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Introduction

Since the beginning of 1997, a currency and/or banking crisis broke out in several transition countries (Bulgaria, Romania, the Czech Republic, Russia, Ukraine). In 1995, Hungary avoided a financial crisis by adjusting properly her macroeconomic policies. Financial markets in transition countries are still small. They gain, however, more and more importance for the entire economy. Part of the countries mentioned are candidates for EU membership. They have to show their ability to stabilize their exchange rates and financial sectors. The fact that overcoming the financial crisis in Asia and Latin America required international assistance (e.g. IMF) underlines the political importance of strategies of preventing such crises in the EU's immediate neighborhood.

Against this background, the Halle Institute for Economic Research (IWH) and the Centre for European Integration Studies Bonn (ZEI) organized a conference on 'Financial crises in transition countries: recent lessons and problems yet to solve'. The conference took place on 13/14 July 2000 in Halle. The organizers invited papers that are theoretical or empirical/policy oriented and offer a critical and up-to-date insight into a field that may gain more evidence in the future. Most of the papers selected by the scientific committee (*Jürgen von Hagen, Hubert Gabrisch and Thomas Linne*) present new results of empirical and theoretical research. This volume presents some of the papers. Discussants were *Jarko Fidrmuc* (Austrian National Bank, Austria), *Paul Gower* (Brighton Business School, UK), *Jens Hölscher* (Brighton Business School, UK), *Thomas Linne* (IWH, Halle, Germany), *Lukas Menkhoff* (RWTH Aachen), *Lucjan Orlowski* (Sacred Heart University, Fairfield, CT, USA) and *Magdalena Tomczynska* (CASE, Warsaw, Poland).

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Models of financial crises and the transition economy experience[1]

Zsófia Árvai and János Vincze

1 Introduction

Financial vulnerability became a much-studied topic in recent years. The Mexican crisis of 1994-95 reinvigorated interest in developing country capital market crises, and the 1997 events originating in East Asia widened the range of possible causes and mechanisms. Then the Russian crisis of 1998 brought the issue especially close to the transition countries in Central and Eastern Europe, where exchange rate, banking and stock market upheavals have been quite frequent. Countries with a view towards joining the Economic and Monetary Union must regard vulnerability to crises as one of their most important concerns, since preconditions of candidature explicitly require that violent movements in certain financial variables, such as exchange rates do not occur.

In this study we analyze the financial crisis experience of 11 transition countries. Section 2 is devoted to definitions, whereas Section 3 gives a short summary of the theoretical literature, on the basis of which we evaluate the country stories. Section 4 contains the 11 case studies. These include the five first-round EU accession countries (the Czech Republic, Estonia, Hungary, Poland, and Slovenia), the five second-round accession countries (Bulgaria, Latvia, Lithuania, and the Slovak Republic, Romania) and finally Russia, because of its obvious importance. As the early 1990s were characterized by the elementary structural reforms (some of the countries are still struggling with that), and the economies were not functioning as market economies, we focused on the period since 1995. In Section 5 a (neglected) theoretical aspect of currency crises is studied, in the framework of a simple model. Section 5 summarizes the link between crisis models and recent economic history in Eastern Europe.

2 The notion of financial crises

A crisis is something that develops abruptly though not necessarily unexpectedly. A financial crisis is then one that occurs in one of the financial markets. The principal types include currency, debt, stock market and banking crises. There exists no generally accepted definition of any of these, but there are phenomena that have the distinctive flavor of a crisis. In the case of a large quantitative study it would be necessary to give precise definitions, here we can avail ourselves with listing a few features of an informal way.

1 We thank for comments by participants at the conference "Financial Development in Eastern Europe: The First Ten Years" (Klaffenbach Castle, Chemnitz, February, 2000). The views expressed herein are those of the authors and do not necessarily represent those of the National Bank of Hungary.

A c*urrency crisis* can happen via abandoning a precommitted peg that results in a devaluation, and then either in a new fixing or in letting the currency float. In the latter case the ensuing depreciation often overshoots. Alternatively there might happen a large depreciation of a floating (or managed floating) currency. In cases of (managed) floating it is harder to give strict definitions, one possible solution is offered by Eichengreen, Rose and Wyplosz (1996) who establish thresholds for several "indicators". The currency crisis definition may entail unsuccessful attacks that do not end in a devaluation, as attacks may cause troubles, since they are frequently associated with high interest rates, or with significant loss of official reserves. We talk of a *debt crisis* when a country is unable to meet its obligations to repay its official foreign debt, and asks for rescheduling or writing off the debt. Also, there may be an official ban on honoring foreign debt by private entities, or a significant number of corporations may be in default towards foreign lenders. By a *stock market crisis* we mean a sufficiently high drop in share prices, where many agents in the market (securities firms, brokers, investors) go bankrupt. During such a crisis turnover reaches extremely low levels usually. Finally, in a *banking crisis* the illiquidity or insolvency of some of the banks disrupts the normal functioning of the banking system. A crisis can start out from one bank and spread to other banks through the payments system, or several banks face difficulties due to common reasons. It is characterized by bank runs and/or a breaking down in the payments system. In a broader sense one may include in the definition of a banking crisis bank consolidation schemes without the symptoms of runs or payments system problems, as these can involve substantial fiscal costs, and a disruption in the form of a sharp reduction in the volume of credit.

Usually, these types of financial market crises are related to each other, though one type of crises does not necessarily bring about the other ones. A currency crisis may put a pressure on the stock market, as foreign investors try to flee the country. A large devaluation may also lead to a banking crisis, e.g., if the currency mismatch is high in the banking sector's balance sheet. A banking crisis may induce a currency crisis, if the confidence of residents in the domestic banking system is shaken, and they wish to reallocate their savings into foreign currency.[2] Debt crises and currency crises usually go together, as the confidence in the local currency is shattered in both cases.[3]

3 Theories of currency crises

In this section the main models of currency crises and speculative attacks will be reviewed. The theory of currency crises has a rich literature, of which we do not aim to give a full review. A few years ago there seemed to be a consensus in the literature about the existence of two major families of models, namely first and second-generation models. However, we follow Jeanne (1999) and distinguish between *currency attack* and *escape clause* models.

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2 On the relationship between currency and banking crises see *Goldfajn-Valdes* (1997), for example.

3 On the two famous recent non-European crises see, among others, *Calvo-Mendoza* (1996) on the Mexican crisis, and *Krugman* (1998), *Corsetti-Pesenti-Roubini* (1998) on the East-Asian crisis.

3.1 Currency attack models

The main features of this type of models include: 1. There exists a prespecified level below which central bank reserves cannot fall. 2. There exists a monetary policy rule. 3. The shadow exchange rate is defined as the floating exchange rate that would prevail if the level of reserves were at the lower bound from period t indefinitely. 4. The model starts with a fixed rate, which remains the actual exchange rate until the shadow rate becomes larger than the fixed rate. 5. In that instant speculators attack the currency, reserves fall to their lower limit and the exchange rate becomes equal to the shadow exchange rate.

The crucial point in this type of models is that reserves cannot be acquired instantaneously to replete the stock at the time of an attack. Thus, when the shadow rate exceeds the fixed rate the attack leaves the monetary authorities helpless, and there is nothing to do but float. A subcategory in this class is the so-called first generation models (see Krugman (1979 or Flood-Garber (1984) where the floating rate is unique, (or, to be more precise, a unique floating rate solution is considered as nonstationary exchange rate bubbles are disregarded), and the policy rule is invariant to the occurrence of an attack. Here one can rightfully say that attacks come for fundamental reasons, and are caused by monetary-fiscal policy mixes that are inconsistent with the peg. The models are silent, however, on why this is the case.

Other *currency attack* models, such as Obstfeld (1986), were distinguished from first generation models as second generation ones. These assumed that policy is altered after an attack occurs, indeed it becomes looser. The explanation of this assumption is not part of the formal framework, though informal justifications are offered in the literature. In concrete examples it can be proved that with certain parameter constellations this little change in the framework can result in multiple equilibria, and an independent role for expectations even if we still disown the possibility of nonstationary bubbles. It has been shown, however, that self-fulfilling equilibria can be obtained in other ways, too. The trick is to devise a model where the stationary shadow rate solution is not unique, and this multiplicity once more results in an independent role for expectations (see Flood-Marion (1997).

