# Exchange rate crises in Latin America, East Asia and Russia

*Crises cambiais na América Latina, Leste Asiático e Rússia*

MANMOHAN AGARWAL*
T. R. VANDANA**

RESUMO: Vários países em desenvolvimento, principalmente no Leste Asiático e na América Latina e na Rússia, sofreram crises cambiais na década de 1990. Examinamos a corrida até a crise em termos de alguns indicadores macro sugeridos por vários modelos de crise. Em seguida, examinamos as consequências da crise, em contraste com a maioria dos trabalhos empíricos que se concentram em determinar as causas das crises. Procuramos explicar a situação pré e pós-crise à luz de vários modelos de crise. Descobrimos que o modelo de crise de primeira geração, apesar das anomalias, parece se adequar às crises dos países latino-americanos, ao passo que não se ajusta à crise dos países asiáticos. O caso russo é diferente de qualquer um dos modelos de crise. A crise eliminou os aspectos da doença holandesa levando a um grande aumento das exportações e à melhora do saldo em conta-corrente. Isso resultou em uma maior taxa de crescimento do PIB. Também descobrimos que o índice de pressão do mercado de câmbio não tem sucesso em prever as crises.
PALAVRAS-CHAVE: Regime monetário; crise monetária; balança de pagamentos.

ABSTRACT: A number of developing countries mainly in East Asia and Latin America and Russia suffered exchange rate crises in the 1990s. We examine the run up to the crisis in terms of a few macro indicators suggested by various crisis models. We then examine the aftermath of the crisis, in contrast to most empirical work that concentrates on determining the causes of crises. We seek to explain the pre-crisis as well as the post-crisis situation in the light of various crisis models. We find that the first-generation crisis model despite anomalies seems to fit the crises in Latin American countries whereas it does not fit the crisis in the Asian countries. The Russian case is different from any of the crisis models. The crisis eliminated the Dutch disease aspects leading to a large increase in exports and an improvement in the current account balance. This resulted in a higher growth rate of

* Adjunct Senior Fellow, Research and Information System for Developing Countries, New Delhi, India. Retired Professor, Centre for International Trade and Development, Jawaharlal Nehru University (JNU) New Delhi, India. E-mail: manmohan44@gmail.com. Orcid: https://orcid.org/0000-0002-9299-4537.
** Student of Center for Development Studies. Thiruvananthapuram/Kerala, India. E-mail: 94vandana@gmail.com. Orcid: https://0000-0002-0898-4863. Submitted: 16/February/2021; Approved: 7/April/2021.

GDP. We also find that the exchange market pressure index is not successful in predicting the crises.
KEYWORDS: Monetary regime; currency crisis; balance of payments.
JEL Classification: E420; F310; F320.

## INTRODUCTION

This paper attempts to analyse the similarities and differences in the causation and effects of the various balance of payments (BOP), the East Asian crisis of 1997, Mexico in 1994, Brazil and Russia in 1998, and Argentina in 2001.We use a number of macro indicators suggested by the models for a decade before the crisis and after the crisis to analyse the differences in the run up to the crisis and its consequences. Most of the empirical work as noted below concentrates on finding the causes of crises and does not usually analyse the aftermath in terms of the models. Others have tended to use a large number of indicators as predictors that reduce their usefulness for policy. Our analysis is done in terms of simple statistics and also regression analysis to help us see which of the various crises models best describe these crises. We seek to provide a parsimonious explanation for the crises. Also, by examining the post crisis situation we seek to guide policy making to avoid the excessive GDP costs of IMF policies in the East Asian case as admitted by the IMF.

## 2. LITERATURE SURVEY

### Theoretical Modelling

As each new crisis could not be explained by the existing models, newer models were developed to explain the newer crises. Almost each set of crises has given rise to newer models. The first generation models (FGM) were based on the critical assumption that the supply of money must equal the demand for money (Krugman, 1979; Flood and Garber, 1984). Furthermore, since the demand for money in these models was given exogenously, any change in the supply of money would be reversed. Now, a government budget deficit financed by increased credit would raise the money supply. The supply of money needs to be reduced to match the unchanged demand for money. The country would run a current account deficit (CAD) which would reduce foreign exchange reserves, base money and the money supply. Reserves would keep declining if the deficit persists. At some level of reserves people would expect devaluation, and there would then be a run on the currency and a crisis ensues. An important point was that the crisis would occur before the country ran out of reserves. Flood and Garber (1984) explained this by deriving a shadow price of foreign exchange, the price that would prevail if the entire stock of foreign exchange was put on the market. Initially because of large reserves, the shadow price would be less than the official price and no speculator would have an incentive to

acquire the stock as he would suffer a capital loss. The speculative attack would occur when the shadow price equalled the market price. In the Krugman (1979) model, the government persistently running a budget deficit financed by money creation is a necessary and sufficient condition for a crisis.

However, the crisis in the European exchange rate mechanism (ERM) occurred despite most of the economies not running large budget deficits. The second-generation models (SGM) sought to explain the European crisis. In these models the government maximizes an explicit objective function (Obstfeld, 1994; 1996), and they allow for two equilibria, each of which can persist depending on the state of expectations. If people's expectations about government policy change, then their actions based on this new expectation would lead to a shift from one equilibrium to the other and this process would be accompanied by a crisis. So, a currency crisis occurs because of a crisis of confidence and is not a problem of macro fundamentals. For instance, the increase in interest rates in Britain in the first instance stemmed the speculative attack as people believed that the exchange rate would not be changed. In the later attack, the rate of unemployment was already high, and the public believed that the government would not raise the interest rate high enough to stem the speculation as this would raise the unemployment too high for the government's objectives. So, the actions of the people based on their expectation that the government would not defend the rate resulted in a crisis.

In the Asian crisis also the government budget did not seem to be in imbalance. The currency crises coincide with one in the financial sector. This conjunction has motivated a literature about the balance-sheet effects associated with devaluations (Diaz-Alejandro, 1985; Kaminsky and Reinhart, 1999). These arise because the balance sheets of banks and firms in emerging market countries exhibit currency mismatches as they borrow in foreign currency and lend in local currency (Eichengreen and Hausmann, 1999). They face a credit risk as their income is related to the production of non-traded goods whose prices in foreign currency fall after devaluations. Another mismatch arises as long-term projects are financed with short-term borrowing (Chang and Velasco, 2001). Mendoza and Calvo (2000) examine cases where the private sector is in imbalance. They also show that herd behaviour can arise as it is not profitable for well diversified firms to seek costly information that would lower the risk attached to projects in different countries. Because of lack of information, firms exhibit herd behaviour.

