. People feared financial instability and withdrew large sums of money from their bank accounts and sent them abroad. The president enacted the freeze of banking accounts for twelve months, allowing only 250 peso per week to be withdrawn. This measure and ongoing serious economic problems enraged people and demonstration against the government increased, which was called cacerolazo. People attacked banks, foreign privatized companies, and the government. Finally, enraged people enclosed Casa Rosada (the official residence of the President), and President Fernando de la Rúa had to escape by a helicopter, and resigned on December 21, 2001.

During the last week of 2001, the interim government led by Adolfo Rodríguez Saa declared default on public debt payment. Next President, Duhalde, abandoned the currency board on January 5, 2002. He set the official exchange rate at 1.4 pesos per dollar on January 6, and introduced the float exchange rate system on February 3. Thus, currency board, which had been utilized more than a decade in Argentina, ended in 2002.

This currency crisis had the additional severe effect on Argentine economy. GDP growth rate contracted as deep as 11 percent, and unemployment rate reached 20 percent in 2002. As a result of the abandonment of the currency board, inflation rate increased to double digits at an annual rate in 2002 and 2003.

4. EXAMINATION

4-1. The Pattern of Currency Crises in These Cases

There is unique pattern in these Latin American currency crises which cannot be explained in neither of the existing models. The unique point is control of inflation. In every case, the governments tried to fix exchange rate per US dollar in order to control inflation rate because they suffered hyper-inflation for a long time and they could not achieve sustainable economic growth without solving their inflation problem. A fixed exchange rate regime is very effective for reducing inflation rate since the domestic currency becomes more credible by the back up of US dollar. However, this regime caused overvaluation of their currencies, which weakened their competitiveness in international market and curbed their export, thus current account deficit widened to a significant level. Foreign investors feared that they might devalue their currencies, and capital outflow was accelerated, and caused the currency crises. In the 1980's as well as the 1990's, these governments often used fixed exchange rate regimes to control inflation, and they experienced currency crises when they became unable to maintain the exchange rate.

Sudden stop or massive reversal in capital flow is another important point. Financial deregulation, which was taken by these governments, made the capital flows more volatile than before the deregulation. Since sovereign debt problem was solved in late 1980's, Latin America turned to financial liberalization. Brazil began financial reform in 1988, and Argentina and Mexico adopted financial deregulation in 1992 (Inter-American Development Bank, IDB). According to the research of IDB, the speed of

financial deregulation of Latin America was more than double of that of Southeast Asia at that period. Financial deregulation enabled massive foreign capital inflows, which contributed to the acceleration of their economies significantly. However, it increased too much credit expansion and caused a bubble economy. What's more, the large part of this massive capital flow was in the shape of short-term investment, which withdrew rapidly when political and economic uncertainty increased in these countries. Since their financial markets were still fragile, sudden withdrawal of foreign capital triggered the currency crisis in these countries.

Fiscal deficit is also regarded as one of the common factors in these cases. Since the 1980's, these countries tackled economic reform including the reduction of the government deficit. With the aid of external debt negotiation and drastic privatization, their fiscal balance showed improvement in the 1990s. However, Argentina and Brazil were still unable to diminish fiscal deficit, owing to high interest payments and public officers' high wages. In the case of Mexico, fiscal balance showed surplus during 1991 – 1993. However, the large amount of dollar denominated government bond, tesobonos, was slated to mature, which discouraged foreign investors and triggered currency crisis.

Banking system was another factor, too. Especially in Mexico, banks expanded lending to private companies significantly after the deregulation of banking sector. It caused bubble economy, and they had to suffer solving non-performing loans after the currency crisis happened.

Thus, there are many different factors of currency crises underlying in these countries. Also, there are several candidates of currency crises models which might explain these cases. First-generation model, third- generation model and sudden stop

model can be applied to explain part of the causes of crises to some degree. However, the most important factor is fixed exchange rate system, which was taken to control inflation. It was effective for reducing hyper-inflation, but it caused overvaluation of their currencies, which weakened their export competitiveness and widened current account deficit. Then, capital flight accelerated, and they couldn't keep fixed exchange rate system anymore. This pattern is the key and unique for these currency crises so I would like to examine these cases from this point.

4-2. The Effectiveness of the Fixed Exchange Rate System

To see how much the fixed exchange rate contributed to the decreasing of inflation rates in these countries, it's useful to regress inflation rates on exchange rates by OLS models. I regressed inflation rate on exchange rate for the three countries; Mexico, Brazil and Argentina. Regarding exchange rate, I used exchange rate per US dollar whose value is at the end of period. Regarding price index, I used CPI (Consumer Price Index) for Argentina and Mexico, and WPI (Wholesale Price Index) for Brazil. CPI is more commonly used as a deflator of nominal exchange rate so it's better to use CPI in the case of Brazil, too. But Brazil doesn't publish continuous CPI data for a long period thus I had to use WPI instead of CPI. Source of the data is IFS (International Financial Statistics). The time span is 1961-2005, means as long as 45 years. Time frequency is yearly since the macro economic data in these countries are really hard to obtain in monthly or quarterly bases in a long term.

Table1 is the outcome of the regression model of Mexico, Brazil and Argentina. As the outcome of regression shows, exchange rate explained more than 80 percent of the

movement of the inflation. Regarding Mexico, it explained about 95 percent of the movement of exchange rate. So, we can recognize that there is a strong relation between inflation and exchange rate thus the fixed exchange rate regimes really worked efficiently to control inflation in these countries.

Table1: The Outcome of the Regression

	Mexico	Brazil	Argentina
Intercept	-2.679	0.731	7.783*
Standard Error	1.734	2.665	3.694
t-value	-1.55	0.27	2.11
Exchange rate	9.914*	55.1*	53.925*
Standard Error	0.353	2.526	3.593
t-value	28.07	21.82	15.01
Number of observations	46	46	46
R-square	0.9471	0.9154	0.8366
F-value	787.69	475.91	225.21
Root MSE	9.537		21.609

*Reject the null hypothesis at the 5 % level of significance

5. INDICATORS OF CURRENCY CRISES

Next, I will discuss about the main indicators of currency crises in these countries. To examine it, first, it's effective to check those literature which treat indicators of currency crises.

One of the useful literatures which give us general idea about it is "Leading Indicators of Currency Crises", written by Graciela Kaminsky, Saul Lizondo and Carmen Reinhart (Kaminsky, Lizondo and Reinhart 1997). They examined 25 references on indicators of currency crises and listed 103 indicators which were used as currency crises indicators. Appendix2 shows these indicators. Since many of them are transformations of the same variable, they consolidated different transformation of the same variable and introduced main indicators by sector as follows:

- **Capital Account:** international reserves, capital flows, short-term capital flow, foreign direct investment, and the differential between domestic and foreign interest rate.
- **Debt profile:** public foreign debt, total foreign debt, short-term debt, share of debt classified by type of creditor and by interest structure, debt service, and foreign aid.
- **Current Account:** the real exchange rate, the current account balance, the trade balance, exports, imports, the terms of trade, the price of exports, savings and investment.
- **International variables:** foreign real GDP growth, interest rates, and price level.

- **Financial liberalization:** credit growth, the change in the money multiplier, real interest rates, and the spread between bank lending and deposit interest rates.
- **Other financial variables:** central bank credit to the banking system, the gap between money demand and supply, money growth, bond yields, domestic inflation, the “shadow” exchange rate, the parallel market exchange rate premium, the central exchange rate parity, the position of the exchange rate within the official band, and M2/international reserves.
- **Fiscal variables:** the fiscal deficit, government consumption, and credit to the public sector.
- **International/structural factors:** openness, trade concentration, and dummies for multiple exchange rates, exchange controls, duration of the fixed exchange rate periods, financial liberalization, banking crises, past foreign exchange market crises, and past foreign exchange market events.
- **Political variables:** dummies for elections, incumbent electoral victory or loss, change of government, legal executive transfer, illegal executive transfer, left-wing government, and new finance minister; also, degree of political instability (qualitative variable based on judgement).

Among these candidates, they recommended 5 useful indicators of international reserves: the real exchange rate, credit growth, credit to the public sector and domestic inflation. They also recommend following 6 indicators as supportive: trade balance,

export performance, money growth, M2/international reserves, real GDP growth and the fiscal deficit.