3.2 Escape clause models

In contrast to currency attack models escape clause models can be characterized by the following features. 1. (Again) there exists an initial peg. 2. It is supposed that there exists a loss function for the monetary authorities, depending on the state of the economy. 3. There is a fixed opting-out cost that must be incurred if the fixed arrangement is given up. 4. Monetary policy makers want to minimize expected loss plus the opting-out cost by setting their instruments in an appropriate way, including the decision whether the initial peg is maintained. 5. A crisis occurs when the peg is "deliberately" abandoned.

In escape clause models expectations are important because they can make policies that keep the fixed arrangement costly. The authorities decide on the fate of the peg by a

cost-benefit analysis. There is a built-in discontinuity via the fixed opting-out cost that leads to a regime change in policy after the peg is given up. Here one can also define a shadow exchange rate as the one that prevails in period *t* if the authorities decide to abandon the peg in that period.[4] However, because of the fixed opting-out costs, this shadow rate must "definitely" exceed the peg to make the abandonment of it worthwhile to the monetary authorities. Because of the policy regime change one can construct examples where multiple equilibria and expectations can be self-fulfilling. See e.g. Bensaid-Jeanne (1997). Because of this feature the traditional classification put these models into the second-generation class. However, we think that this similarity is more superficial, whereas the differences between *currency attack* and *escape clause* models as described above are essential.

There exist a wide variety of formulations leading to a specific loss function, and to a mechanism that may result in the giving up of a peg eventually. In theory, there is always an interest rate level at which it is more profitable to invest into domestic assets compared to foreign assets. It is obvious, however, that high interest rates cannot be maintained forever, since it would be very costly. This cost can take the form of increasing interest expenditures on existing debt by the budget (countries with high public debt are particularly sensitive to this), or it can contribute to a slowdown in economic growth (which is particularly important in cases when the economy is in a recession anyway or there is political interest in high growth). The central bank may also be hesitant to maintain high interest rates in those cases, where private sector indebtedness is significant, and its debt bears variable interest rates predominantly. It is obvious that the outcome of the crisis depends on who is able and willing to bear the costs of high interest rates longer: the monetary authorities or speculators. Usually there are three regions in the parameter space: 1 No change in regime, 2. The regime necessarily changes and 3. Self-fulfilling (multiple) equilibria.

4 Case studies

This section gives a brief overview of the major macro- and microeconomic developments since 1995 of the 11 transition economies under investigation. We do not aim to give a full evaluation of these countries' economic performance, instead, we focus on issues having direct relevance to the financial crises that have hit the region since 1995. For a summary of main macroeconomic indicators see the Appendix.

Russia

For several years after the political break-up with the communist past the Russian economy existed in total disarray. In 1996 a new government began to introduce promising reforms in order to accomplish market economy transformation and stabilize the economy. This program marshaled substantial external help in terms of finances and political support, too. Two interrelated topics stood at the core of the reforms: the speeding up of

4 One has to note that reserves are not necessarily part of an escape clause model.

privatization, and the reform of government finances. The process was surrounded by a general aura of optimism that resulted in large capital inflows, and sharp increases in asset prices (see Chart S9). The concomitant decrease in ruble denominated fixed income yields was also felt finally, still, the positive yield differential on ruble bonds was perceived to be large enough to justify the relative increase of foreign currency debt. (The short term ruble yield was never below 17% in 1997, whereas the ruble depreciated only by 7% during the year.)

During 1997 the miracle started to fade. There was an increasing recognition that changes had been stalled, and extraneous circumstances, e.g. the general pessimism following the East Asian crisis, put an end to the stock price rally. In addition, low commodities prices weakened Russian foreign earnings, and the sacking of Prime Minister Chernomyrdin must have been the final step to disillusion.

From early 1998 there must have remained only one question: would there be an international bailout or not? Without this, a full (debt, currency, banking, stock exchange) crisis seemed inevitable. A pre-crisis stage was set by huge increases in interest rates and the shortening of maturities, setting government debt on a runaway path. Stock markets lost nerve first, and a stock market crisis materialized in May. With time the negative impact of high interest rates on production also became apparent, exacerbating thereby the already tremendous political uncertainties.

Though some international help arrived, it was perceived to be too little, and in August the crisis was full-blown. Large devaluation of the already heavily managed ruble, and default on ruble debt, including private debt, followed. A spiral developed, more devaluation, bank runs leading to a collapse of financial intermediation and the breakdown of the payments system, finished the play. For most observers the root of the problems was clear: fiscal reform had been unsuccessful, and the soft budget constraints of firms had not been hardened.

The Russian crisis of 1998 has a good chance to be classified as a currency attack type crisis, policy inconsistencies resulting in bad fundamentals inevitably leading to a situation where reserves might have fallen to a level where further defending the exchange rate was impossible. Fiscal policy was clearly inconsistent with the peg, and debt financing of the deficit had effects that can be understood by Calvo's [1996] model. The time of attack was delayed, but the severity of the crisis was probably larger. The shortening of maturities are to be considered along the same lines. The government eager to gain time should have insured international investors by issuing debt with shorter maturities increasingly denominated in foreign currency. This resulted in a currency-cum-debt crisis, since with the significant foreign debt a mere devaluation may not have achieved the necessary adjustment, and explicit default became inevitable.

Still there was an aspect of this crisis that may be missing from current theories. As we emphasized, in CA models the defense is simply infeasible at some point, whereas in EC models the central bank can always choose to maintain the peg. In the Russian case the ability and/or willingness of keeping the peg may have rested outside the country. It seems that investors believed that there was a chance that Russia's reserves were unlim-

ited because of the "too big to fail" syndrome on an international level that would have ended in a bailout. In this sense the best model for describing the Russian crisis can be one where there is some probability that the system in a CA regime with finite bounds for reserves, or in an EC regime where reserves are unimportant. Political developments making the likelihood of the first case very high might have resulted in the eruption of the crisis eventually.

The Russian crisis was a full-blown financial crisis with a currency, debt, banking and stock market crisis. Though the stock market crisis preceded the other crises, it cannot be considered as a cause of the currency crisis. A good precedent may have been the Mexican crisis when fixed income investors did not post losses. Though the banking crisis seemed to be a consequence of the currency-debt crisis, banking problems were part of the policy inconsistencies leading up to the crisis. The interwoven nature of the public and private sectors may explain why official default was extended to private debt, too.

Bulgaria

The early 1990s witnessed a similar transition pattern in Bulgaria to that prevailing in Russia. There was never a fully successful macroeconomic stabilization, soft budget constraints dominated the enterprise sector, there existed significant asset stripping that was accompanied by high level of criminality. Banking was in particular an area of fraudulent behavior, assisted by weak banking supervision. The country had a relatively high level of official foreign debt that was rescheduled in 1994, but still remained uncomfortably high (78 % of GDP in 1998), especially in view of low official reserves. Dollarization was relatively high expressing serious doubts about the future of the domestic currency.

In 1996 there was a new attempt at stabilization, which was a money-based program (recall low reserves), which, as usual, led to very high interest rates. The experience of money-based stabilization's in Latin America has taught us that money based programs suffer from upfront problems, i.e. a recession (see Tables 1-4) now rather than later, due to high interest rates, and sometimes, as in Bulgaria's case, to a decline of real wages. Fiscal imbalances were not reduced in Bulgaria, rather exacerbated, but despite of this the social costs of stabilization were not alleviated, either. The outside world did not regard Bulgaria with the same hopes as Russia, partly because of its size, and also because it did not have significant stock or domestic bond markets[5]. The stabilization program lost credibility quickly, which was followed first by a political stalemate then a full-blown crisis in 1997 with sharp depreciation of the domestic currency, bank runs, and the significant acceleration of inflation (see Table 2 in Appendix).