## Empirical Research on Crisis Models

There are two main methods in the literature for predicting currency crises and these can be broadly classified as Exchange Market Pressure and Early Warning Systems models.

### Exchange Market Pressure (EMP)

We employ the EMP in analyzing the countries in our study to test the effectiveness of the method and to analyze the similarities among the countries, if any. We

present a literature review encompassing theoretical papers and papers that have analyzed EMP for the countries under study using different EMP indices. We find that EMP serves to be a reliable indicator in the case of the Asian countries whereas for the Latin American countries, it doesn't serve as a good predictor.

Usually before a speculative attack there is pressure on the exchange market which can be alleviated either by a devaluation/depreciation or by supplying foreign exchange to the market. Therefore, *exchange market pressure (EMP)* corresponding to total pressure on the exchange rate is the sum of exchange rate depreciation and reserve outflows. Such a crisis can happen even in the absence of clear imbalances in macroeconomic fundamentals.

Eichengreen et al. (1995) calculate an exchange market pressure index (EMPI) using a weighted average of quarterly changes in nominal exchange rate, reserves, and interest rate differential. Kaminsky and Reinhart (1999) calculate an EMPI using weighted average of monthly changes in nominal exchange rate and reserves. The weights attached are inversely proportional to the standard deviations of the components.

Chang et al. (2010) uses EMPI to model probabilities of crises for 17 countries between 1970 and 2008 and Boonman, (2019) studies EA and LA countries among others for a period between 1990 and 2016 to find it to be a good leading indicator. Tanner (1999) studies the EMP for Brazil, Mexico, Indonesia, South Korea and Thailand, among others and finds that a reduction in domestic credit component of money supply helps reduce EMP.

**Early Warning Systems (EWS)**

In the aftermath of the exchange rate crises in the 1990s, several indicators were attributed as causing crises; ranging from excessive inflation, unsustainable current account deficits, low savings, etc. The motive was to find a set of variables that are consistently linked to such crises; those that are "fundamental" and others.

The shortcomings of the previous models in accurately predicting a crisis led to the rise of the "EWS" models or "signal" approach to study crisis prediction. Eichengreen et al., (1995) use a multivariate (using a range of economic and political variables), dynamic (exploring periods of time before and after the crises) and multinomial (compares periods of tranquillity and crises and other events simultaneously) approach to analyse the antecedents and consequences of devaluations and revaluations for a quarterly panel of 20 countries from 1959 through 1993. The results are mixed as there are no unambiguous predictors. They find that devaluations typically occur when unemployment is high, monetary policy is loose, and external accounts are weak. Post devaluation, reserves flow back, and external balance is restored while monetary and fiscal policies tighten. However, they also find that regime transitions from a fixed to a floating exchange rate system are rarely due to macroeconomic imbalances of the kind that crises models suggest. Kaminsky et al., (1998) use a broad set of 105 indicators and find them to be significant. Using such a broad range of indicators, however, provides little guidance to policy makers. Furthermore, they find no support for some conventional indica-

tors, current account deficit, exchange rate expectations and interest rate differentials. In contrast, Reinhart et al., (2000) find a large current account deficit to be a good indicator.

Berg and Patillo (1998) use bivariate probit regressions and find that EWS aren't solely sufficient to predict crisis and that they should be used in conjunction with more comprehensive assessments.

There have been numerous papers exploring different other indicators to predict crisis. Bussiere and Fratzscher (2006) use a multinomial discrete-dependent-variable approach, Lin et al., (2006) presents a hybrid causal model using neural networks and fuzzy logic, Laina et al., 2015 uses quarterly data from 1980Q1 to 2013Q2 for a panel of 11 EU countries to find that loans-to-deposits and house price growth are the best leading indicators. Babecky, et al., (2012) uses Bayesian Model Averaging technique to select the most useful early warning indicators among the set of all available indicators, although only for developed countries.

Most empirical analyses have concentrated on being able to predict crises. The theoretical models, however, also don't predict post crisis behaviour. In the Krugman model, GDP does not change after the crisis. Also, after the crisis the extent of devaluation and inflation depends on the deficit. Since the real exchange rate does not change, the division of GDP between tradeables and non tradeables does not change. In the Obstfeld model (1994), with a government objective function, governments stop supporting the exchange rate as such support would drive up unemployment. So, after the crisis, unemployment would be lower and GDP higher. Also, the development of empirical models, as discussed above, has expanded the set of determinants to an extent that they are perhaps not very useful for policy purposes. Furthermore, while they are successful in predicting older crises, their efficacy in predicting newer crises is yet to be established. An important aspect of IMF policy in dealing with the East Asian crises has been its failure, as admitted by the Fund, to predict the extent of fall in demand and GDP. So, our purpose is to use the more parsimonious theoretical models to see how they could be tweaked. Also, by looking at the post crisis situation we hope to provide a guide to policy to reduce the GDP costs of tackling crises.

## 2.3 Country Experiences

We now briefly describe the events leading to exchange rate crises in different countries.

### Mexican Crisis

Mexico had many crises before 1994. Usually, a period of expansion would be accompanied by a real appreciation of the fixed ER leading to large external deficits and a collapse. The 1994 collapse did not follow this pattern though the exchange rate was fixed to provide a nominal anchor for the stabilization plan adopted in 1988. At the end of 1993, the overall public sector had a surplus of 1% of GDP, inflation was down to single digits and foreign exchange reserves were at a record

level of US$ 26 billion. The private sector, however, was in disequilibrium because of a large gap between savings and investment as private investment rose and private savings fell (Sachs, Velasco and Tornell, 1996). But the real exchange rate had appreciated and there was a large current account deficit. The government increased the money supply to prevent a further rise in interest rates. Disallowing interest rates to rise not only prevented a narrowing of the investment savings gap but also cut off inflow of foreign funds. To shore up foreign exchange reserves and confidence, the government converted short term peso debt denominated, the cetes, into short term foreign debt, tesobonos. As a consequence, the share of tesobonos in privately held public debt increased from 4% to 75%. The current account deficit instead of being financed by capital inflows was now financed by drawing down reserves. While the situation seemed to be under control, it made the government more vulnerable with large short term liabilities in foreign exchange, namely vulnerable to a self-fulfilling crisis.