Another reference is “The Twin Crises: The Causes of Banking and Balance-of-Payment Problems”, written by Kaminsky and Reinhart. In this paper, the authors examined 76 currency crises and 26 banking crises, including Mexican, Brazilian and Argentine crises. They used 16 indicators as follows: M2 multiplier, domestic credit/GDP, real interest rate, lending-deposit rate ratio, excess M1 balances, M2/reserves, bank deposits, exports, imports, terms of trade, real exchange rate, reserves, real interest-rate differential, output, stock prices and deficit/GDP. They classified these indicators by 6 categories of financial liberalization, other financial sector, current account, capital account, real sector and fiscal sector. Appendix3 is the summary of their examination. According to it, capital account indicators, which composed of reserves and real interest-rate differential, called the highest proportion of financial crises. Second best are financial liberalization indicators, which include M2 multiplier, domestic credit/GDP, real interest rate and lending-deposit rate ratio. Also, interesting thing is that real sector showed high proportion of calling banking crises but not calling currency crises (Kaminsky and Reinhart 1996).

Kaminsky wrote another interesting article, whose title is “Varieties of Currency Crises.” In this paper, she classified currency crises as 6 varieties as follows: current account, financial excesses, fiscal deficit, sovereign debt, sudden stops and self-filling. Former 4 varieties are of domestic problems such as current account deterioration, booms in financial markets, expansionary fiscal policy and unsustainable foreign debt. Sudden-stop is associated with reversal in capital flow triggered by hike in world interest rate.

Self-fulfilling crises are those happened in economies with immaculate fundamentals. She investigated 96 crises and categorized according to 6 varieties. Appendix 4 is the result of her investigation regarding crises of Argentina, Brazil and Mexico. According to it, current account is the main cause of the Argentine crisis in 2002 while financial excesses are regarded as the main causes of crises in the Mexican crisis in 1994 and the Brazilian crisis in 1999 (Kaminsky 2003).

Another useful reference is the study by Amado, Cerro and Meloni which investigated currency crises in Argentina from 1885 to 2003. They investigated 19 crises by three methods of the graphic analyses, the logit estimation and the tree method. And they concluded that fiscal deficit is always the important factor of crises. Also, they stressed that adverse foreign factors, such as increase in international interest rate and an impairing in terms of trade, had also a key role in explaining crises. (Amado, Cerro and Meloni 2004).

These references suggest that capital account indicators and current account indicators are effective indicators. My examination shows that the main pattern of the currency crises in these countries is as follows; the adoption of fixed exchange rate system, overvaluation of the currency, deterioration of the external account and the significant decrease of foreign reserves. I chose real exchange rate, current account deficit and foreign reserves as indicators among capital account indicators and current account indicators. Real exchange rate shows how much the currency is overvalued. Current account deficit is the major indicator of the deterioration of external sector. And the significant decrease of foreign reserves is the main symptom of currency crises.

6. REGRESSION

6-1. CART (Classification of Regression Tree)

The most popular way of regressing currency crises is the probit model (or logit model). In this model, they use several indicators to regress the influence on the possibility of currency crises as follows:

$$Y = X\beta + e \text{ (e: disturbance with mean 0 and variance 1)}$$

Dependent variable Y is 1 if currency crisis happened in this period, otherwise Y equals 0. X is a set of explanatory variables. e is a stochastic disturbance whose distribution is normal with mean 0.

While it is well-known and effective, I used another way of regressing currency crises called CART (Classification of Tree Method), or tree method. It is a non-parametric, data classification technique, which allows one to search for a number of sample splits using multiple indicators. CART is composed of a set of questions, or thresholds which correspond to the indicators of currency crises. The top node represents all observations, which are then separated into two groups by threshold: those in which a currency crisis is likely to happen and those in which a crisis is unlikely to happen. For each group, the methodology is repeated. This process is repeated until observations are categorized into crisis years and non-crisis years.

The advantage of CART is that it does not need as many observations as are required probit or logit regression models. Since it is not easy to obtain long term continuous data of these countries, CART is a useful technique for analysis of these countries.

The second merit is that it does not impose the same functional form to all period such as logit and probit model (Amado, Cerro and Meloni 2005). For example, Mexico experienced large current account deficit during 1991-1994 though only 1994 is defined as a crisis year. Under the CART, year 1991 is classified as non-crisis year by another question such as the drop of foreign reserves thus current account deficit of 1991 doesn't affect the outcome eventually. However, under the probit model, the effect of large current account deficit of 1991 cannot be eliminated, thus it will likely distort the outcome. Also, the macro economic data of Latin America usually fluctuates significantly and doesn't have stable relationship among them. So it's not appropriate to impose same functional form such as probit or logit model.

Another advantage of CART is that it's intuitive and easy to interpret and implement. We can regress currency crises more easily by CART than by probit or logit model.

6-2. Data

I used three explanatory variables: annual change of real exchange rate, current account deficit/GDP and the drop of foreign reserves. The time span is 1990-2001 since IMF working paper defines the currency crises in this period.

The definition of the indicators is as follows:

1: Real exchange rate: deflate nominal exchange rate by CPI (Consumer Price Index) or WPI (Wholesale Price Index)

I used CPI for Mexico and Argentina, and WPI for Brazil. Nominal exchange rate is the value at the end of the period. I used exchange rate per US dollar because the

United States is their main trade partner and the exchange rate per US dollar is the most important for these countries. The source of all the data is IFS (International Financial Statistics), published by IMF (International Monetary Fund). I calculated the annual change of real exchange rate and used it for the regression for tree method.

2: Current account deficit/GDP: Current Account deficit divided by nominal GDP. Both are from IFS, published by IMF.

3. Foreign reserves: Total reserves minus gold, published by IMF.

Table2: Exchange Rate and Indicators of Mexico

	Exchange rate (per US dollar)	Foreign reserves (annual change,%)	Real exchange rate (annual change,%)	Current account/GDP (%)
1990	2.94540	55.83	-11.94	-2.97
1991	3.07100	79.72	-15.00	-4.82
1992	3.11540	6.86	-12.17	-6.77
1993	3.10590	32.56	-9.16	-5.79
1994	5.32500	-75.00	60.28	-11.12
1995	7.64250	168.34	6.31	-0.66
1996	7.85090	15.35	-23.55	-0.79
1997	8.08330	48.19	-14.65	-1.96
1998	9.86500	10.42	5.27	-4.11
1999	9.51430	-0.05	-17.28	-2.89
2000	9.57220	11.73	-8.12	-3.26
2001	9.14230	26.00	-10.20	-2.78

Table3: Exchange Rate and Indicators of Brazil

	Exchange rate	Foreign reserves	Real exchange rate	Current account/GDP
	(per US dollar)	(annual change,%)	(annual change,%)	(%)
1990	0.00006	-1.26	-44.40	-2.13
1991	0.00039	7.96	20.40	-0.94
1992	0.00450	180.36	6.55	4.28
1993	0.11858	35.89	22.44	0.02
1994	0.84600	21.13	-70.42	-0.28
1995	0.97300	34.09	-26.99	-2.73
1996	1.03940	17.33	0.53	-3.10
1997	1.11640	-12.85	-0.68	-3.91
1998	1.20870	-16.23	4.56	-4.47
1999	1.78900	-18.28	26.98	-4.67
2000	1.95460	-6.63	-7.50	-4.30
2001	2.32040	10.01	5.42	-4.49

Table4: Exchange Rate and Indicators of Argentina

	Exchange rate	Foreign reserves	Real exchange rate	Current account/GDP
	(per US dollar)	(annual change,%)	(annual change,%)	(%)
1990	0.55850	213.83	-87.11	0.04
1991	0.99850	30.75	-34.19	0.00
1992	0.99050	66.37	-20.58	-0.02
1993	0.99850	38.05	-8.86	-0.03
1994	0.99950	3.89	-3.91	-0.04
1995	1.00000	-0.27	-3.22	-0.02
1996	0.99950	26.71	-0.20	-0.02
1997	0.99950	23.29	-0.52	-0.04
1998	0.99950	10.90	-0.91	-0.05
1999	0.99950	6.06	1.18	-0.04
2000	0.99950	-4.21	0.94	-0.03
2001	0.99950	-42.13	1.08	-0.01

6-3. Regression of Three Countries

The CART model is composed of three questions as follows:

Q1: Is the annual change of real exchange rate more than 20 percent?