After the crisis a new government was formed. It appeared to be intent on wholesale reforms for which it could obtain the IMF's support. A currency board was introduced, and tight fiscal policies with structural adjustment in public finances were put in place.

5 The stock market was founded in 1998.

Banking problems were also addressed by the new government radically. Long-delayed privatization was started, ailing banks recapitalized, and banking supervision was significantly strengthened. This was particularly important as the banking system was perceived to have been at the center of the crisis. Interestingly the Russian crisis tested the banking system, and it proved to be strong enough to withstand the storm. Only one bank heavily exposed to Russia failed.

Bulgaria's story can be divided into two distinct periods. Before the introduction of the currency board in 1997 Bulgaria had a managed float, an arrangement perfectly corresponding to what a rational government wishing to avoid a currency attack would have chosen if finding itself in a situation described by a CA model. Bulgaria had many structural weaknesses and little political support. An immediate and successful currency attack would have been certain if a peg had been attempted. Sharp deprecations in a floating system occurred, a currency crisis of this type and a banking crisis followed a failed stabilization in 1996-97.[6] Then came a sudden change, a political will to make a complete transformation appeared, and it was given international support. The introduction of the currency board was accompanied by other reforms that practically reversed the woeful state prevailing beforehand. Budgetary discipline, privatization, strengthening of bank supervision, labor market reform all occurred simultaneously and this change in fundamentals resulted in an apparently highly credible peg, which the government would not wish to give up, and its maintenance would probably be feasible, too.

Romania

Romania's case is comparable to those of Russia and Bulgaria. Again, we see a series of unsuccessful stabilization attempts, generating quite extreme degrees of nominal and real uncertainty. The country experimented with monetary and exchange rate targeting with a view towards a large set of changing objectives. Periods of very high real interest rates were followed by excessive easing in monetary conditions. During this time markets sometimes exerted substantial upward, sometimes significant downward pressure on the exchange rate. Policies either withstood or allowed market pressures to be validated. From time to time huge reserve losses occurred. There was a period when the exchange rate was a de facto anchor that was key to reigning in inflation. In 1996-7 a full-blown currency crisis developed that can be taken as a purely domestically produced "bad" without reference to contagion from abroad.

In the whole period little progress was made in structural reforms, and output almost continuously fell. The fiscal stance was loose in general, but high inflation (see Table 2) and seigniorage helped keeping government debt within bounds. There has been a large appreciation on a CPI basis, but sometimes large real wage declines signaled intentions to halt the erosion of competitiveness. The banking sector has been a mess, enterprise restructuring proceeded very slowly. The central bank was usually demanded to provide direct credit to loss-making sectors.

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6 Stock market crisis was not possible, because there was no stock market, and the debt crisis did not materialize because most of the foreign debt was sovereign and owed to official creditors.

Bulgaria and Romania have much less international importance than Russia, and also do not possess the same natural riches. Their different treatment by the international investors must be attributed to these features. On the other hand, Romania's and Bulgaria's path started to diverge, too. Perhaps the essential difference was that in Romania things did not go so utterly wrong that a fundamental change became inevitable. There was no full-scale banking crisis in Romania, despite the existence of a very fragile banking system. The Romanian situation can again remind us to the Latin American experience of chronic high inflation. While hyperinflation is so insufferable that attempts to stop it are credible and usually successful, high inflation rates can survive for longer periods, interspersed with weak and unsuccessful attempts to stabilize that are never fully credible, and where this lack of credibility undermines their very success. After 1997 inflation reaccelerate, the exchange rate has steadily depreciated (Chart E11), and negative growth rates have reappeared (Table 1). This is in sharp contrast with what happened in Bulgaria.

Latvia

The impact of the Russian crisis on Latvia was quite severe due to the economy's high exposure to Russian markets. Before 1998, the country's progress toward a well-functioning market economy has been promising, the exchange rate peg to the SDR contributed significantly to economic stabilization. The results of structural reforms and stabilization-oriented macroeconomic policies were becoming visible by 1997, when real GDP growth reached 8,6%, CPI inflation decreased to 7%, and the budget was close to be balanced. Although real appreciation has been substantial vis-à-vis Latvia's trading partners in the past years, other indicators show that the economy is still competitive. As macroeconomic indicators and banking sector data show, the economy was in fact becoming overheated, credit expansion had been very rapid between 1996 and mid-1998. Due to its location and historical reasons, Latvia have always had close trade and financial relations with Russia, therefore contagion effects of the Russian crisis were quite serious on Latvia. The sharp depreciation of the ruble brought down several Latvian banks (including the third largest commercial bank) as a result of the substantial systemic exposure to Russia which amounted to 11% of total assets in August 1998. The outburst of the crisis in Russia prompted the Latvian central bank to intervene defending the lats, and several banks – known to be heavily exposed to Russia – experienced runs. Following the crisis, the country saw three quarters of negative growth, the current account deficit reached 9% in 1998, the budget deficit increased significantly and structural reforms slowed down temporarily. The crisis had some positive consequences as well, since then sizeable part of foreign trade has been redirected towards non-CIS countries, prudential regulation of the banking system has been tightened as the crisis exposed the weaknesses of the banking sector, and the formerly overheated economy cooled down (though at a rather high price).

There was some pressure on the exchange rate system at the outburst of the Russian crisis, but the exchange rate peg did not have to be abandoned. Despite the fact that there

was no currency crisis, the medium-term consequences of the contagion from Russia are rather severe because of the economy's heavy exposure to Russia. Latvia's case is similar to that of Estonia, that is there was no significant speculation against the lats. Therefore it is hard to classify, it is closest to the escape clause model, where the maintenance of the exchange rate peg was given priority.

Lithuania

Among the countries reviewed in this section, Lithuania – along with Latvia – suffered the most from contagion effects of the Russian crisis of 1998, though contagion was not as significant as to bring the country's currency board arrangement (established in 1994 as a peg to the US dollar) down. Real GDP growth had been sizeable since 1995 (7.3% in 1997) until the second half of 1998, when a sharp slowdown was experienced, and in 1999 the country entered a recession (Table 1). This can clearly be attributed to the Russian crisis, as Lithuania's exposure to Russian market conditions is the highest among the countries under investigation. Even though Lithuania has done much progress toward a market economy, this characteristic sets the country apart from other advanced transition economies. The share of developed economies in Lithuania's foreign trade is significantly lower than in Estonia. External imbalance has been the major weakness of the Lithuanian economy for several years, in 1998 the current account deficit reached 12.1% of GDP following the 10.2% of the preceding year. Real exchange rate appreciation played a part in the significant current account deficit, the cumulative real appreciation of the lita since December 1994 reached 81% vis-à-vis Russia and 80% vis-à-vis the EU. The real appreciation vis-à-vis the EU (the largest export market by 1998) was due to the inflation rate differences between Lithuania and the EU, in the first two years following the introduction of the currency board CPI inflation was substantial (39.5% in 1995) which declined to 0.3 by the end of 1999. Fiscal prudence has been acceptable, though the general government had a deficit since the currency board was established (Table 3), and the deficit was financed mainly by foreign borrowing and privatization receipts. The structural transformation of the economy has not been very rapid, and it is still not completed, in fact, structural reforms lost momentum following the Russian crisis, when quasi-fiscal support was granted to certain sectors and enterprises hit hard by the crisis. Financial market reform can be considered advanced, foreign ownership is high, and the banking sector consolidated after the banking crisis in 1995-96. Commercial banks were not affected significantly by the Russian crisis due to their limited direct exposure and strict prudential regulation. The stock market, however, was hit hard by the Russian crisis, the index plunged by more than 40% in 1998 (Chart S6).

Although Lithuania was quite vulnerable to contagion from Russia in 1998, the currency board arrangement survived the storm. As a consequence of the Russian crisis, there was some capital outflow (though not to the extent that it can be considered an attack), interest rates jumped up and remained high for more than half a year (Chart R6). Lithuania's case can be evaluated as an escape clause type situation with a positive outcome. There was strong political will to maintain the so far successful currency board whose abandonment would have entailed a very serious credibility loss, as it was the basis of the country's stabilization strategy.