Two hypotheses have sought to explain the Mexican crisis that finally erupted in December 1994. The real disequilibria hypothesis (Dornbusch and Werner, 1994) points to unsustainable fundamentals viz; burgeoning CAD and an overvalued peso. The second is the standard speculative attack explanation. However, Sachs, Velasco and Tornell (1996) argue that both these hypotheses don't adequately explain the crisis. A relatively small devaluation which would have corrected the external imbalance created a panic because of large balance sheet effects. The exchange rate plunged, and Mexico had to approach the IMF for a large loan. So, according to Calvo and Mendoza (1996), balance sheet effects were the cause behind the Mexican crisis.

A herding panic is said to be the reason behind strong contagion effects in the region and the greater world economy (Calvo and Reinhart, 1995). The crisis was due to a combination of FGM where however the imbalance was not in the public sector accounts but the private sector.

**East Asian Crisis**

The East Asian financial crisis that affected Thailand, Malaysia, Indonesia, South Korea and Philippines was unexpected because it didn't follow the standard Krugman (1979) model. The fundamentals were not bad enough. Net government borrowings were less than half a percent in each country except in Philippines (1.3%). Due to fiscal prudence, inflation across the region had been below 10 percent. Savings and investment rates were high. Capital inflows were larger than current account deficits leading to growing reserves. The ratings by international agencies remained unchanged and strong till the onset of the crisis and a few weeks into it and the IMF didn't raise any concerns even during 1996.

There was, however, a weakness in these economies. Since their currencies were pegged to the dollar, the appreciation of the dollar against the Yen created a significant real appreciation of 25 percent in their currencies reducing the growth of exports from 24.8 percent in the five countries in 1995 to 7.2 percent in 1996. The current account deficits averaged 4% in these countries and were on the rise. The

only exception was Indonesia which remained at 3.5% in 1995 and 1996. There also existed political uncertainty in the region.

Considerable capital flowed in following financial liberalization and deregulation. Capital flows were a remarkable 10.3 percent of GDP over 1990-96 in Thailand. These large inflows could not be invested in traded goods production and were invested in non-traded goods production, particularly housing in Thailand (Wade, 2002). The bursting of the resulting real estate bubble created a financial crisis.[1] Banks intermediated between the high savings rates and enterprises. So, debt-equity ratios were much higher than would be the case in a market oriented financial system (Wade, 2002). The fear of depreciation unleashed a self-fulfilling panic when foreign lenders became wary about repayment of their debts. This sparked new withdrawals as domestic borrowers with unhedged currency positions rushed to buy dollars.

When the countries ran out of reserves because of capital flight, they had to abandon their pegged exchange rates. Moreover, interest rates soared and non-performing loans increased which eroded the capital base of the banks. The balance sheet losses of banks significantly contributed to the crisis in Indonesia, Thailand and Korea (Krugman, 1999). It can be said that the Asian crisis can be best understood from third-generation models.

### Russian Rouble Collapse

The Russian crisis of 1998 was due to macroeconomic fundamentals, mainly the high fiscal deficits during 1996-1997. Macroeconomic stabilization policies during the period July 1992-August 1998, aimed at stable economic recovery. The policy combination was strict monetary-control, but fiscal laxity (Desai, 2000). Strict monetary control brought down growth of consumer prices to less than 1 percent per month by September 1997. Nonetheless, the federal budget deficit remained high, in the range of 7-8 percent of GDP. The large deficit was because of declining revenues and increasing interest payments and jumped from 23 percent of revenues in January 1998 to a whopping 51 percent in July 1998. The government was adversely affected by the East Asian Crisis' contagion effects as well as the fall in export prices. The fiscal consolidation attempted by the government under an IMF led programme resulted in weak GDP growth. The government prohibited from borrowing from the central bank and unable to raise taxes relied on market borrowings, short-term bills and longer-term bonds, to finance the deficit. Moreover, the lifting of capital controls led to a surge of inflows, especially short-term funds that were disproportionately in excess of the reserves. Premature capital account convertibility was a fundamental cause as well since it incited the later speculative attack.

This worsened the position of the Russian banks. The Russia crisis had symptoms of both first and third generation models (Krugman, 1979, 1999).

---

[1] Also see Radelet and Sachs (1998).

### Brazil

Brazil adopted an exchange rate based stabilisation policy in 1994 to stem the hyperinflation.[2] The Real Plan of 1994 sought to reduce inflation gradually by reducing both inflationary expectations; through the real being 'pegged' to the US dollar at a rate of around one Brazilian Real to US$ 1 (but allowed to move in a narrow band), and inflationary 'inertia' (indexation). Simultaneously, the government sought to progressively achieve internal and external macroeconomic equilibrium (Palma, 2012) based on limiting fiscal deficits and adopting a very tight monetary policy to limit increases in the money supply. The new Plan had considerable public support and achieved initial success. Inflation was reduced from 2000 percent in 1993 to 1000 percent in 1994 and 7 percent in 1997 and GDP growth increased to 4 percent (Ayres et al.). The success resulted in large capital inflows which were sterilized, and tight control on the money supply maintained.

However, the Brazilian economy faced two problems. It was buffeted by a series of external shocks, especially the Mexican, East Asian and Russian crises. Additionally, political considerations, in particular, the divided coalition government added to the woes of the economy. The contagion effects of these shocks were met by increases in the rate of interest. Interest rates came down when the shock was successfully met. The Brazilian economy was characterised by excessively high and unstable domestic interest rates. Fluctuating interest rates were accompanied by fluctuating growth.

The second problem arose from the exchange rate based stabilisation plan adopted. Even though inflation was controlled there was a tendency for the exchange rate to become overvalued. The real exchange rate fell by nearly one-half between mid-1992 and mid-1996. This trend began to be reversed in 1997 and 1998, but at a rate that eventually proved to be too little, too late. Resumption of growth together with the overvalued exchange rate meant a worsening of the current account. During the four and a half years from July 1994 to the end of 1998 the price index for non-traded goods increased by 120 per cent, and the price index for traded goods increased by only about 27 per cent (Ferreira and Tullio, 2002). This resulted in an enormous loss of competitiveness of Brazilian exports on world markets, a substantial worsening of the current account which moved from a surplus of 1 per cent of GDP in 1992 to a deficit of 4.5 per cent in 1998 (both were recession years) and a significant increase in Brazilian foreign debt both private and public (Ferreira and Tullio, 2002).