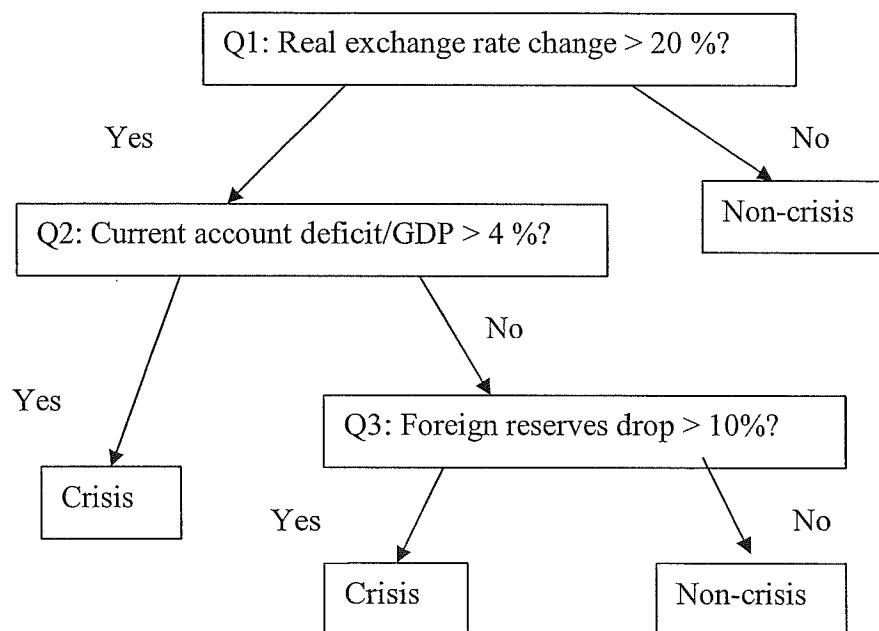
If it is yes, it goes to the second question. Otherwise, it is determined to be non-currency crisis year.

Q2: Does the current account deficit per GDP exceed 4 percent?

If it is yes, it is determined to be a currency crisis year. Otherwise, it goes to the third question.

Q3: Does the foreign reserves drop more than 10 percent per annual change?

If it is yes, it is classified as a currency crisis year. Otherwise, it is determined to be a non-currency crisis year.



The criteria for these questions are as follows:

Q1: Real Exchange Rate

In these countries, the governments often adopted the fixed exchange rate system to control inflation. It was effective for solving hyper-inflation, but it caused overvaluation of their currency. To check the overvaluation of the currency, I used the annual change of real exchange rate. If the real exchange rate varies more than 20 percent per annual rate, it is a significant change and can easy to cause currency crises. I identified it as a condition of currency crises. If the real exchange rate varies less than 20 percent, the year is identified as non-currency crisis.

Q2: Current Account Deficit

Even with overvaluation, a currency crisis will not likely happen unless it also worsens external balance significantly. I used current account deficit/GDP as the degree of worsening external balance. If it exceeds more than 4 percent, it is serious enough to cause a currency crisis thus it is used as a condition of crisis.

Q3: Foreign Reserves

When the governments face worsening external balance and thus speculative attacks, the governments try to keep exchange rate system by using foreign reserves. So, the decrease of foreign reserves is a symptom of the currency crisis. I classified a currency year if the foreign reserves drop more than 10 percent per annual rate. Otherwise, it is not classified as currency crisis-year.

I applied these questions to each year of 1990-2001 regarding Mexico, Brazil and Argentina, and checked if it coincides with the IMF definition.

6-4. The Outcome of CART

Table5 is the outcome of the CART regarding three countries.

Table5: Outcome of the CART

	Mexico			Brazil			Argentina		
	CART	IMF	Coincide?	CART	IMF	Coincide?	CART	IMF	Coincide?
1990	NC	NC	Yes	NC	NC	Yes	NC	C	No
1991	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
1992	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
1993	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
1994	C	C	Yes	NC	NC	Yes	NC	NC	Yes
1995	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
1996	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
1997	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
1998	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
1999	NC	NC	Yes	C	C	Yes	NC	NC	Yes
2000	NC	NC	Yes	NC	NC	Yes	NC	NC	Yes
2001	NC	NC	Yes	NC	NC	Yes	NC	C	No

C : Crisis year

NC: Non-crisis year

Regarding the Mexican case, CART classified only 1994 as a currency crisis year and all other years were classified as non-currency crisis years. So, in the case of Mexico during the period of 1990-2001, CART classified 100 percent correctly. In the case of Brazil, CART classified 1999 as the only currency crisis year, which coincides with the definition of IMF working paper. Only, in the case of Argentina, CART classified all years as non-crisis years. However, when I check 1989 and 2002, both were classified as currency crisis years by CART. According to the definition of IMF working paper, the currency crises happened in February 1990 and July 2001. However, actually, the exchange rate depreciated more dramatically in 1989 than in 1990, and the exchange rate didn't change in 2001 but changed at the beginning of 2002. So we can say that it's better to define currency crisis years of Argentina as 1989 and 2001. According to the new definition, CART classifies currency crisis years 100 percent correctly.

7. GOVERNMENT POLICY

In the previous chapter, I examined how the relationships between currency crises and other macro economic variables by CART. In this chapter, I will discuss government policies to prevent currency crises. Which economic policy should the government adopt to prevent currency crises? Since the currency crises of recent years, two main issues have been emphasized regarding the government policy. One is desirable exchange rate regime and the other is financial liberalization.

Regarding the exchange rate regime, fixed exchange rate regimes have been a factor in major emerging market financial crisis in recent years- Mexico at the end of 1994, South-east Asia in 1997, Russia and Brazil in 1998, Turkey in 2000 and 2001. Many policy makers now believe that intermediate regime between hard pegs and free floating are unsustainable. According to paper published by IMF, between 1991 and 1999, the proportion of the countries with intermediate regimes fell from 64 percent to 42 percent (Fisher 2001). Many countries are currently seeking either free float regime or super-fixed exchange regime (currency union including dollarization and currency board). In Latin American countries, the idea of dollarization has become prominent in recent years, since the United States is their major trade partner and it is easy for them to adopt it². The government of Argentina stated that it sought a formal agreement with the United States to become officially dollarized in 1999, and Ecuador's president proposed dollarization in January 2000 as a way of helping his country out of a deep recession and political turmoil.

² Actually, most of Latin American countries are already regarded as unofficially dollarized economies (Kurt Schuler, "Basics of Dollarization").

What are the benefits of dollarization? One of the expected benefits is the decline of inflation rates. Dollarization eliminates the risk of depreciation of the domestic currency, a continuing factor to the acceleration of inflation (Quispe-Agnoli 2002). Another expected benefit is the fiscal discipline that it may induce. The elimination of the possibility of printing money would limit the possibilities of financing fiscal deficits and would prompt more fiscal discipline (Goldfajn and Olivares 2000). Also, dollarization is expected to reduce transaction costs (Mack 1999).

What are the costs of dollarization? Many economists have claimed that there is a cost of losing a domestic central bank as a lender of last resort. This induces banks to seek for alternative contingent credits, particularly foreign funds, to replace partially the lender of last resort role. It has also been claimed that there is a cost of losing flexibility in monetary policy, such as when the issuing country is tightening monetary policy during a boom while an officially dollarized country really needs looser monetary policy because it is a recession (Mack 1999). Another cost is that the Central Bank loses its ability to collect seigniorage, the profit gained from issuing coinage. Instead, the U.S. Federal Reserve collects the seigniorage, and the dollarized government and its Gross Domestic Product (GDP) as a whole thus suffer a loss of income.

How much dollarization works for the stabilization of the economy actually? To see the effect of dollarization, I examine the case of Panama because Panama is the largest independent country adopting dollarization and it has adopted dollarization for as long as more than one century. According to the research of Panama by Ilan Goldfajn and Gino Olivares, dollarization delivered an impressive inflation performance and may even reduce the impact of external confidence shocks to Panama. However, dollarization

didn't guarantee fiscal discipline since the resort to debt financing is still available and the government can substitute fully money financing for higher debts (Goldfajn and Olivares 2000).