Estonia

Estonian transition can be regarded as a success story, as it is shown by the country's inclusion in the first group of accession candidates to the EU. Estonia took the most liberal view among transition economies as far as the transformation of the real economy and financial markets are concerned. Price, trade and capital market liberalization is among the most advanced in Transition Europe, which had a positive effect both on the micro and macroeconomic performance of the country. Estonia established a currency board arrangement in 1992 and the exchange rate (8 croon to 1 Deutsche Mark) remained unchanged until January 1, 1999 when the Estonian croon was pegged to the Euro. The currency board was successful in providing a predictable economic environment and bringing inflation down to single-digit level by 1998 and reaching 4% in December 1999. Real GDP growth was around 4% between 1995 and 1998 with the exception of 1997, when it reached an outstanding 10.6%, whereas in 1999 the country entered a recession (Table 1). The gradual decline of the inflation rate (Table 2) means that on a CPI basis the Estonian croon appreciated substantially in real terms against the major trading partners (the European Union), which may also be reflected in the current account deficit reaching about 10% of GDP in the last few years. The reorientation of foreign trade from Eastern (former Soviet Union) markets to Western markets reached a high level, in 1998 62% of Estonian exports went to the EU (also boosted by the Russian crisis). The current account deficit (Table 4) has been financed by capital inflows, especially foreign direct investment was high, Estonia has the second highest FDI per capita in transition Europe after Hungary. High capital inflows indicate the liberal and hospitable attitude of Estonian authorities to foreign investment which helped the structural transformation of the corporate sector reaching an advanced stage by the end of the 1990s. Unlike the Czech and Slovak Republics, Estonia favored the strategy of selling formerly state-owned enterprises as quickly as possible against cash and trying to find effective new owners. As a result of high FDI, the chosen privatization strategy and the well-functioning bankruptcy regulation, corporate governance can be considered good. The unemployment rate has been stable – around 10% – since 1995. Financial market reform is also quite advanced, following the banking crisis in 1992-93 the situation in the banking sector consolidated, state ownership is insignificant and the major commercial banks are in foreign hands. As a consequence, intermediation is relatively efficient, the share of bad loans is remarkably low. The budget was more or less in balance since the beginning of transition (Table 3), the government is not burdened with high public debt.

Emerging market crises had a limited impact on the Estonian currency board system. There was some pressure on the Estonian croon at the time of the Czech crisis in May 1997, and brief but intense trading was experienced in the spot and forward foreign exchange markets in the fall of 1997 during the crisis in Southeast Asia. These events somewhat reduced the trust in the croon for a short time, but immediate speculative pressures did not last long as interest rates (Chart R3) rose automatically due to the currency board system. Estonia's response to the Russian crisis was similar to that of the other two Baltic economies though with less damaging consequences on the real economy due to its lower exposure to Russia. The stock market, however, was hit hard by the loss of confidence of foreign investors in emerging markets. Again there was an imme-

diate rise in interest rates, but capital flight was not substantial. As there was no significant speculation, this case is hard to classify, it is closest to an escape close model with a positive outcome where the costs of giving up the currency board in terms of credibility loss would have been great.

The Slovak Republic

Despite the vulnerability of the Slovak economy to financial crises, the country was able to defend its fixed exchange rate system until the Russian crisis of 1998. The vulnerability of the crown's exchange rate was more of microeconomic in nature, as some of the main macroeconomic indicators were among the most favorable among transition economies until 1997: High economic growth (about 6% annually on average between 1994 and 1997 mainly driven by domestic consumption, gradually decreasing inflation (from 13% in 1994 to 6% in 1997), fiscal stability and low public debt, high investment growth (see Tables 1-4). These positive macroeconomic developments, however, concealed shaky microeconomic foundations, which were visible in high real wage growth exceeding productivity gains, low growth of industrial production, increasing current account deficit (8% of GDP in 1997) accompanied by a low export growth rate and continuous real appreciation, lower share of developed countries in foreign trade than in case of other advanced transition countries, and increasing foreign private debt with a growing share of short term debt. The necessary restructuring and transformation of enterprises and financial markets have just started in the Slovak Republic. The mass coupon privatization and the selling of state-owned enterprises to cronies of the ruling political establishment proved to be a disaster as far as enterprise performance is concerned. This was aggravated by a lack of strong capital market regulation, a dysfunctional bankruptcy law, weak judicial infrastructure and enforcement. The aversion to foreign investors and clear preference of domestic investors in the privatization process also played a part in poor enterprise performance. All these factors resulted in inefficient and weak corporate governance, inefficient resource allocation, and the build-up of pressures on the seemingly positive macroeconomic indicators. When the implementation of structural reforms speeded up with the change of government economic growth slowed down, inflation jumped to two-digit levels, the budget deficit and public debt deteriorated. Unemployment increased, and real wage growth became negative.

The exchange rate was fixed against a basket of DEM and USD in 1993, and the fluctuation band was widened three times, finally to +/-7% in the beginning of 1997. The first serious pressure on the Slovak crown was experienced five days after the first attack on the Czech crown in May, 1997. As the contagion reached Slovakia, the Slovak central bank acted promptly by raising interest rates (Chart R2) and squeezing liquidity by other means, e.g., reserve requirements. The central bank was able to maintain the peg, though interest rates remained high for a longer period of time. The main reason why this attack on the Slovak crown was not successful is that speculative (and other type of) foreign capital inflow was relatively low in the preceding years. Unlike the Czech Republic, the Slovak economy was rather closed, the country reached a low level of capital market liberalization, and foreign participation in the banking sector and the stock exchange was insignificant. The Slovak crown, however, was not able to withstand the contagion

from the Russian crisis and the peg was given up in September 1998. The costs of defending the exchange rate clearly outweighed the benefits, the main arguments for the maintenance of the peg in the past being the prevention of the pass-through of a devaluation to inflation and political considerations. The ensuing devaluation reached about 20% which was beneficial to the country's competitiveness and improved the catastrophic current account deficit. The new government did not treat the peg as a political issue, and realized the costs and distorting effects of the mispositioned exchange rate.

Both the first attack on the Slovak crown in 1997 following the Czech crisis and the second attack in September 1998 can be classified as escape clause model types with different outcomes. The costs and benefits of maintaining the fixed exchange rate system were the same in both situations, but the political situation was different. In the first case, under the Meciar government, the defense of the peg at any price was given priority. In the new political situation of 1998, however, political considerations had lower preference than economic reasoning, also the costs of defending the peg (higher interest rates, lower reserves) would have been higher than in the first case. However, it is also possible that with time the costs of maintaining the peg increased, and also that there may have existed a fear of an attack model scenario.

The Czech Republic

The Czech Republic used to be regarded as the most advanced of the transition economies in Eastern and Central Europe. Until 1997, the country experienced relatively high economic growth, low inflation (compared to other transition economies), fiscal stability, and a low level of public debt inherited from the pre-transition period (see Tables 1-4). The seemingly positive macroeconomic indicators, however, concealed serious microeconomic problems. The mass coupon privatization scheme ex post proved to be an inefficient method to restructure the corporate sector. The most important problems were the delays in privatizing the large commercial banks, weak capital market regulation, the inefficient and dysfunctional bankruptcy and debt enforcement regulation. High real wage growth exceeding productivity growth, and, perhaps, the remarkably low unemployment rate also indicated the failure of the transformation and restructuring of the corporate sector. Until 1997, real exchange rate appreciation and the accompanying loss of competitiveness led to an increasing current account deficit which reached about 8% of GDP in 1996. Foreign participation in the privatization process was lower than, for instance, in Hungary or Poland. The Czech Republic had the most open capital account in transition Europe, and speculative capital inflow was very high, especially preceding the crisis of May, 1997. The 1997 currency crisis destroyed the Czech Republic's image as the most advanced economy in the region. The reforms following the crisis, however, are painful as shown by the macroeconomic indicators: in 1998 the economy entered a recession, the unemployment rate jumped up, and fiscal stability deteriorated. At the same time, the inflation rate dropped to EU levels, the current account improved significantly and foreign debt accumulation slowed down.