Monetary policy with its high interest rates led to major financial fragility in the financial sector and state finances, and to an unmanageable Ponzi finance in the accounts of the Federal Government (Palma, 1998). After an initial budget surplus in 1994 (equivalent to 1.1% of GDP), the budget returned to massive deficits as high as 8% of GDP in 1998. Consequently, total net public debt (that is,

---

[2] For a history of Brazilian monetary and fiscal policies see Ayres, Garcia, Guillen and Kehoe, (2018) and Afonso, Araújo and Fajardo (2016).

total debt minus international reserves and other financial assets of the public sector) nearly doubled during this period, from 28.5% to 50% of GDP. This amount, although not excessively large as a share of GDP compared with other countries, became unmanageable due to the remarkably high interest rates. Thus, Brazil had a crisis in the midst of low growth rate in contrast to other cases where crises occurred after a period of rapid growth.

The disequilibrium became obvious and the resulting net outflows proved unsustainable; the government had to devalue the Real in January 1999. Thus, 1998 posted both the all-time record for net inflows (first quarter), and for net outflows (third quarter)! This exemplifies the difficulties confronted by economic authorities in the implementation of their macroeconomic policies when they operated with a liberalised capital account in a world of highly volatile flows, a high degree of 'contagion', and asymmetric information.

Once again it became evident that no matter how large the levels of reserves, and no matter how high interest rates, they can never be large enough and high enough to withstand a sudden collapse in confidence and withdrawal of funds by restless international fund managers in an economy with a liberalised capital account. Although high interest rates were able to check the development of a Kindlebergerian mania (via credit expansion leading to a consumption boom and asset bubbles in construction and the stock market), which in particular characterised other experiments with financial liberalisation in Latin America, this 'success' came at a huge cost: high interest rates created an 'interest rate trap', which equally led to a financial crisis but via a different route.

The exchange rate based stabilisation pursued by Brazil after the hyperinflation was the most reasonable policy to follow and can be considered successful. However, it was pursued for too long at the cost of a large loss in competitiveness first and of economic growth later.

**Argentina**

The Argentina crisis followed the fall of the Russian Rouble and the Brazilian Real and partly due to the devaluation by its major trading partners which affected the profitability of its trading sector. Argentina after its experience with hyperinflation adopted a currency board so that any increase in the money supply would have as its counterpart an increase in foreign exchange reserves. It was believed that a fixed exchange rate with a currency board would prevent increases in the money supply and would imply that the rate of inflation in Argentina would be the same as in the world so that its goods would not become non-competitive leading to large current account deficits. Thus, the twin problems of the past, high rates of inflation and large current account deficits would be avoided. For many years this exchange rate centred stabilization policy worked and the economy grew rapidly with low rates of inflation.

However, the devaluation of the Real and other developments in the external sector resulted in the Argentine currency becoming overvalued. Capital flight reduced the money supply and resulted in a fall in economic activity. As its currency ar-

rangements prevented the government from devaluing the currency to restore the competitiveness of Argentina's goods, the only solution was to engineer an internal deflation. Finally, the government had to abandon the currency board arrangement and the fixed exchange rate. Argentina was a case where the exchange rate could not be maintained not because of government policies but because of external events, unlike in the Krugman case, and the currency board arrangement did not permit devaluation. The devaluation then generated balance sheet effects akin to the third-generation model (Krugman, 1999).

## THE PRE-CRISIS AND POST-CRISIS PERFORMANCE

We compare the average for the pre-crisis 10-year period and for the post-crisis 10 year period for important macro indicators. We find a distinct difference in the behaviour of the East Asian countries from that of the Latin American (LA) countries in practically all the indicators. The East Asian countries experienced a very substantial almost 50 percent drop in the rate of growth of per capita income as growth rates declined in all the four Asian countries (Table 1). On the other hand, there was hardly any difference in the pre-crisis and post-crisis growth rates in Argentina and Mexico, and, for Brazil, the growth rate increased substantially (Table 1).

Table 1: Ten Year Averages of Macroeconomic Indicators Before and After Major BOP Crises

| Countries | GDP growth rate | | Gross Fixed Capital Formation | | Export Share | | Current Account Balance | | Budget Balance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Before | After | Before | After | Before | After | Before | After | Before | After |
| Indonesia | 6.9 | 2.8 | 27.4 | 21.9 | 26.2 | 35.8 | -2.4 | 3.1 | 0.2 | -1.3 |
| Korea | 8.7 | 4.8 | 35.8 | 30.8 | 37.4 | 36.1 | 0.4 | 2.7 | 1.7 | 3.8 |
| Malaysia | 7.3 | 4.6 | 34.7 | 22.3 | 78.3 | 112.9 | -2.5 | 12.3 | 2 | -3.6 |
| Thailand | 9.3 | 3.9 | 37.6 | 23.6 | 36 | 78.3 | -5.5 | 4.5 | 2.5 | -1.9 |
| Average | 8.1 | 4 | 33.9 | 24.7 | 42 | 65.8 | -2.5 | 5.7 | 1.6 | 1.3 |
| Argentina | 4.7 | 4.7 | 18 | 16.7 | 9.1 | 22.6 | -3.1 | 2.7 | -1.3 | -0.8 |
| Brazil | 2.2 | 3.4 | 20.3 | 17.9 | 8.5 | 13.6 | -1.2 | -0.7 | -4 | -2.4 |
| Mexico | 2.7 | 2.5 | 18.5 | 19.1 | 17.1 | 25.3 | -1 | -1.8 | -5.7 | -0.6 |
| Average | 3.2 | 3.5 | 18.9 | 17.9 | 11.6 | 20.5 | -1.3 | -1.8 | -3.7 | -1.3 |
| Russia | -6.1 | 6.9 | 22.5 | 19.2 | 26.9 | 35.9 | 1.6 | 9.7 | -5.8 | 4.9 |

Source: World Bank (WB). World Development Indicators (WDI).

The crisis also resulted in a shift in demand patterns. Asian countries saw a sharp drop, averaging almost 30 per cent, in the ratio of gross fixed capital formation (GFCF) to GDP corresponding to the growth rate decline. The share of exports increased, and the budget balance worsened. The decline in investment demand was replaced by higher government demand and exports. The changes in the budget deficit, the current account balance (CAB) and the share of Gross Fixed Capital Formation (GFCF) in GDP added 1.9% of GDP to demand. In the case of the LA countries these components resulted in a drop in demand by 3.9% of GDP. Yet growth fell substantially in Asia while there was hardly any effect in LA, it even increased in Brazil.

In LA countries, the decline in the GFCF to GDP ratio was much smaller than in Asian countries. The share of exports in GDP increased in LA more than in Asia, though, it must be noted that ratio started from a much lower base in LA (Table 1). Also, the budget balance improved. Since the growth rate did not change much, the increase in exports and the improvement in the budget balance were at the expense of private consumption.