Since many Latin American countries have suffered from high inflation, dollarization seems to be effective regime for them. And, of course, currency crisis cannot happen under the dollarization unless US economy collapses. It is appropriate that only small countries should adopt it.

Then, which exchange regime should be adopted by large Latin American countries such as Mexico, Brazil and Argentina? Another alternative as a hard peg is currency board. It is also regarded to be effective to control inflation and maintain fiscal discipline. The cost is that the government will have difficulty in adopting monetary policy so the economy will unlikely to recover soon from a recession. Because of this defect, currency board collapsed in Argentina in early 2001.

It might be appropriate for them to adopt free float exchange rate system. If they adopt it, there is little possibility that currency crisis will happen since the exchange rate is always determined by the market and overvaluation will not likely to happen. But the biggest problem is that they will have difficulty in controlling inflation. So the government should seek for alternative effective economic measure to control inflation.

An alternative strategy is financial liberalization. According to neo-liberalism, economic liberalization is regarded to accelerate competition in the market, decrease inefficiency in the economy and contribute to the higher economic growth. This idea was strongly supported by IMF and developed countries, and they advised developing countries to implement liberalization. Thus many developing countries including

Mexico, Brazil and Argentina have adopted financial liberalization and opened their market to foreign investors after the late 1980's. It seems to have contributed to the economic expansion for the moment, but it caused too much volatile capital flows, which triggered currency crisis. According to the research of Gabriel Palma, the extraordinary surge in capital inflows was observed following financial liberalization in all crisis-countries. In the case of Brazil, the difference between the two periods amounts to about US\$ 220 billion, in Mexico US\$150 billion, and in the three East Asian countries US\$ 260 billion (Palma 2000). As Guillermo Calvo and Carmen Reinhart argued in their paper, surges in capital inflows are often followed by sudden stops. With few exceptions, these sudden stops are involuntary and associated with a currency crisis (Calvo and Reinhart 1999).

Based on these experiences, many economists argued that emerging economies should adopt financial controls of some sort to prevent currency or financial crises. For example, Joseph Stiglitz argues in his paper as follows:

“...capital markets are distinctly different from goods markets. Risk and information are the center of capital markets: capital markets are concerned with the acquisition, analysis, and dissemination of information; with making choices about how to allocate of scarce capital to investment opportunities; and with spreading, sharing, and pooling risks. Markets for information are markedly different from markets for goods. While with perfect information and perfect risk, competitive markets are in general (pareto) efficient, with imperfect information and incomplete risk markets, markets typically do not behave in the

way predicted by standard competitive models, and market equilibrium is in general not (constrained pareto) efficient. Thus, while there may be some presumption that trade liberalization may be welfare improving, there is little basis for presuming that liberalization in the financial and capital markets is welfare improving.” (Stiglitz 2002).

He also introduced metaphors to show how dangerous it is to implement financial liberalization in developing countries as follows:

“capital market liberalization, at least for most developing countries, is like giving a teenage kid a high-powered car before making sure that the tires were in good condition and before installing seatbelts, let alone airbags.” (Stiglitz 2002)

This metaphor indicates that it is too dangerous for developing countries to implement financial liberalization. It’s better for them to wait full financial liberalization until their financial market develops enough to adopt volatile foreign capital flow.

8. CONCLUSION

Mexico, Brazil, and Argentina all suffered from hyper-inflation for a long time. To control inflation, raising the interest rates was not enough. These countries adopted the fixed exchange rate system to control the inflation rate. The fixed exchange rate system effectively worked to control inflation rate in these countries as my empirical analysis demonstrated. Regarding Mexico and Brazil, exchange rate explained more than 90 percent of the inflation rate. Regarding Argentina, it explained more than 80 percent, which is a still high proportion.

However, the fixed exchange rate caused problems for these countries. The main problems are the overvaluation of the currency and weakening competitiveness in export, which worsens the external balance. In addition, when political or economic uncertainties arise, foreign investors withdrew their invested money from these countries, thus leading to capital flight happens. Latin American countries adopted free market policies including financial deregulations from the late 1980's. This accelerated the capital flight thus ignited the currency crises. In defense, the governments intervened in the exchange rate market and used foreign reserves, but finally they became unable to keep fixed exchange rate and despite their efforts, the currency crises resulted.

Thus, the main indicators of currency crises in these countries are real exchange rate, current account and foreign reserves. My examination of CART showed that they are effective in identifying currency crises in Mexico, Brazil and Argentina during 1990-2001. It's highly this model can be applied to other countries whose economies have experienced similar pattern of currency crises.

How to prevent currency crises in these countries? From the point of view of the government, they should adopt the floating exchange rate system instead of the fixed exchange rate system if they can manage controlling inflation in another way like monetary policy or cutting fiscal deficit. Also, the government should not adopt financial deregulation until the financial sector develops the checking ability of their lending fully to control excess lending. From the point of international market, foreign investors should invest their capital to help sustainable economy of developing countries by direct investment or long-term investment. Also, it's a better idea if these countries join hands together to prevent currency crises by making funds available for maintaining their exchange rates. I hope more and more economists will take an interest in currency crises and find effective methods to prevent currency crises. And I sincerely hope no more severe currency crisis will happen in the world.

Appendix1: List of Countries and Crisis Episodes Identified by the EMP Index

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Albania	Jul-92	fixed peg to a currency	independently float	Exchange rate and interest rate pressure associated with exchange rate unification, followed by a float
	Jan-97	independently float	no change in the regime	
Algeria	Jan-91	fixed peg to basket	no change in the regime	Sharp depreciation and reserve loss
	Apr-94	fixed peg to basket	other managed float	Sharp depreciation and reserve loss
Angola	May-95	other managed float	fixed peg to a currency/ other managed float/back to fixed peg to a currency	Sharp depreciation and rise in interest rate
	Mar-96	fixed peg to a currency	other managed float/return to fixed peg within 5 months	
Argentina	May-99	fixed peg to a currency	independently float	Sharp depreciation and reserve loss
	Feb-90	independently float	no change in the regime	Sharp depreciation, interest rate rise, and sharp reserve loss
	Jul-01	currency board	other managed float	Sharp rise in interest rates and reserve loss, followed with a float
Armenia	Oct-96	tightly managed float	other managed float	Interest rate hike and reserve loss in past few months
Aruba	Sep-98	fixed peg to a currency	no change in the regime	Rise in interest rate
Austria	Dec-90	fixed peg to a currency	no change in the regime	Small depreciation and interest rate rise
Azerbaijan	Jul-99	tightly managed float	no change in the regime	Sharp depreciation of the exchange rate
Bahamas	Apr-92	fixed peg to a currency	no change in the regime	Some interest rate rise and reserve loss in past several months
Bahrain	Sep-90	fixed peg to a currency	no change in the regime	Some increase in interest rate
	Dec-94	fixed peg to a currency	no change in the regime	Some increase in interest rate and reserve loss in past several months
	Jan-00	fixed peg to a currency	no change in the regime	Some increase in interest rate
Bangladesh	Mar-90	fixed peg to a currency	no change in the regime	Depreciation of the exchange rate and reserve loss
	Oct-98	tightly managed float	fixed peg to a currency	Interest rate increase and moderate depreciation
	Aug-00	fixed peg to a currency	no change in the regime	Devaluation and reserve losses in previous several months
Barbados	Dec-93	fixed peg to a currency	no change in the regime	Successive rise in interest rate and reserve loss in past several months
	Nov-97	fixed peg to a currency	no change in the regime	Successive rises in interest rate and reserve losses
Belarus	Jan-97	backward looking crawling peg	no change in the regime	Sharp devaluation and reserve loss
	Dec-98	backward looking crawling peg	no change in the regime	Sharp devaluation and interest rate rise
Belgium	Jul-93	horizontal band	no change in the regime	Widening of ERM bands, interest rate rise, moderate depreciation in the band, and some reserve loss
Benin	Jan-94	currency union	no change in the regime	CFA franc devaluation, interest rate rise, and reserve loss
Bhutan	Jan-92	fixed peg to a currency	no change in the regime	Interest rate rise and reserve loss
Bolivia	Nov-99	forward looking crawling peg	no change in the regime	Contagion from Brazil, sharp rise in interest rate
Bosnia	Sep-99	currency board	no change in the regime	Sharp increase in interest rate
Botswana	Jan-91	fixed peg to basket	no change in the regime	Depreciation of the exchange rate
Brazil	Jan-99	forward looking crawling peg	independently float	Sharp reserve loss, interest rate rise in previous months, and float followed by a sharp depreciation
Bulgaria	Feb-91	fixed peg to basket	independently float	Sharp interest rate rise, followed by a float and sharp depreciation
	Mar-94	tightly managed float	no change in the regime	Sharp depreciation, reserve loss, interest rate rise in previous months, continued pressure till late 1994
	May-96	tightly managed float	independently float	Depreciation, sustained reserve losses and interest rate increases, followed by a float
Burkina Faso	Jan-94	currency union	no change in the regime	CFA franc devaluation, interest rate rise, and a sharp reserve loss