The first attack on the fixed exchange rate of the Czech crown – which was at that time allowed to fluctuate in a +/-7.5% wide band since February, 1996 – came on May 15,

1997. During the two weeks of the crisis, the central bank responded by several interest rate hikes (official (repo) rates were raised as high as 75%, and due to liquidity shortage overnight rates in the interbank market reached 500%) and by administrative measures for non-residents (domestic commercial banks were not allowed to lend in domestic currency to foreigners). On May 26, the central bank gave up the peg and the crown started floating around 9-12% below the original parity. The Czech National Bank had several reasons for and against the defense of the fixed exchange rate system. One of the most important costs of giving up the peg was the loss of credibility, as the Czech antiinflationary policy was based on the maintenance of the fixed exchange rate. Another important reason was that foreign debt accumulation by the corporate sector had been significant in the preceding years, whose exchange rate risk was mainly unhedged. The arguments against the defense of the Czech crown included fast diminishing foreign exchange reserves and steeply rising interest rates which – if maintained for too long – would have had a negative impact on economic growth already showing the sign of a slowdown. As the abandoning of the peg indicates, the central bank finally deemed the costs of defending the Czech crown higher than giving up the peg. The contrast with the first attack on the Slovak crown is clear, the most important reason why the speculative attack on the Czech crown was successful is the openness of Czech capital markets and the active participation of non-residents in the attack. Since the Czech crown was allowed to float, there has been serious fluctuation in the exchange rate, but the currency crises of the last three years (the Asian, Russian and Brazilian crises) led only to temporary depreciation's.

The May 1997 currency crisis in the Czech Republic also belongs to the category of escape clause models. The Czech central bank had high foreign exchange reserves and could have resisted the attack for a longer period of time than it did. During the crisis, however, it became apparent that the costs of defending the exchange rate (very high interest rates hurting the real economy, the further accumulation of the current account deficit due to the overvalued exchange rate) were higher than the costs resulting from abandoning the peg.

Poland

Polish transition has been considered as one of the success stories among transition economies. The country has been enjoying robust growth averaging 6% between 1995 and 1998. Other macroeconomic indicators have also been very favorable, the inflation rate has gradually decreased from 28% to 10% in 1999, the fiscal balance has also been improving (see Tables 1-3). The only alarming macroeconomic indicator is the current account deficit (Table 4), which has been deteriorating since 1996 and reached about 8% of GDP in 1999. The structural transformation of the Polish corporate sector has been continuous but not too fast. The strength of the real economy is the relative abundance of newly set-up small and medium-sized enterprises as well as the large volume of foreign direct investment, while policy makers have been reluctant to give up control in "strategic" industries or let loss-making heavy industries fail as Polish trade unions are the most influential in the region. Financial market reform is also quite advanced, the banking sector can be considered healthy, following the bank failures and consolida-

tion process in the first half of the 1990s bad loans in the balance sheet of banks have been low. The bank privatization process, however, is not finished yet, some of the major banks are still awaiting privatization. All in all, corporate governance – as one of the most important determinants of real economic performance – can be viewed as satisfactory. Unemployment is still high (around 12%), but this figure should be used with caution as the grey economy is significant. It is an important problem for the central bank that the monetary transmission mechanism is quite inefficient, and the National Bank of Poland can influence demand only by drastic changes in interest rates. As a result of the inefficient transmission mechanism, real interest rates are very high, reaching 8-9% at times of monetary tightenings. High interest rates, favorable macroeconomic indicators and relative political stability make Poland attractive for foreign investors, and capital inflow has been the highest in the region for a few years now. Foreign capital flows are helped by the relative openness of capital markets, though capital account liberalization has been gradual, and short-term capital movements are still not fully liberalized.

The Polish exchange rate system went through several changes in the last few years. It was based on a crawling peg with a fluctuation band around it. The monthly devaluation rate had been gradually reduced along with the decline in the inflation rate to 0.3% and the band was widened several times finally to +/-15% in April, 1999. As the last step towards a flexible exchange rate regime, the zloty was allowed to float in April 2000. Poland did not experience a currency crisis in the sense that monetary authorities did not have to give up their commitment to the exchange rate arrangement. However, as the fluctuation is rather wide, the exchange rate of the Polish zloty went through volatile periods especially at the time of the Russian and Brazilian crises.

The fact that Poland has not experienced a currency crisis was partly due to the preemptive measures taken by Polish monetary authorities: the fluctuation band around the central parity of the Polish zloty has been widened five times since the introduction of the crawling band regime and finally was allowed to float. Besides the motive of trying to avoid speculative attacks (the weakness of the Polish economy is its high current account deficit), Polish monetary authorities aimed at increasing the independence of monetary policy and keep real interest rates high in an economic environment characterized by disinflation and high economic growth.

Hungary

In Hungary there was a mini crisis in 1995, preceded by recurrent attacks on the forint during 1994-95 in a not-fully liberalized environment. The devaluation was practically contemporaneous with the lifting of several capital controls as a consequence of the country's joining the OECD, and can partly be regarded as a preemptive measure. Though the stabilization package of March 1995 contained important structural reforms, the step devaluation and the subsequent introduction of a crawling peg regime was an essential part. The crawling peg, or rather crawling band, regime has served for striking a balance between stability, flexibility, and the preemption of attacks.

After 1995 no serious crisis occurred, though the exchange rate came under pressure be-

cause of fiscal concerns after the elections of 1998, and because of the Russian crisis. In 1995 the stock market was too insignificant to suffer, but the Asian and especially the Russian crisis caused upheaval there. On the whole the Russian crisis led to a decline in stock market prices (see Chart S5) and a certain turmoil on the foreign currency market, but on the whole the country weathered the crisis rather easily (see Darvas-Szapáry (2000) for details). Most of this period the exchange rate was under a reverse, appreciating pressure that involved substantial intervention and increases in official reserves.

Fiscal policy, having been at the core of the crisis in 1995, has improved substantially, but this may be due to unique and cyclical causes. The reduction in debt levels came as a consequence of large scale privatization, and the solid growth in the last few years must have helped fiscal balances significantly. Banking problems were very severe in the early 90s, but after bank consolidation the banking sector became robust enough. Now foreign ownership is high, while some significant retail banks remained in state hands. Individual banking problems existed, but there is little reason to believe today in systemic problems.

In Hungary there was a sort of currency crisis in 1994-1995, and there were chances that a debt crisis may eventually develop. The currency crisis can be explained by the EC model in our view. Though capital account liberalization was not complete in this period, it was advanced enough to make attacks possible, and indeed the adjustable peg regime was recurrently attacked between 1992-1995. As a matter of fact this arrangement attracts such a response. Still, we believe that the devaluation in March 1995 must be considered as a choice rather than a necessity. The costs of having a strong real exchange rate had become absolutely obvious by that time, and only a political stalemate and capital controls prevented its occurrence earlier. Though fundamentals were bad enough, a continuation of policy would have been conceivable for some time to come. Devaluation was not a panacea, but it had a powerful role, as it turned out, in the adjustment whose main point a very substantial switch of revenues was.

The stabilization package though far from carried out according to plans engineered a substantial improvement in fundamentals, making the adoption of a comparatively rigid crawling band arrangement feasible, which has been successful despite testing it by successive waves of crises. Recently reverse attacks have been more of a danger than normal ones.

Slovenia

Slovenian economic policy has always exhibited definite preference for stability, and it has been put into practice in a consistent way. In the level of micro reforms the country has privatized, but with many restrictions, and asset stripping was probably prevented. There was some bank rehabilitation, but banks are generally overcapitalized, thus they are little threatened by liquidity problems. As far as macroeconomic policy is concerned, conservative fiscal stance and tight monetary policies have been implemented. Though in 1995 the country had to assume some former Yugoslav foreign debt, which caused some problems. Despite these the level of household foreign currency deposits is tradi-

tionally high, thus households are well sheltered against potential domestic nominal instability. Monetary policy resorted to many instruments which resulted logically in implementing many restrictions on capital markets. High interest rates should have led to capital inflows, but restrictions were put in place in order to avoid this. Reducing inflation has been the main goal of monetary policy, but there emerged a concern for the real exchange rate as until 1997 there had always been excessive real wage increase.