The CAB improved, in Asia even though the budget balance worsened. In LA, the CAB improved very substantially despite only a small improvement in the budget balance. In Brazil the improvement in the CAB was almost equal that in the budget balance. In Mexico the CAB worsened considerably despite a massive improvement in the budget balance.

The budget balance behaves very differently in the Asian and LA countries. The Asian countries had run surpluses on an average in the pre-crisis period. But post--crisis they have run deficits except for South Korea. In contrast, the LA countries had run deficits before their crises and continued to do so after their crises, though of a smaller magnitude, considerably smaller for Mexico.

The pattern of deficits/surpluses in the East Asian countries before the crisis does not support the FGM where budget deficits drive current account deficits. The results would also be puzzling from the viewpoint of the FGM for the post-crisis period as increases in budget deficits are coupled with CA surpluses. The budget surpluses in these countries before the crisis might have arisen if their governments believed in models such as the FGM and so ran budget surpluses to obviate a BOP crisis. As the exchange rate became more flexible after the crisis, they might be less concerned about possible BOP deficits and so were not as concerned about budget deficits. But this explanation does not find support in the data. While the currencies did depreciate in the immediate aftermath of the crisis, the year of the crisis and the following year, subsequently they have followed a de facto fixed exchange rate, and even appreciating slowly (Table 2). Thus, it is difficult to explain the conjunction of budget deficits and CA surpluses after the crises.

Table 2: Average Changes in Exchange Rates

| Countries | Years* | | | |
| --- | --- | --- | --- | --- |
| | -9 to -1 | 0 and 1 | 2 to 10 | Change between 0 to 10 |
| Argentina | 0.5 | 103.2 | 3.5 | 311.2 |
| Brazil | 819 .4 | 28.6 | 2.1 | 10.2 |
| Mexico | 46.1 | 49.3 | 6.7 | 234.4 |
| Russia | -56.7 | 110.7 | 0.3 | 156.6 |
| Indonesia | 4 | 134.2 | -0.3 | 214.2 |
| Korea | -0.1 | 32.8 | -4.2 | -2.3 |
| Malaysia | 0 | 25.7 | -1.4 | 22.8 |
| Thailand | -0.2 | 27.8 | -1.8 | 10.1 |

*0 being the year of the crisis
Source: Calculated from data in WB, WDI.

In the case of the LA countries, both the budget and the CA are in deficit as would be expected under the FGM. But the improvement in the CAB bore no relation to the improvement in the budget balance.

The behaviour of the exchange rate (ER) is also puzzling. In the Asian economies the ER was fixed in the pre-crisis period. It then depreciated substantially during the year of the crisis and the subsequent year. It subsequently appreciated in these economies as would be expected by the overshooting model. But 10 years after the crisis, the ER had appreciated relative to its value in the year of the crisis. In Malaysia and Thailand, it was only marginally higher; in Thailand the exchange rate had depreciated by 10 percent, hardly a degree of overvaluation that should have had the cataclysmic effect that the crisis was. In the case of the LA countries the ER continued to devalue after the crisis, and the total devaluation was significant, except for the case of Brazil.

The behaviour of the ER suggests that while it was significantly out of equilibrium in the LA countries it was not so in the Asian economies.

Russia presents an interesting case. There is a massive improvement in the budget balance and in the CAB as export share increases. The increased exports offset the decline in government deficit to generate a massive increase in the growth rate despite a fall in investment. Exports are substituting for investment and government demand. There was a large initial depreciation and then a gradual depreciation over the years.

We now examine the changes in these variables more formally by fitting a regression equation over the 21 year period, 10 years before the crisis, ten years after and the crisis year itself and we use both an intercept dummy and a slope dummy.

The regression equation is

$$Y = a + bt + cd + edt$$

So that *c* represents the coefficient on the intercept dummy and *e* the coefficient on the slope dummy. *t* is time and *Y* is the dependent variable. The dummy *d* is 1 for the post crises years and 0 otherwise. *b* reflects the rate of growth in the pre-crises years, and *(b+e)* reflects the rate of growth in the post crises years.

The results indicate that whereas in the case of the LA countries and Russia the crises had no effect on growth rates either the level or the rate of change this was not the case for the Asian countries (Table 3). Since the dependent variable is the rate of growth, the dummy *d* represents a shift in the rate of growth and e represents whether there was an acceleration or deceleration after the crisis. Among the Asian countries there was no effect only in the case of Korea. The other three Asian countries experienced a significant fall in their growth rates after the crisis. After a significant fall, Korea recovered to almost its pre crisis growth as almost did Malaysia (Figure 1). But the growth rate in Korea fell in later years. Only Malaysia at the end of the ten year period seems to be reaching its pre-crisis growth rate. Both Indonesia and Thailand seem to have settled at a lower rate of growth, though Thailand seems to be steadily albeit slowly accelerating its growth rate and thus the positive sign on '*e*'.

Table 3: Shifts in the Behaviour of the Key Macroeconomic Variables
in the 21 Year Period Spanning Ten Years Before and After the Crises

| Countries | GDP growth rate | | Gross Fixed Capital Formation | | Export Share | | Exchange Rate | | Current Account Balance | | Fiscal Balance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | c | e | c | e | c | e | c | e | c | e | c | e |
| Indonesia | - | n | - | n | + | n | - | n | + | n | - | - |
| Korea | n | n | - | - | + | + | n | n | + | n | n | n |
| Malaysia | - | n | - | - | + | - | - | n | + | n | n | n |
| Thailand | - | + | - | + | + | n | - | + | + | n | - | n |
| Argentina | n | n | n | n | + | n | n | + | + | - | - | n |
| Brazil | n | n | - | + | + | n | n | n | n | + | n | n |
| Mexico | n | n | n | - | + | n | n | n | + | + | n | - |
| Russia-I | n | n | n | + | n | n | n | n | + | n | n | n |
| Russia-II | ++ | NA | n | NA | n | NA | + | NA | + | NA | n | NA |

Note: n means coefficient not significant at the 5 percent level. + or – means significant at, at least the 5 percent level, ++ means significant at 10 percent level, with the sign signifying whether the coefficient was positive or negative. Russia-I regression has both slope and intercept dummies, whereas Russia-II regression has only the intercept dummy. Source: Results from authors' calculations.