(Continued)

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Burundi	Aug-91	fixed peg to basket	no change in the regime	Devaluation
	Nov-97	fixed peg to basket	no change in the regime	Devaluation, interest rate rise, and reserve losses in previous months
	Aug-99	fixed peg to basket	other managed float	Sharp depreciation, reserve losses in previous months, and float
	Jul-00	other managed float	no change in the regime	Sharp depreciation, reserve loss, and interest rate rise
Cambodia	May-98	other managed float	no change in the regime	Depreciation to narrow spread with free market rate, and some reserve loss
Cameroon	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve losses in previous months, and some rise in interest rate
Canada	Sep-92	other managed float	no change in the regime	Sharp reserve loss, interest rate rise and depreciation
Cape Verde	May-95	fixed peg to basket	no change in the regime	Some reserve loss and depreciation
	Oct-00	fixed peg to a currency	no change in the regime	Devaluation and reserve loss
Central African R.	Jan-94	currency union	no change in the regime	CFA franc devaluation and some interest rate rise
Chad	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve losses in previous months, and some interest rate rise
Chile	Oct-90	backward looking crawling band	no change in the regime	Some depreciation of the exchange rate and successive rises in interest rate
China	Jan-94	other managed float	no change in the regime	Sharp devaluation and unification of dual exchange rates
Colombia	Sep-98	forward looking crawling band	no change in the regime	Sharp depreciation within the band and some reserve loss, followed by a float after a year
Congo, D. R. of	Dec-93	other managed float	no change in the regime	Sharp depreciation and huge reserve loss
	May-01	fixed peg to a currency	independently float	Sharp devaluation and float followed by interest rate hike
Congo, R. of	Jan-94	currency union	no change in the regime	CFA franc devaluation, some interest rate rise, and reserve loss in the previous month
Costa Rica	Nov-90	backward looking crawling peg	no change in the regime	Interest rate increase, some depreciation, and reserve loss in previous months
Côte d'Ivoire	Jan-94	currency union	no change in the regime	CFA franc devaluation and interest rate rise
Croatia	Apr-97	horizontal band	no change in the regime	Sharp depreciation and successive interest rate increases in previous months
	Aug-01	tightly managed float	no change in the regime	Depreciation of the exchange rate, interest rise, and reserve loss
Cyprus	Sep-92	fixed peg to basket	horizontal band	Some depreciation of the exchange rate and reserve loss
	Aug-93	horizontal band	no change in the regime	Some depreciation of the exchange rate
Czech R.	May-97	horizontal band	other managed float	Depreciation, large interest rise and reserve loss followed by float
	Aug-98	other managed float	no change in the regime	Depreciation of the exchange rate
Denmark	Feb-93	horizontal band	no change in the regime	Sharp interest rise, reserve loss following ERM crisis
Dominican R.	Apr-97	other managed float	no change in the regime	Depreciation of the exchange rate
Ecuador	Sep-92	forward looking crawling peg	fixed peg to a currency/ horizontal band	Sharp devaluation, interest rate rise, and some reserve loss in previous months
Egypt	Jul-90	fixed peg to a currency	horizontal band	Sharp devaluation
El Salvador	May-90	fixed peg to a currency	other managed float/tightly managed float	Sharp devaluation and reserve loss followed by float and exchange rate unification at the free market rate
Equatorial Guinea	Jan-94	currency union	no change in the regime	CFA franc devaluation reserve loss in previous month, and some interest rate rise
Ethiopia	Oct-92	fixed peg to a currency	other managed float	Sharp devaluation and a rise in interest rate
Fiji	Jan-98	fixed peg to basket	no change in the regime	Sharp devaluation
Finland	Nov-91	horizontal band	no change in the regime	Devaluation, reserve loss and interest rate rises in previous months
	Sep-92	horizontal band	independently float	Reserve loss, interest rate rise, followed by a float
Gabon	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve losses in previous months, and some interest rate rise
Gambia	Mar-91	independently float	no change in the regime	Sharp exchange rate depreciation
	Sep-00	independently float	no change in the regime	Sharp exchange rate depreciation

(Continued)

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Georgia	Jan-99	tightly managed float	independently float	Sharp depreciation and interest rate rise and reserve losses in previous months
Ghana	Nov-99	other managed float	no change in the regime	Exchange rate depreciation and interest rate rise
Greece	Mar-98	forward looking crawling peg	horizontal band	Exchange rate depreciation; entry to ERM
Guatemala	Apr-90	independently float	tightly managed float	Sharp exchange rate depreciation and interest rate rise
Guinea-Bissau	Jul-92	backward looking crawling peg	no change in the regime	Sharp depreciation and reserve loss
	Aug-96	backward looking crawling peg	no change in the regime	Sharp depreciation, reserve loss, and interest rate rise
Guyana	Jun-90	fixed peg to a currency	other managed float	Devaluation
Haiti	Sep-00	independently float	no change in the regime	Sharp depreciation, reserve loss, interest rate rise
Honduras	Apr-90	fixed peg to a currency	forward looking crawling band/fixed peg to a currency	Sharp depreciation and interest rate rise
Hong Kong, SAR	Jul-98	currency board	no change in the regime	Contagion from Asian crisis, sharp interest rate rises during Apr-Aug-98
Hungary	Jan-91	fixed peg to basket	no change in the regime	Devaluation
	Sep-93	fixed peg to basket	no change in the regime	Devaluation and sharp rises in interest rate in consecutive months
	Aug-94	fixed peg to basket	horizontal band/forward looking crawling band	Devaluation, and reserve loss and increase in interest rates in past few months
Iceland	Feb-01	horizontal band	independently float	Sharp rise in interest rate and some depreciation within the band before moving to a float
India	Jul-91	horizontal band	fixed peg to a currency	Devaluation
	Mar-93	fixed peg to a currency	no change in the regime	Devaluation and exchange rate unification
Indonesia	Aug-97	backward looking crawling band	independently float	Sharp depreciation, interest rate rise followed by float during the Asian crisis
Ireland	Nov-92	horizontal band	no change in the regime	Sharp reserve loss, interest rate hike during ERM crisis, followed by a devaluation in early-93
Israel	Mar-91	horizontal band	forward looking crawling band	Devaluation (to correct competitiveness loss)
	Oct-98	forward looking crawling band	no change in the regime	Depreciation within the band during the Russian crisis
Italy	Sep-92	horizontal band	independently float	Depreciation, reserve loss, and interest rise followed by a float
	Feb-95	independently float	no change in the regime	Depreciation, reserve loss, interest rise during ERM tensions
Jamaica	Aug-91	other managed float	independently float	Depreciation, reserve loss, interest rise in successive months, followed by free float
Japan	Aug-95	independently float	no change in the regime	Sharp depreciation
Jordan	Jun-93	fixed peg to a basket	no change in the regime	Some depreciation, reserve loss, and interest rate rise
	Aug-95	fixed peg to a basket	no change in the regime	Some depreciation
Kazakhstan	May-94	independently float	other managed float	Interest rate increase and depreciation
	Apr-99	backward looking crawling peg	independently float/tightly managed float	Sharp depreciation and reserve loss, followed by a float
Kenya	Mar-93	fixed peg to basket	other managed float	Sharp depreciation, interest rise followed by float in 6 months
Korea	Nov-97	tightly managed float	independently float	Depreciation reserve loss, and successive interest rate rises, followed by a move to a free float during Asian crisis
Kuwait	Jan-92	fixed peg to a basket	no change in the regime	Exchange rate depreciation and reserve losses in past several months
Laos	Dec-97	fixed peg to a currency	other managed float	Sharp depreciation and reserve losses in successive months, followed by a float
Lebanon	Aug-90	other managed float	no change in the regime	Sharp depreciation and reserve loss
	Feb-92	other managed float	independently float/other managed float	Depreciation, reserve loss, and interest rate rise