The country easily weathered the Asian and Russian crises, it has an AA grade investment rank with small spreads that did not increase even after the Russian crisis. Currently the biggest problem the country faces is how to manage further liberalization. Also, there are problems with financial and labor market reforms that are necessary to achieve sustained high growth.

Slovenia did not make exchange rate announcements. However, the central bank has always heavily managed the exchange rate following certain principles, thus we can discuss the working of this implicit arrangement. Apparently, the basic idea was to maintain exchange rate stability whenever possible with a view to price stability, still exchange rate adjustments, usually devaluation's, were engineered whenever there was a good reason. On the other hand, none of these adjustments was very sharp. Exchange rates were adjusted whenever some obvious fundamental upward pressure presented itself, whether in the form of an increase in debt or in real appreciation. On the other hand, speculation was checked by capital controls. It must be noticed also that monetary independence was a preference for Slovenia, since interest rates were thought to be an effective independent means of fighting inflation. This was another reason why Slovenia has retained capital controls even to such an extent that has inspired criticism. The Slovenian system can be regarded as highly preventive with respect to crises. Fiscal fundamentals were usually strong, deficits were in general close to zero (Table 3). High domestic interest rates did not result in a substantial increase in foreign gross debt because of the controls. The development of the stock exchange was not a primary concern, excluding another area from the influence of speculators. Banks were strictly regulated, and generally overcapitalized. It seemed that stability, i.e. the avoidance of any sort of crises have occupied a very prominent place in the thinking of Slovenian policy makers, and they have done practically everything in order that Slovenia do not exhibit any of the features that might result in a financial crisis.

5 A model

In several transition country cases policy makers were intent to fight inflation with high interest rates, and this, together with good fundamentals, led to capital inflows, and to reverse attacks (Poland, Slovenia, Hungary and the Czech Republic). Policy makers either had to give in and decrease interest rates (Hungary), or had to apply capital controls (Slovenia), or had to make the exchange rate regime more flexible (Poland). The analysis of these policy options is missing from the theoretical literature. This issue can be particularly interesting since attacks have been in many cases preceded by reverse attacks, and the bulk of the problem consisted in sudden reversal of capital flows, and not

just in a flight.

In this section we first ask when it may be reasonable to use interest rate policy for reducing inflation in a pegged, but adjustable, exchange rate regime under the condition of perfect capital mobility. Then we look for some motive that makes devaluation optimal in some state of the world. Therefore we analyze a more complex monetary policy game, in which such a behavior is (ex post) optimal.[7]

5.1 Inflation and the interest rate

In this subsection we focus on a monetary authority that has a preference for low inflation, and faces "perfect" capital mobility. First, let us consider what perfect capital mobility implies for the constraints on monetary policy. We model perfect mobility by the requirement that one-period government bonds issued by the home government must yield the same expected return, irrespective of their denomination.[8] Thus if I^* is the gross return on foreign currency denominated bonds (assumed to be exogenous), I is the home currency gross interest rate set by the monetary authorities, and p is the probability that there will be no devaluation, then the following equality must hold:

$$pI + (1-p)I / e_b = I^* \tag{1}$$

The nominal exchange rate is measured in units of home currency per foreign currency, the initial exchange rate is normalized to 1, and e_b is the level of the devalued currency. In this subsection we simply assume that in the "good" state there is no change in the exchange rate, whereas in the "bad" state the monetary policy maker devalues. One can express e_b as

$$e_b = \frac{(1-p)I}{I^* - pI} \tag{2}$$

Since we consider only devaluation's (e_b>1) one can easily see that *I* can take values between I^* and I^*/p, and e_b is a strictly monotonically increasing, convex function of I on this domain, having $[1,\infty)$ as its range. We regard (2) as expressing the fundamental constraint that unrestricted international capital markets impose on monetary policy.

Next we have to make assumptions about price formation to link monetary policy to the goal of reducing inflation. We assume that the price index in every period can be expressed as a Cobb-Douglas function of the nominal exchange rate and of the nominal

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7 We present the model and the results in a non-rigorous way. The technical description of the model can be found in *Árvai* and *Vincze* (2000).

8 It is a stylized fact that most developing countries issues sovereign debt in both home and foreign currency denomination. We neglect default risk in what follows, since it must be rather small (normally) in the short term.

wage.[9]

$$\Pi = W^{\alpha} e^{1-\alpha} \tag{3}$$

Here W is the nominal wage, and Π the price level next period. As we normalize the initial price level to 1, Π is also the gross inflation rate. We suppose that the nominal exchange rate passthrough via import prices is fast, i.e. the new exchange rate set by the authorities appears among production costs immediately. On the other hand nominal wages are sticky, and are set after the interest rate decision, but before the exchange rate decision is made. We assume that wage setting can be described by the following formula[10]:

$$W = E(\Pi)C \tag{4}$$

where E is the expectation operator, and C is consumption. Let us suppose that consumption depends on the expected real interest rate.

$$C = \left(\frac{I}{E(\Pi)} \right)^{-\gamma} \tag{5}$$

Here γ is the elasticity of consumption with respect to the expected real interest rate.[11] After combining (3), (4), and (5), taking expectations, and solving for expected inflation we obtain the following expression.

$$E(\Pi) = E(e^{1-\alpha})^{\frac{1}{1-\alpha\gamma-\alpha}} I^{\frac{-\alpha\gamma}{1-\alpha\gamma-\alpha}} \tag{6}$$

From (2) $E(e^{1-\alpha})$ can be written as

$$E(e^{1-\alpha}) = \left(p + (1-p) e_b^{\,1-\alpha} \right) = \left(p + (1-p)((1-p) I (I^* - pI)^{-1})^{1-\alpha} \right) \tag{7}$$

One can derive that at $I=I^*$ the derivative of expected inflation is positive. Supposing that $1-\alpha\gamma-\alpha$ is positive it turns out that it remains positive, and increasing. On the other hand if $1-\alpha\gamma-\alpha$ is negative expected inflation has a maximum, but then declines. In either case there does not exist a minimum, but whereas in the first case increasing the interest rate always raises inflation, in the latter it turns out to reduce inflation eventually.

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9 This could be derived from Cobb-Douglas technology with labor and imported goods inputs, and perfect competition.

10 Assuming that consumers' utility is additively separable in consumption and leisure, and it is linear in the latter, then $W=\Pi C$, ignoring a proportionality factor, would be an exact formula with competitive spot labor markets. Replacing Π with its expectation is an approximation that renders second order (insurance) effects of wage setting nil.

11 This definition of the expected real interest rate is, strictly speaking, incorrect, because of Jensen's inequality. The difference for "plausible" parameters is rather small, but the current definition greatly simplifies subsequent derivations.

We can see that under our assumptions on price formation it may make sense to increase the home nominal interest rate above the exogenous I^* in order to reduce expected inflation. The conditions leading to this conclusion seem to be plausible in larger and less open economies as a higher γ means a larger elasticity of inflation with respect to the real interest rate, and a higher α can be interpreted as less openness. In the small open economy case, when $1-\alpha\gamma-\alpha$ is positive, increasing the interest rate is never improving inflationary prospects. In addition, capital mobility implies that raising interest rates will result in higher devaluation, and therefore a higher burst of inflation, whenever it occurs, in both cases. In other words, even if higher interest rates can buy some reduction in expected inflation in certain circumstances it is achieved at the cost of increasing the variability of inflation.

The above analysis begs the question of time consistency. As the exchange rate is set after nominal wages are determined, and since a devaluation always increases inflation, it must never be time consistent for a monetary policy maker to administer the devaluation if inflation is his only concern. In the next subsection we motivate this behavior of occasionally devaluing via formulating a more complex game.