Figure 1: Behaviour of GDP Growth Rates in Asian Countries
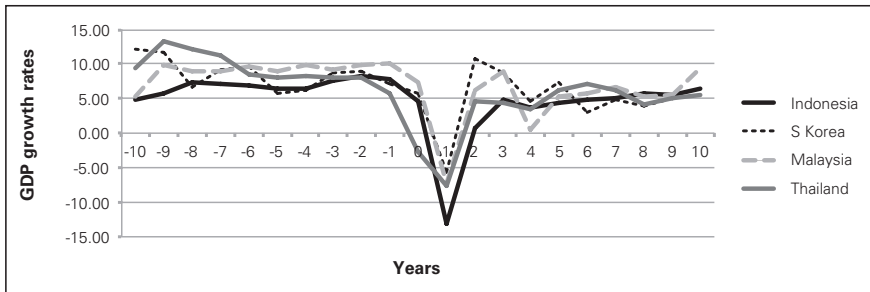


Note: Year 0 represents year of the crisis. Source: WB, WDI.

When we look at the behaviour of the LA countries, the first-generation crisis model seems to fit their case, though there are some anomalies. In the first-generation case there is no effect on GDP after the crisis. There may be no effect on the fiscal deficit. Only effect in comparison to the pre-crisis situation is that if the government budget deficit continues then the current account balance will continue to be in deficit and the exchange rate will continue to depreciate. The budget balance improves in these countries (Table 1) from an average deficit of 4.5 percent to an average deficit of 1.1 percent of GDP. With the improvement n the fiscal situation the current account balance should also improve. The CAB improves immediately in the case of Argentina and Mexico, '*a*' is positive. While the improvement in the case of Argentina is subsequently gradually eroded ('*b*' is negative), the CAB improves in the case of Brazil and Mexico ('*b*' is positive). The effect on export shares is positive, foreign demand substitutes for government demand, there is crowding in of exports. The increase of exports occurs despite a lack of depreciation of the exchange rate, 5 of the 6 coefficients are insignificant. The effect on GFCF is often not clear cut for these economies so one may not expect lasting effects on the growth rates. Only for Brazil both the intercept and the slope are positive so growth rate can be expected to increase and this happens.

The case of Russia is different. There was a significant improvement in the growth rate from -6.1 pre-crisis to 6.9 post-crisis (Table 1). Yet the regression equation shows no change in the growth equation. The growth was a very large negative in some of the pre-crisis years. Post-crisis the growth rate exhibits a cyclical pattern and so the slope dummy would not be significant (Table 4). We dropped the slope dummy and we find a significant intercept (Equation II in Table 3)

Table 4: Russia's Growth Rate Before and After the Crisis

| Time | Year | GDP growth rate |
|------|------|-----------------|
| -10 | 1988 | -5.11 |
| -9 | 1989 | -5.75 |
| -8 | 1990 | -3 |
| -7 | 1991 | -5.05 |
| -6 | 1992 | -14.53 |
| -5 | 1993 | -8.67 |
| -4 | 1994 | -12.57 |
| -3 | 1995 | -4.14 |
| -2 | 1996 | -3.6 |
| -1 | 1997 | 1.4 |
| 0 | 1998 | -5.3 |
| 1 | 1999 | 6.4 |
| 2 | 2000 | 10 |
| 3 | 2001 | 5.09 |
| 4 | 2002 | 4.74 |
| 5 | 2003 | 7.3 |
| 6 | 2004 | 7.18 |
| 7 | 2005 | 6.38 |
| 8 | 2006 | 8.15 |
| 9 | 2007 | 8.54 |
| 10 | 2008 | 5.25 |

Source: WB, WDI.

The Russian economy in the pre-crisis period was a dual economy that exhibited a form of the Dutch disease (Tabata, 2000). Exports of mineral resources resulted in an appreciated exchange rate. This made the manufacturing sector uncompetitive in the foreign as well domestic markets. Imports of competitive priced raw materials and semi-manufactured goods made investments in the domestic sectors unprofitable. Lower investment, reduced current account balance and gross savings through the 1990s, resulted in negative GDP growth rates. The devaluation of the rouble after the crisis allowed the manufacturing sector to become more competitive resulting in a substantial increase in the share of exports of goods and services in GDP and a large improvement in the CAB (Table 1). Also, the accumulation of oil related fiscal surpluses in sovereign wealth funds reversed the Dutch disease (Dabrowski, 2019b). In addition, the high growth rate in the post-crisis credits resulted from the structural and institutional changes in the 1990s and the global commodity boom (high oil prices) (Dabrowski, 2019a).

The crisis in the Asian countries does not fit the first-generation models. Again,

as in the LA countries the fiscal balance does not show a significant change between the pre-crisis and post-crisis years. But the growth rates plummet, as noticed above. The intercept dummy for exports is positive and so is the intercept dummy for the CAB. Exports increase and the CAB improves. However, the share of GFCF in GDP declines. So here we have exports at the expense of investment.

This is very different from Rodrik's (1995) explanation of the export performance in East Asia. According to him these countries maintained a very high investment ratio which required very large imports of capital goods which could only be financed by high exports. In his model, investment resulted in exports. But we now find that export shares grew even when investment shares fell. The exchange rate played a limited role in this export performance as the exchange rate at the end of the 10 year period was very close to that before the crisis.[3] For Korea, the depreciation was less than 20 percent (Figure 2). For Thailand and Malaysia, the depreciation was less than 40 percent. For all three countries the exchange rate was appreciating towards the end of the post-crisis period. There was overshooting immediately after the crisis.

Figure 2: Behaviour of exchange rates of Asian Countries (year 1987=100)
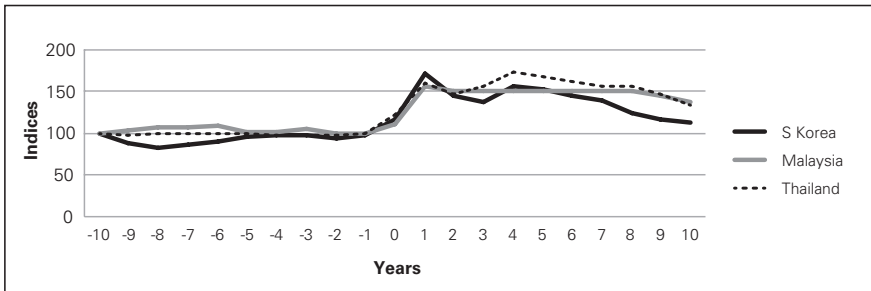


Note: 21 years spanning the, i.e., crisis year and
10 years before and after. Source: WB, WDI.