(Continued)

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Lesotho	Jul-98	fixed peg to a currency	no change in the regime	Sharp interest rate rise, and some reserve loss in previous months, associated with pressure on the S.A. rand
	Oct-01	fixed peg to a currency	no change in the regime	Sharp reserve loss and interest rate increase associated with pressure on the S. A. rand
Luxembourg	Aug-93	fixed peg to a currency	no change in the regime	Interest rate increase , widening of ERM bands
Macedonia, FYR	Jul-97	fixed peg to a currency	no change in the regime	Devaluation
Madagascar	May-94	fixed peg to basket	independently float	Sharp depreciation and float
Malawi	Feb-94	fixed peg to basket	independently float	Sharp depreciation with float, following reserve losses
	Aug-98	other managed float	no change in the regime	Sharp depreciation
Malaysia	Dec-97	tightly managed float	other managed float	Reserve losses, interest rate rise and depreciation following a halt in intervention defense during Asian crisis
Maldives	Jan-91	other managed float	no change in the regime	Depreciation and some reserve loss in previous few months
	Jul-01	fixed peg to a currency	no change in the regime	Devaluation
Malta	Nov-92	fixed peg to basket	no change in the regime	Devaluation and reserve loss
	May-97	fixed peg to basket	no change in the regime	Devaluation and reserve loss
Mauritius	Jan-97	other managed float	independently float	Reserve loss, interest rise, depreciation, followed by free float
	Nov-98	independently float	other managed float	Sharp depreciation, reserve loss in previous months
Mexico	Dec-94	forward looking crawling band	independently float	Reserve loss, interest rise, devaluation followed by a float during the Mexican crisis
Moldova	Nov-98	tightly managed float	other managed float/ independently float	Reserve loss, interest rise, depreciation, followed by a move to free float in a few months
Mongolia	Jan-93	fixed peg to a currency	independently float	Reserve loss, interest rise, and devaluation followed by a float within six months
	Apr-01	fixed peg to basket	no change in the regime	Devaluation
Mozambique	Jun-94	independently float	no change in the regime	Sharp interest rate rise and some consecutive depreciation
	Dec-95	fixed peg to basket	other managed float	Sharp depreciation associated with the legalization of the free secondary market, accompanied with reserve losses
Namibia	May-96	fixed peg to a currency	no change in the regime	Interest rate rise related to pressure on the S.A. rand
	Jun-98	fixed peg to a currency	no change in the regime	Interest rate rise and reserve loss related to pressure on the S.A. rand
Nepal	Feb-93	fixed peg to a currency	no change in the regime	Depreciation vis-à-vis the Indian rupee
Netherlands	Apr-91	fixed peg to a currency	no change in the regime	Depreciation and reserve losses in previous months
New Zealand	Sep-01	Independently floating	no change in the regime	Sharp depreciation
Nicaragua	Mar-91	backward looking crawling peg	fixed peg to a currency	Devaluation
	Jan-93	fixed peg to a currency	forward looking crawling peg	Devaluation and reserve loss
Nigeria	Mar-92	tightly managed float	no change in the regime	Devaluation and exchange rate unification, reserve loss
	Feb-95	fixed peg to a currency	tightly managed float	Sharp depreciation associated with a switch of more transactions to a freely floating rate
Norway	Sep-92	horizontal band	independently float/tightly managed float	Some depreciation, reserve loss, and interest hike followed by a float in ERM crisis
Papua New Guinea	Jul-98	independently float	no change in the regime	Depreciation reserve losses, and interest rate rise
Peru	Aug-90	forward looking crawling peg	other managed float/independently float	Sharp devaluation and float
	Jun-92	independently float	other managed float	Depreciation and interest rate rise
Philippines	Sep-97	fixed peg to a currency	independently float/other managed float	Depreciation, reserve loss, and interest rise followed by a float during the Asian crisis
Poland	Feb-92	fixed peg to basket	forward looking crawling peg	Devaluation, four months after a move from a basket peg to a forward looking crawling peg

(Continued)

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Portugal	Sep-92	horizontal band	no change in the regime	Reserve loss, interest hike, devaluation during the ERM crisis
	Jul-93	horizontal band	no change in the regime	Sharp depreciation; widening of ERM bands
	Mar-95	horizontal band	no change in the regime	Devaluation within the ERM, interest rate rise
Romania	Jan-97	tightly managed float	backward looking crawling peg	Depreciation, reserve loss, and interest rises
	Sep-98	forward looking crawling peg	other managed float	Sharp reserve loss, interest rate rises, devaluation, and capital controls, followed by a float during the Russian crisis
Samoa	Dec-90	fixed peg to basket	no change in the regime	Some depreciation and interest rate rise
	Mar-98	fixed peg to basket	no change in the regime	Depreciation and reserve loss
Sao Tomé & Príncipe	Sep-91	fixed peg to basket	backward looking crawling peg	Devaluation and move to crawling peg
	Dec-94	backward looking crawling peg	other managed float	Pressure followed by a sharp depreciation and float
	Jul-97	independently float	no change in the regime	Sharp depreciation and interest rate rise, following a move (in Jan-97) from a managed float to a free floating regime
Senegal	Jan-94	currency union	no change in the regime	CFA franc devaluation, interest rate rise, and successive reserve losses in previous months
Seychelles	Nov-00	fixed peg to basket	no change in the regime	Devaluation and reserve loss
Sierra Leone	May-90	fixed peg to a currency	independently float	Sharp devaluation followed by float
	Aug-97	independently float	no change in the regime	Sharp depreciation and reserve loss
Singapore	Dec-97	tightly managed float	other managed float	Depreciation, reserve loss and interest rate rise during the Asian crisis
Slovak R.	Jul-93	fixed peg to a currency	horizontal band	Sharp depreciation within the band
	Aug-98	horizontal band	other managed float	Depreciation, reserve loss, and interest rise followed by a float in a few months
Slovenia	Feb-93	backward looking crawling peg	no change in the regime	Sharp interest rate rise and some reserve loss
Solomon Islands	Dec-97	backward looking crawling peg	no change in the regime	Devaluation and reserve loss
South Africa	Jun-98	independently float	no change in the regime	Sharp depreciation, reserve loss, interest rise
	Nov-01	independently float	no change in the regime	Successive depreciation for a few months
Spain	Sep-92	horizontal band	no change in the regime	Devaluation and reserve loss during ERM crisis
Sri Lanka	Jun-00	backward looking crawling band	horizontal band/backward looking crawling band/other managed float	Depreciation, reserve loss and interest rate rises, followed by a brief move to a horizontal band, then to a float in Jan-01; tightening of FX regulations
Swaziland	Jun-98	fixed peg to a currency	no change in the regime	Reserve loss and interest rate increase related to pressure on the S.A. rand
Sweden	Sep-92	horizontal band	independently float	Sharp rise in interest rate, and depreciation followed by float
Switzerland	Mar-91	Independently floating	no change in the regime	Sharp depreciation
Syria	Jan-96	fixed peg to a currency	no change in the regime	Devaluation to approach the free market rate
	Jan-97	fixed peg to a currency	no change in the regime	Devaluation to approach the free market rate
	Jan-98	fixed peg to a currency	no change in the regime	Devaluation to approach the free market rate
Tanzania	Jul-93	tightly managed float	independently float	Reserve loss and interest rate rise
	May-95	independently float	no change in the regime	Depreciation, reserve loss, and interest rate rise
Thailand	Jul-97	fixed peg to basket	other managed float	Depreciation, reserve loss, and interest rise followed by float and introduction of exchange and capital controls
Togo	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve loss, and interest rate rise
Tonga	Aug-98	fixed peg to basket	horizontal band	Devaluation and some reserve loss
	Sep-00	horizontal band	no change in the regime	Exchange rate depreciation, successive adjustments of the band width, reserve losses in previous months
Trinidad and Tobago	Apr-93	fixed peg to a currency	independently float	Sharp devaluation followed by a float
Tunisia	Aug-93	backward looking crawling peg	no change in the regime	Devaluation