5.2 Inflation or debt or default

Our framework is an escape clause model where the monetary authority has inherited a fixed exchange rate regime that can be given up at some fixed cost. Maintaining the regime has some utility, but if this utility is smaller than the cost of holding to it the policy maker will "renounce", and devalue. The model is a two-period one in which interest rates are set at the beginning of period 1, and, after private sector agents make their choices and a binary random shock is realized, the policy maker decides on the level of the exchange rate at the beginning of period 2. We assume that there is a "good" state that never implies devaluation[12], and a "bad" state that may give incentives for the central bank to devalue.

The sequence of actions is thus as follows. 1. The monetary authorities set the nominal interest rate. 2. Foreign investors divide their holdings between local and foreign currency denominated assets. Private agents borrow from abroad, inflation expectations are formed, and wages are set for the next period. 3. The state is realized and observed by the monetary authorities. 4. At the end of period the new exchange rate is determined.

We assume that in addition to causing an adverse effect by increasing inflation, a devaluation has a beneficial effect by reducing the foreign currency value of the home government's foreign debt, and has another negative effect by increasing the domestic currency value of foreign currency denominated private debt. The debt erosion service of devaluation has been analyzed by Velasco (1997), for example. Here we differ from Velasco's analysis, because we regard only debt reduction vis-à-vis foreigners as beneficial for the policy maker.[13] Concerning private debt we assume that private agents and the

12 By choosing the fix opting out cost appropriately this can be made a "result" rather than an assumption.

13 In *Velasco* (1997) seigniorage is useful because it substituted "costly" taxes.

government are treated differently by foreign creditors. Government revenues are essentially indexed to the exchange rate, thus a devaluation does not increase the "real" burden of foreign currency debt. Though this may be true for some part of the private sector, we assume that a significant part of it is "unhedged", thus a devaluation may cause solvency problems in this sector. The existence of an unhedged sector is well-documented in the Asian crisis, and has been given a theoretical rationale by Burnside-Eichenbaum-Rebelo (1999). That paper invokes government guarantees resulting in an asset substitution problem that boosts the preference for taking risks in the private sector. As Eichengreen-Hausman (1999) emphasized, the lack of hedging must prevail in the whole economy as long as foreigners are unwilling to extend credit in home currency. This appears to be quite a general feature of developing economies, and Eichengreen-Hausman (1999) lists three reasons why this might be so. The right explanation does not concern us here, we just make the assumption that a devaluation is harmful because it increases the number of bankruptcies in the corporate sector, and causes negative real effects thereby.

Accordingly, the loss function of the monetary authorities has the general form of $L(\Pi,D,B^k_p)$ where D is total foreign government debt measured in foreign currency

$$D = I^*(F - B) + \frac{IB}{e} \tag{9}$$

F is total initial financing requirement, B is the amount held in home currency denominated bonds, and

$$B_p^h = eB_p \tag{10}$$

is the domestic currency value of foreign private debt, where B_p is the foreign currency value of it. We assume that this latter is an increasing function of $(I-I^*)$, the interest rate differential. This assumption is reasonable in the Burnside-Eichenbaum-Rebelo (1999) model, because a higher differential increases the costs saving if there is no devaluation, whereas in case of a devaluation and of the concomitant defaults, guarantees limit the loss of investors. The central bank loss function, however, takes into account the social costs of such defaults. Inflation can be written as

$$\Pi = E(\Pi)^{\alpha(1+\gamma)} I^{-\alpha\gamma} e^{1-\alpha} \tag{11}$$

The authorities minimize L by setting the nominal exchange rate in period 2, given the nominal interest rate, portfolio decisions, and inflation expectations (i.e. wages). The resulting first order condition, taking into account (1), (6), and (7), can be solved for any given I, to provide us with a continuation equilibrium value for B. Then the nominal interest rate is set so as to minimize expected losses as of period 1 by taking into account optimal behavior along the equilibrium path. Assuming specific preferences Appendix 1 in Árvai-Vincze (2000) demonstrates for the small open economy case that an interior equilibrium can exist.

An interesting feature of this model is that the portfolio choice of foreign investors is

determinate, despite UIP. What determines their choice between bonds of different currency denomination is the expectation that a change in their portfolios will result in a change in the size of devaluation. Too much exposure to home currency bonds would give a high incentive to devalue, and thereby a lower yield. Holding too little of these assets can lead to little devaluation, and a higher yield. Under the condition of $1-\alpha\gamma-\alpha > 0$ the B(I) function exhibits similar qualitative properties as e_b (I). This means that small increases in the nominal interest rate can lead to increasing capital inflows denominated in the home currency, exerting an upward pressure on the nominal exchange rate. With a very large B in the bad state the policy maker could achieve a substantial (net) debt reduction, by eroding the foreign currency value of foreign debt, thereby providing an incentive to raise interest rates at the beginning. On the other hand in the good state high B at a higher nominal rate than the foreign currency rate ($I>I^*$) with no devaluation would mean an increasing debt burden. On the other hand, increasing the home interest rate has an adverse effect by increasing unhedged private foreign debt, whose costs are reinforced by the eventually higher devaluation. Also a dispreference for inflation variability can help in weakening the incentives to increase interest rates too much.

What is a crisis in this context? If the optimal solution would imply only a sufficiently small improvement over the fix rate, i.e. the optimal e_b were "close" to 1 then the fixed opt out cost argument would mean that the second period exchange rate would be unchanged. Thus, a change in the exchange rate can be construed as a crisis. An alternative idea is that though small changes in exogenous parameters can lead to small changes in I, but if the $\partial e_b/\partial I$ derivative is large then a small shift in "fundamentals" can result in a substantial devaluation.

6 Summary

We try to identify the causes why certain countries experienced a currency crisis, while others didn't. In the time period under investigation, six countries were hit by speculative attacks and had to finally give up the former exchange rate system (Russia, Bulgaria, Romania, the Czech Republic, the Slovak Republic, Hungary). It was a common feature in all the six cases that these economies had major macro- and/or microeconomic problems, which finally led to the collapse of the exchange rate, so none of them can be considered as a second generation *currency attack* type *crisis*, i.e. a self-fulfilling prophesy. There were, however, significant differences in the causes of and reactions to the speculative attacks as these countries were at different stages of transition, and the degree of capital account liberalization was also different.

Patently weak microeconomic foundations and inconsistent policies characterized Russia, Bulgaria, and Romania. These three countries had several elements in common in the years preceding the crisis: soft budget constraints, asset stripping, weak supervision of financial markets, lack of efficient privatization, fiscal imbalances, high inflation, real appreciation of the exchange rate, increasing foreign debt. The Russian currency crisis can be clearly classified as a *currency attack* crisis. Romania and Bulgaria had floating exchange rate systems, so currency crises occurred in the form of sharp depreciation's,

so this type can best be described as a 'would-have-been *currency attack crisis'*.

Of the remaining three countries that were attacked, the Czech Republic and Slovakia possess a lot of similarities. In these two countries macroeconomic indicators painted a rather favorable picture of the economy, but they concealed very serious microeconomic problems. The slow pace of restructuring and privatization together with the overvalued exchange rate led to a deterioration in external competitiveness, and the resulting high current account deficit made the two countries very vulnerable to speculative attacks. The Czech and Slovak crises were more of the escape clause model type, as the decision about the fate of the exchange rate was the result of a cost-benefit analysis. The comparison of the first and second speculative attacks on the Slovak crown is an especially good example for illustrating the escape clause model, as the costs of maintaining the peg were valued differently in the 1997 May and 1998 September attacks. In the first case Slovak monetary authorities were determined to defend the exchange rate as they regarded the political and real economic costs higher than the benefits resulting from the devaluation, whereas in 1998 the currency was not defended for too long, especially because political considerations did not play a large part in the decision. Hungary's 1995 devaluation also belongs to escape clause models in our view, as prevailing macroeconomic policies would have been sustainable for some more time, but the costs of having a strong real exchange rate were considered too high.