The case of Indonesia is different. There was about 500 percent depreciation after the crisis. Since then, the exchange rate has been fluctuating between 400 percent depreciation and 500 percent depreciation. This would suggest that there was disequilibrium in the Indonesian case. The behaviour of the other three countries would suggest that they needed to move from a high growth rate based on high rates of investment to a lower growth rate with lower rates of investment. The crisis was the mechanism to move from the earlier equilibrium to the new one. This move can be seen in two ways. One would be the Obstfeld (1986) self-fulfilling prophecy way. There were two sustainable equilibrium points. An event triggered a move from one equilibrium to the other. The other way is that the earlier growth

---

[3] The exchange rate played a very limited role in Rodrik's (1995) analysis of growth in Korea and Taiwan.

pattern of high growth rates accompanied by high levels of investment was no longer sustainable. The crisis showed that, but also enabled a move to a more sustainable pattern of growth.

### Exchange Market Pressure

We construct the EMPI for our seven countries for a time period of 21 years that span a major currency crisis in the respective country. Moreover, we try to establish if there are systematic differences between the East Asian and Latin American countries with respect to the EMPI behavior during the crisis episodes.

The EMPI index a la Kaminsky (1998) is as follows:

$$EMP_{i,t} = \frac{1}{\sigma \Delta\%er_i} \Delta\%er_{i,t} - \frac{1}{\sigma \Delta\%res_i} \Delta\%res_{i,t}$$

$$\Delta\%er_{i,t} = \frac{er_{i,t} - er_{i,t-1}}{er_{i,t-1}}$$

$$\Delta\%res_{i,t} = \frac{res_{i,t} - res_{i,t-1}}{res_{i,t-1}}$$

For a country $i$ in year $t$, the exchange market pressure (EMP) index is defined as the weighted average of two components: (1) the percent change of the nominal exchange rate of country $i$ against a reference country (US) in year $t$ and (2) the percentage change in foreign reserves in year $t$. The weights are the inverse of the standard deviations of the two components, so as to ensure that none of them dominates the index; i.e., two components have equal sample volatilities. We consider the threshold for a currency as 2 standard deviations above the mean (Eichengreen et al., 1995). That is when the EMP crosses the threshold is when a crisis is expected to occur.

### Data

Annual nominal exchange rate and foreign reserves data are sourced from IMF IFS.

### Results

The average EMPI for 21 years spanning a crisis episode do not show significant pressure except Argentina after the year of the crisis and in Korea and Thailand in the year of the crisis and the subsequent year. In many cases, the pressure is negative in the years before the crisis (Table 5 for details). The EMP of Latin American countries were higher than that of the East Asian countries before the crisis; in fact, it was negative for the East Asian countries except for Malaysia suggesting again the unexpectedness of the East Asian crisis.

Table 5: Exchange Market Pressure Index Averages for Chosen Countries

| Years | Argentina | Brazil | Mexico | Latin Am | Indonesia | Malaysia | S Korea | Thailand | East Asia |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Exchange Market Pressure Index Averages | | | | | |
| -10 to -1 | -0.58 | 0.57 | 0.42 | 0.13 | -1.03 | -0.64 | -0.84 | -1.58 | -1.02 |
| -1 | 0.25 | 0.36 | -0.68 | -0.02 | -2.16 | 0.25 | -0.56 | -0.07 | -0.64 |
| 0 | 1.57 | 0.44 | 1.67 | 1.23 | 1.08 | 1.99 | 2.24 | 3.93 | 2.31 |
| 1 | 5.60 | 0.17 | -0.82 | 1.65 | 1.87 | 0.87 | 3.04 | 2.66 | 2.11 |
| 1 to 10 | 0.01 | -0.52 | -0.25 | -0.26 | -0.48 | -0.48 | -0.53 | -0.51 | -0.50 |

Note* Averages from -10 to -1 years and 1 to 10 years. Averages of countries in Latin America and East Asia.
Source: Authors' calculations

The threshold method of identifying a crisis doesn't help in predicting a crisis (Table 6). Out of the seven countries, Brazil, Mexico and Malaysia haven't exceeded the threshold in any of the years -1 to 1, i.e., three years spanning the crisis. This shows that the threshold method isn't always an accurate method to predict a crisis.

Table 6: Summary Statistics and Thresholds for Identifying a Currency Crisis

| | Argentina | Brazil | Mexico | Latin Am | Indonesia | Malaysia | South Korea | Thailand | East Asia |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Summary Statistics of EMPI | | | | | |
| Mean | -0.20 | 0.05 | 0.16 | 0.001 | -0.66 | -0.44 | -0.55 | -0.81 | -0.61 |
| Std Dev | 1.64 | 1.29 | 1.18 | 1.37 | 1.18 | 1.29 | 1.48 | 1.73 | 1.42 |
| Threshold | 3.08 | 2.63 | 2.52 | 2.74 | 1.69 | 2.14 | 2.41 | 2.65 | 2.22 |

Source: Authors' calculations.

## CONCLUSIONS

The first-generation crisis model despite anomalies seems to fit the crises in LA countries. The crisis in the Asian countries does not fit the first-generation models. The crisis was the mechanism to move from the earlier equilibrium to the new one. This move can be seen in two ways. One would be the Obstfeld (1986) self-fulfilling prophecy way. The other way is that the earlier growth pattern of high growth rates accompanied by high levels of investment was no longer sustainable. The crisis showed that, but also enabled a move to a more sustainable pattern of growth. The Russian case is different from the LA and Asian cases. The crisis eliminated the Dutch disease aspects leading to a large increase in exports and an improvement in

the CAB. This resulted in a higher growth rate of GDP. The EMP index is not successful in predicting the crises.

# REFERENCES

Afonso José Roberto, Eliane Cristina Araújo, Bernardo Guelber Fajardo, (2016), "The role of fiscal and monetary policies in the Brazilian economy: Understanding recent institutional reforms and economic changes", The Quarterly Review of Economics and Finance 62: 41–55.

Ayres Joao, Marcio Garcia, Diogo Guillen and Patrick Kehoe (2018) "The monetary and fiscal history of Brazil, 1960–2016", *Federal Reserve Bank of Minneapolis Staff Report* 575 December, accessed on 21 May 2019, at https://www.minneapolisfed.org/research/sr/sr575.pdf.

Babecky, Jan and Havranek, Tomas and Mateju, Jakub and Rusnák, Marek and Smidkova, Katerina and Vasicek, Borek (2012), Banking, Debt and Currency Crises: Early Warning Indicators for Developed Countries (October 17). *ECB Working Paper* No. 1485. Available at SSRN: https://ssrn.com/abstract=2162901

Berg, Andrew, and Catherine Pattillo, (1998), "Are currency crises predictable? A test" *IMF Staff Papers*, Vol. 46 (June), pp. 107–38.