(Continued)

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Turkey	Mar-94	backward looking crawling peg	other managed float/forward looking crawling peg	Depreciation, successive reserve losses, and sharp interest rate rise; move to a float
	Feb-01	forward looking crawling peg	independently float	Depreciation, reserve loss, sharp interest rate rise and float
Uganda	Jun-90	other managed float	no change in the regime	Sharp depreciation
	Jul-91	other managed float	no change in the regime	Sharp depreciation and reserve loss
Ukraine	Oct-94	fixed peg to a currency	other managed float	Sharp depreciation associated with exchange rate unification
	Sep-98	horizontal band	no change in the regime	Reserve loss, interest rise, and devaluation of the band
United Kingdom	Sep-92	horizontal band	independently float	Reserve loss in ERM crisis followed by float and depreciation
	May-00	independently float	no change in the regime	Exchange rate depreciation
Uruguay	Dec-01	forward looking crawling band	independently floating	Sharp depreciation within the band, interest rate hike, and reserve losses, followed by a float in Jun-02
	May-98	fixed peg to basket	no change in the regime	Pressure through reserve loss and interest rate rise since early 98
Venezuela	May-94	backward looking crawling peg	independently float/ fixed peg to a currency	Depreciation, reserve loss, and interest rise followed by float and a subsequent peg, along with the introduction of exchange controls
	Dec-95	fixed peg to a currency	other managed float/forward looking crawling band	Reserve losses in previous months, followed by a sharp devaluation and a float in a few months, subsequent introduction of a crawling band regime and removal of exchange controls
Vietnam	Feb-98	horizontal band	no change in the regime	Exchange rate depreciation and some reserve loss
	Jan-96	fixed peg to a currency	independently float	Sharp devaluation followed by a float in a few months
Zambia	Mar-94	Independently float	no change in the regime	Sharp depreciation
Zimbabwe	Sep-91	fixed peg to basket	no change in the regime	Sharp devaluation and interest rate increase
	Dec-97	backward looking crawling band	other managed float	Interest rate rise and a sharp reserve loss in the previous month, followed by a float and sharp depreciation

Bubula, Andrea and Inci Otker-Robe. "Are Pegged and Intermediate Exchange Rate Regimes More Crises Prone?" No.3/223, International Monetary Fund. (2003).

Appendix 2: Indicators by Category

Sector	Indicators	
External		
Capital account	(1) international reserves/base money (2) international reserves/GDP (3) stock of international reserves (4) reserves/imports (5) growth in reserves (6) central bank foreign assets/base money (7) growth of central bank net foreign assets (8) net foreign assets/M1 (9) net foreign assets/M1 squared	(10) errors and omissions plus short-term capital (11) share capital flows in the form of short-term borrowing (12) short-term capital flows/GDP (13) FDI/debt (14) capital account balance/GDP (15) domestic-foreign real interest rate differential (16) domestic-foreign nominal interest rate differential
Debt profile	(1) foreign aid (2) external debt/GDP (3) public debt/GDP (4) share of commercial bank loans (5) share of concessional loans (6) share of variable-rate debt	(7) share of short-term debt (8) share of public sector debt (9) share of multilateral development bank loans (10) debt service/GDP adjusted for GDP growth
Current account	(1) change in the real exchange rate (2) level of the real exchange rate (3) drift of the real exchange rate (4) variance of the real exchange rate (5) deviations from PPP in the real bilateral exchange rate (6) deviations from trend in the real exchange rate (7) deviations from historical average of the real exchange rate (8) real exchange rate squared	(9) trade balance/GDP (10) current account/GDP (11) exports/GDP (12) exports/imports (13) change in exports (14) change in imports (15) saving/GDP (16) investment/GDP (17) change in the terms-of-trade (18) change in export prices (19) exchange rate expectations
International	(1) OECD real GDP growth (2) international interest rates	(3) U.S. interest rates (4) foreign price level
Financial		
Financial liberalization	(1) real interest rates (2) credit growth (3) growth in credit/GDP (4) lending-deposit interest rate spread	(5) growth in M2 multiplier (6) growth of credit/reserve money relative to the United States

(Continued)

Sector	Indicators	
Other financial	(1) "shadow" exchange rate (2) parallel market premium (3) central parity (4) position within the band (5) central bank credit to the banking system (6) money demand-supply gap (7) M1 growth (8) M1 level	(9) M1 growth relative to the United States (10) broad money growth relative to the United States (11) change in bank deposits (12) bond yields (13) inflation (14) inflation relative to the United States (15) M2/international reserves
Real sector	(1) real GDP growth (2) per-capita growth (3) output level (4) output gap (5) manufacturing real wages	(6) wage growth (7) unemployment rate (8) employment growth (9) changes in stock prices
Fiscal	(1) fiscal deficit/GDP (2) fiscal deficit/government spending relative to the United States (3) government consumption/GDP	(4) domestic credit to public sector/total credit (5) growth in public sector credit (6) public sector credit growth/GDP
Institutional/structural	(1) multiple exchange rate dummy (2) exchange controls dummy (3) relative GDP per capita (4) financial liberalization dummy (5) banking crisis dummy	(6) openness (7) trade concentration (8) months spent on peg (9) past foreign exchange market crisis (10) past foreign exchange market event
Political	(1) government victory dummy (2) government loss dummy (3) elections (4) change in government (5) legal executive transfers	(6) illegal executive transfers (7) degree of political instability (8) left-wing government (9) new finance minister
Contagion	(1) crisis elsewhere	

Kaminsky, Graciela, Saul Lizondo and Carmen Reinhart. "Leading Indicators of Currency Crises." No.97/79. International Monetary Fund. (1997).

Appendix 3: The Onset of Financial Crises Early Signals (% of Crises Actually Called)

	Balance-of payment crises					Banking Crises
	Total	Single	Twin	Before Financial Liberalization	After Financial Liberalization	
Financial sector	67	67	67	67	68	65
Financial liberalization	74	72	78	64	77	71
M2 multiplier	76	75	78	74	77	73
Domestic credit/GDP	61	59	67	56	65	50
Real interest rate	89	86	94	78	91	100
Lending-deposit rate ratio	71	70	73	50	73	57
Other	57	58	53	57	56	57
Excess M1 balances	37	43	22	52	26	32
M2/reserves	81	79	89	74	86	75
Bank deposits	51	52	47	44	56	67
External sector	72	71	74	72	72	82
Current account	68	67	70	70	66	75
Exports	85	83	89	78	89	88
Terms of trade	75	72	83	73	77	96
Real exchange rate	59	57	67	58	60	58
Imports	52	57	39	73	40	60
Capital account	81	80	83	74	83	96
Reserves	75	74	79	70	78	92
Real interest-rate Differential	86	86	88	78	89	100
Real sector	69	69	70	61	72	85
Output	74	73	77	68	76	89
Stock prices	64	65	63	53	68	81
Fiscal sector	28	27	29	21	31	44

Note: Episodes in which the beginning of a banking crisis is followed by a balance-of payment crisis within 48 months are classified as twin crises.

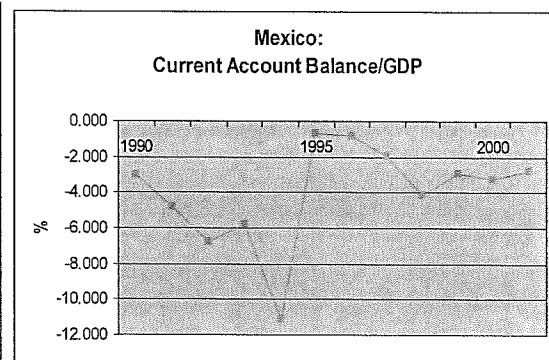
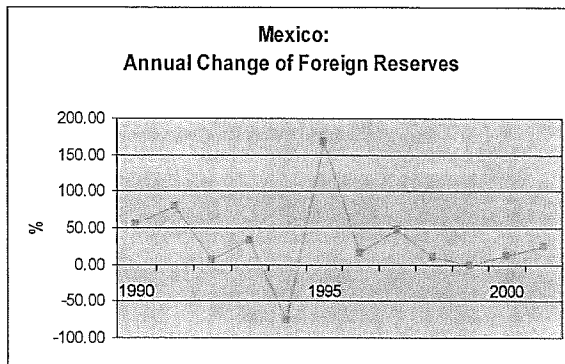
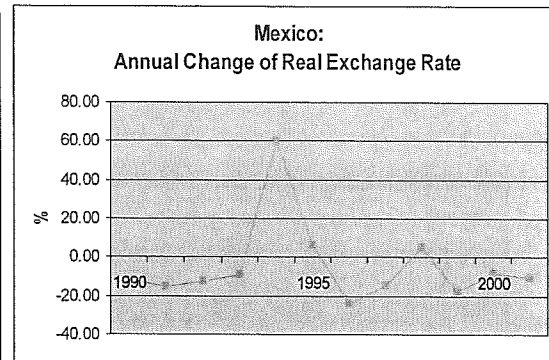
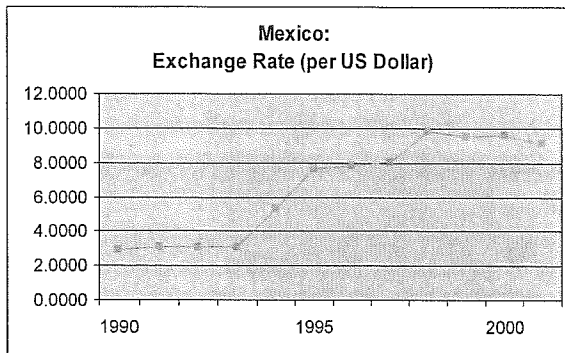
Kaminsky, Graciela and Carmen Reinhart. "The Cause of Banking and Balance-of-Payments Problems." *The American Economic Review* 89(June 1999):474-500.

Appendix 4: Classification of Crises

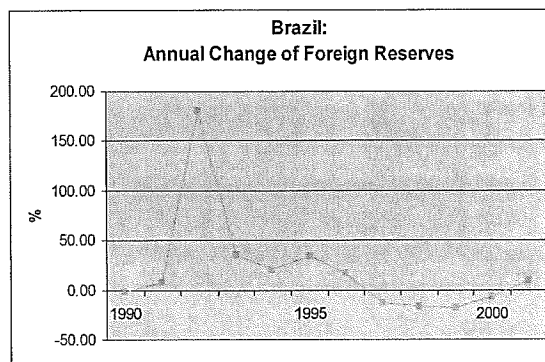
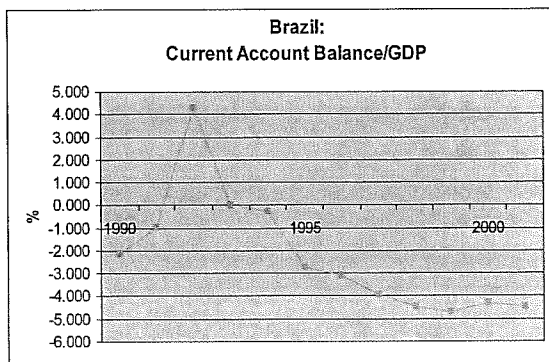
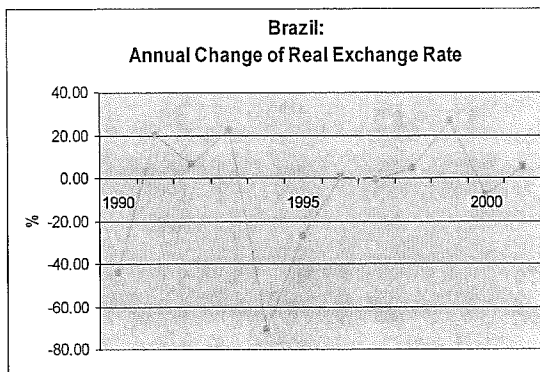
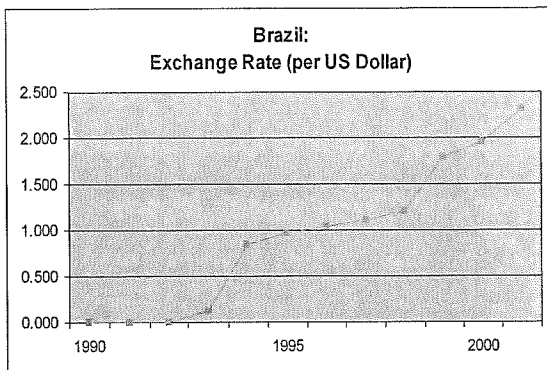
Country	Crisis	Variety
Argentina	Jun-75	Financial Excesses
	Feb-81	Financial Excesses
	Jul-82	Financial Excesses
	Sep-86	Sovereign Debt
	Apr-89	Sovereign Debt
	Feb-90	Sovereign Debt
	Jan-02	Current Account
Brazil	Feb-83	Sovereign Debt
	Nov-86	Sovereign Debt
	Jul-89	Sovereign Debt
	Nov-90	Sovereign Debt
	Oct-91	Sovereign Debt
	Jan-99	Financial Excesses
Mexico	Sep-76	Sovereign Debt
	Feb-82	Financial Excesses
	Dec-82	Sovereign Debt
	Dec-94	Financial Excesses

Kaminsky, Graciela. "Varieties of Currency Crises." NBER Working Paper Series #10193. (2003).

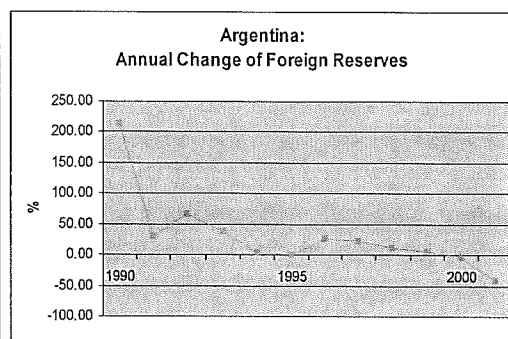
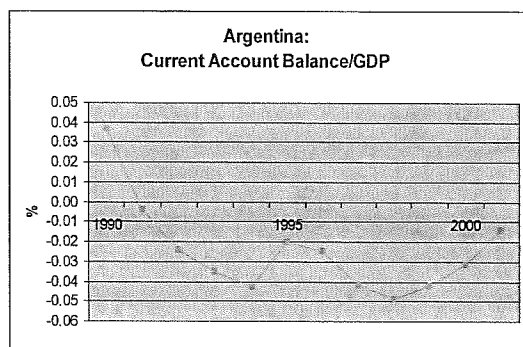
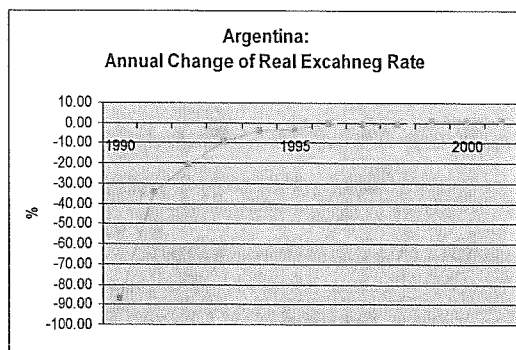
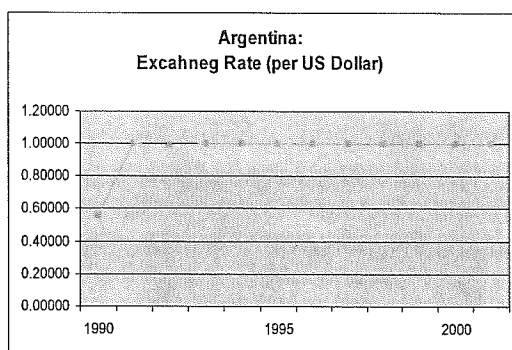
Appendix5: Exchange Rate and Indicators of Mexico



Appendix 6: Exchange Rate and Indicators of Brazil



Appendix 7: Exchange Rate and Indicators of Argentina



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