Boonman, T. M. (2019) "Dating currency crises in emerging market economies". *The North American Journal of Economics and Finance*, 49, 273-286.

Bussiere, M., & Fratzscher, M. (2006). "Towards a new early warning system of financial crises". *Journal of International Money and Finance*, 25(6), 953-973.

Calvo, Guillermo and Enrique Mendoza, (1996), "Mexico's balance-of-payments crisis: A chronicle of a death foretold," *Journal of International Economics*, Vol. 41, pp. 235-264.

Calvo, Sara and Carmen M. Reinhart, (1995) "Capital flows to Latin America: Is there evidence of contagion effects". Mimeo, World Bank, Washington D.C.

Chang, Roberto and Velasco, Andres (2001) "A model of financial crises in emerging markets", The *Quarterly Journal of Economics*, Volume 116, Issue 2, May , pp.489–517,

Dabrowski, M. (2019b). "Factors determining Russia's long-term growth rate". Russian Journal of Economics, 5(4), 328-353.

Dabrowski, M., & Collin, A. M. (2019a). "Russia's growth problem". *Bruegel Policy Contribution*. N.2019/4.

Desai, Padma (2000) "Why did the ruble collapse in August 1998?", *The American Economic Review*, Vol. 90, No. 2, Papers and Proceedings, pp. 48-52

Diaz-Alejandro, Carlos F, (1984), "Goodbye financial repression, hello financial crash". *Kellog Institute WP* 24

Dornbusch, R., Werner, A., Calvo, G., & Fischer, S., (1994), "Mexico: stabilization, reform, and no growth." *Brookings papers on economic activity*, 1994(1), 253-315.

Edison, H. J. (2003). "Do indicators of financial crises work? An evaluation of an early warning system". *International Journal of Finance & Economics*, 8(1), 11-53.

Eichengreen, B., and Hausmann, R, (1999) "Exchange rates and financial fragility" *National Bureau of Economic Research*. WP 7418.

Eichengreen, B., Rose, A. and Wyplosz, C. (1995). "Exchange market mayhem: The antecedents and aftermath of speculative attacks." *Economic Policy* 21, 249-312

Ferreira, Afonso and Tullio, Guiseppe (2002), "The Brazilian exchange rate crisis of January 1999", *Journal of Latin American Studies* 34 (1), p 143-164.

Flood, Robert and Garber, Peter, (1984) "Collapsing exchange rate regimes; some linear examples", *Journal of International Economics*, Volume 17, Issues 1–2, 1984, Pages 1-13.

Kaminsky, G. and Reinhart, C. (1999). "The twin crises: the causes of banking and balance-of-payments problems." *American Economic Review* 89(3), 473–500.

Kaminsky, G. L. (1999). "Currency and banking crises: the early warnings of distress" *International Monetary Fund*. (No. 99-178).

Kaminsky, Graciela, Lizondo Saul and Carmen M. Reinhart, (1998)" Leading indicators of currency crises", Staff Papers (*International Monetary Fund*), Vol. 45, No. 1, pp. 1-48

Krugman, P. (1999). "Balance sheets, the transfer problem, and financial crises." In *International Finance and Financial Crises* (pp. 31-55). Springer, Dordrecht.

Krugman, Paul, (1979) "A model of balance-of-payments crises," *Journal of Money, Credit and Banking*, Vol. 11 (August), pp. 311-25.

Krugman, Paul, (1996) "Are currency crises self-fulfilling?" *NBER Macroeconomics Annual*, Vol.11.

Laina, P., Nyholm, J., & Sarlin, P. (2015). "Leading indicators of systemic banking crises: Finland in a panel of EU countries". *Review of Financial Economics*, 24, 18-35.

Lin, C. S., Khan, H. A., Chang, R. Y., & Wang, Y. C. (2008). A" new approach to modeling early warning systems for currency crises: Can a machine-learning fuzzy expert system predict the currency crises effectively?". *Journal of International Money and Finance*, 27(7), 1098-1121.

Obstfeld, Maurice, (1986) "Rational and self-fulfilling balance of payment crises", *American Economic Review*, Vol.76, No.1 (March).

Obstfeld, Maurice, (1994) "The logic of currency crises," NBER Working Paper No. 4640 (Cambridge, Massachusetts: *National Bureau of Economic Research*, February).

Obstfeld, Maurice, (1996) "Models of currency crises with self-fulfilling features," *European Economic Review*, Vol. 40 (April), pp. 1037-47.

Palma José Gabriel, (2012) "The 1999 Brazilian financial crisis: how to create a financial crisis by trying to avoid one", Third Workshop "Financial Stability and Growth" Organized by CEMA-CRO – Center of Structuralist Development Macroeconomics, São Paulo School of Economics Fundação Getulio Vargas, and the Ford Foundation, March 2012.

Palma, José Gabriel, (1998), Three and a half cycles of 'Mania, Panic, and [Asymmetric] Crash': East Asia and Latin America Compared, *Cambridge Journal of Economics*, 22, issue 6, p. 789-808.

Radelet Steven and Jeffrey Sachs (1998), "The onset of the east Asian Financial Crisis", *National Bureau of Economic Research* WP 6680.

Reinhart, Carmen, Goldstein, Morris and Kaminsky, Graciela, (2000), Assessing financial vulnerability, an early warning system for emerging markets: Introduction, *MPRA* Paper.

Rodrik, D., Grossman, G., & Norman, V. (1995). "Getting interventions right: How South Korea and Taiwan grew rich. *Economic Policy*, 10(20), 55-107. doi:10.2307/1344538

Sachs, Jeffrey D., Tornell, Aaron and Velasco, Andre (1996) "Financial crises in emerging markets: The lessons From 1995," *Brookings Papers on Economic Activity*: 1, Brookings Institution, pp. 147-215

Su, C. W., Chang, H. L., Zhu, M. N., & Qiao, Z. (2010) "An evaluation of leading indicators of currency crises". *African Journal of Business Management*, 4(15), 3321

Tabata, S. (2000). "The great Russian depression of the 1990s: observations on causes and implications". *Post-Soviet Geography and Economics*, 41(6), 389-398.

Tanner, M. E. (1999). Exchange Market Pressure and Monetary Policy: Asia and Latin America in the 1990's. *International Monetary Fund* (No. 99-114).

UNCTAD (1998) , "The Russian Crisis", Geneva.

Wade, Robert (2002) "Gestalt shift: from "Miracle" to "Cronyism" in the Asian Crisis", *Working Paper Series Development Studies Institute London School of Economics and Political Science*, No. 02-25.