The remaining five countries which did not go through a currency crisis in the second half of the 1990s can be divided into to distinct groups. One group introduced a very rigid system (currency board in Estonia and Lithuania, a traditional peg in Latvia) in order to facilitate macroeconomic stabilization and to increase the credibility of exchange rate system. The implementation of the reform measures was fast and successful enough to avoid giving up the peg even at the time of the Russian crisis which had a significant impact on these economies. The key in this group's case was that they did not experiment too much with other exchange rate regimes, but introduced the currency board at a relatively early stage of the transition process, which in turn served as a crucial support in macroeconomic stabilization.

Slovenia and Poland in different ways tried to retain some flexibility in influencing the exchange rate in order to respond to macroeconomic developments. Slovenia did not make exchange rate announcements, but the central bank has always heavily managed the exchange rate and the interest rate together, which was made feasible by significant controls on capital flows. In contradistinction Poland adopted more and more flexible exchange rate regimes to preempt currency attacks and to target inflation via managing the domestic interest rate. On the other hand Hungary's successful sticking to a crawling system with a rather narrow band, puts its more recent experience closer to the Baltic countries, demonstrating that increased exchange rate flexibility is not necessary for avoiding delicate situations.

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APPENDIX

Table 1:
Real GDP growth

	1995	1996	1997	1998	1999
Bulgaria	2.1	-10.9	-6.9	3.5	2.5
Czech Republic	6.4	3.8	0.3	-2.3	-0.5
Estonia	4.3	3.9	10.6	4.0	-1.3
Hungary	1.5	1.3	4.6	4.9	4.1
Latvia	0.3	3.3	6.5	3.6	0.8
Lithuania	3.3	4.7	7.3	5.1	-3.3
Poland	7.0	6.0	6.8	4.8	4.1
Romania	7.1	3.9	-6.1	-5.4	-3.9
Russia	-4.2	-3.4	0.9	-4.5	3.2
Slovak Republic	6.9	6.6	6.5	4.4	1.0
Slovenia	4.1	3.5	4.6	3.9	3.8

Table 2:
CPI inflation (annual percentage change)

	1995	1996	1997	1998	1999
Bulgaria	62.1	123.0	1082.2	22.3	0.3
Czech Republic	9.1	8.8	8.5	10.6	2.1
Estonia	29	23.1	11.2	8.2	3.3
Hungary	28.3	23.5	18.3	14.3	10.0
Latvia	25.1	17.6	8.4	4.7	3.2
Lithuania	39.5	24.7	8.8	5.1	0.8
Poland	27.9	19.9	14.9	11.8	7.3
Romania	32.3	38.8	154.8	59.1	45.8
Russia	197.4	47.6	14.7	27.7	85.9
Slovak Republic	9.9	5.8	6.1	6.7	10.7
Slovenia	13.5	9.9	8.4	8.0	6.2

Table 3:
Budget balance/GDP (general government)

	1995	1996	1997	1998	1999
Bulgaria	-6.3	-12.7	-2.5	0.9	-0.9
Czech Republic	-2.1	-2.1	-1.9	-2.3	
Estonia	-1.2	-1.5	2.0	-0.3	-3.6
Hungary	-7.3	-4.6	-5.1	-4.9	-5.6
Latvia	-3.3	-1.5	0.4	-0.7	
Lithuania	-4.5	-4.5	-1.8	-5.8	-6.7
Poland	-3.1	-3.3	-3.1	-3.2	-3.3
Romania*	-4.1	-3.5	-4.9	-5.0	-3.6
Russia		-8.4	-7.1	-5.9	-5.1
Slovak Republic	-0.5	-1.9	-2.6	-2.6	
Slovenia	-0.2	-0.2	-1.7	-1.1	-0.9

*central government budget

Table 4:
Current account balance/GDP

	1995	1996	1997	1998	1999
Bulgaria	-0.6	0.2	4.4	-0.5	-5.2
Czech Republic	-2.7	-7.6	-6.1	-1.9	
Estonia	-5.1	-9.2	-12.1	-9.2	-4.1
Hungary	-5.5	-3.7	-2.1	-4.8	
Latvia	-3.6	-4.2	-5.1	-9.5	
Lithuania	-10.2	-9.1	-10.2	-12.1	-9.6
Poland	4.2	-1.0	-3.0	-4.4	-7.6
Romania	-4.9	-7.4	-6.2	8.3	8.6
Russia		0.9	-0.7	0.7	6.8
Slovak Republic	2.2	-11.2	-10.1	-10.1	
Slovenia	-0.1	0.2	0.2	0.2	-2.4

EXCHANGE RATES

Chart E1: Czech crown/USD exchange rate

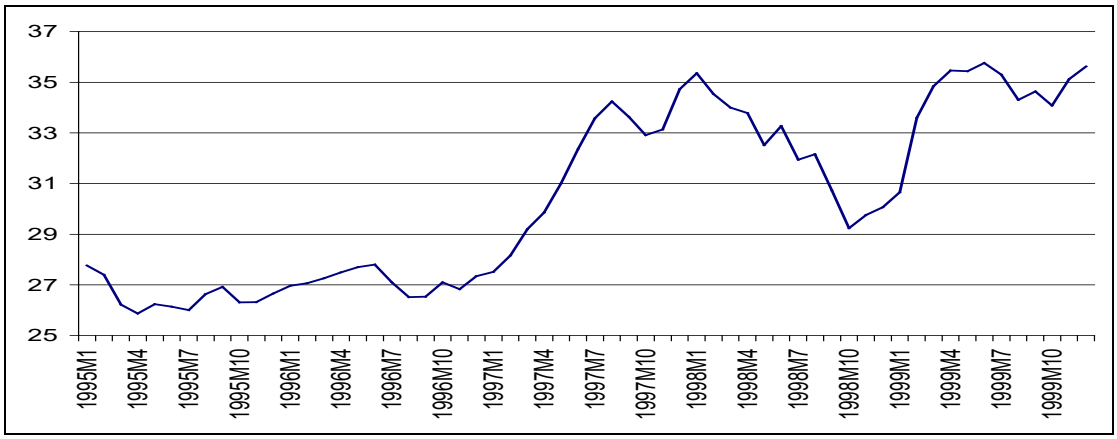


Chart E2: Slovak crown/USD exchange rate

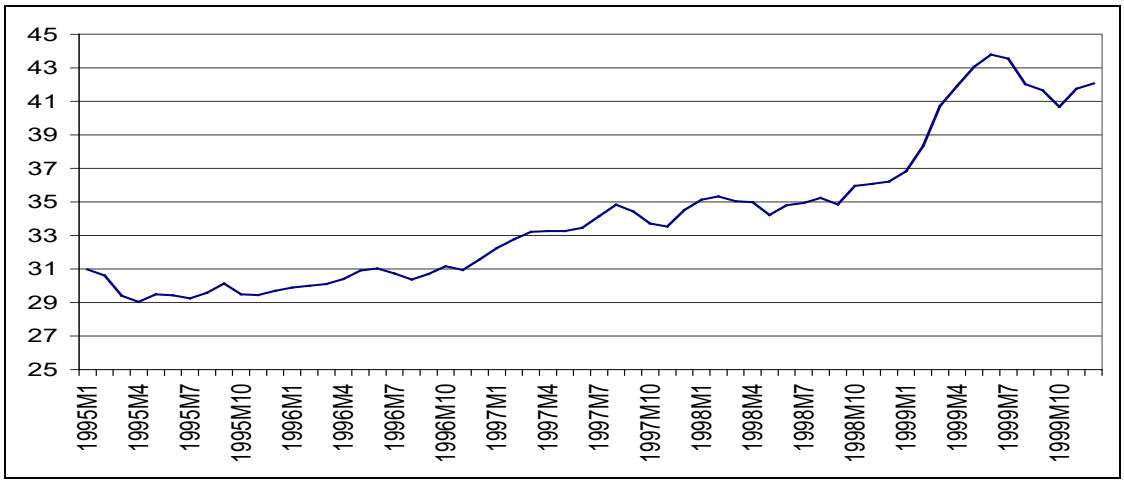


Chart E3: Estonian crown/USD exchange rate

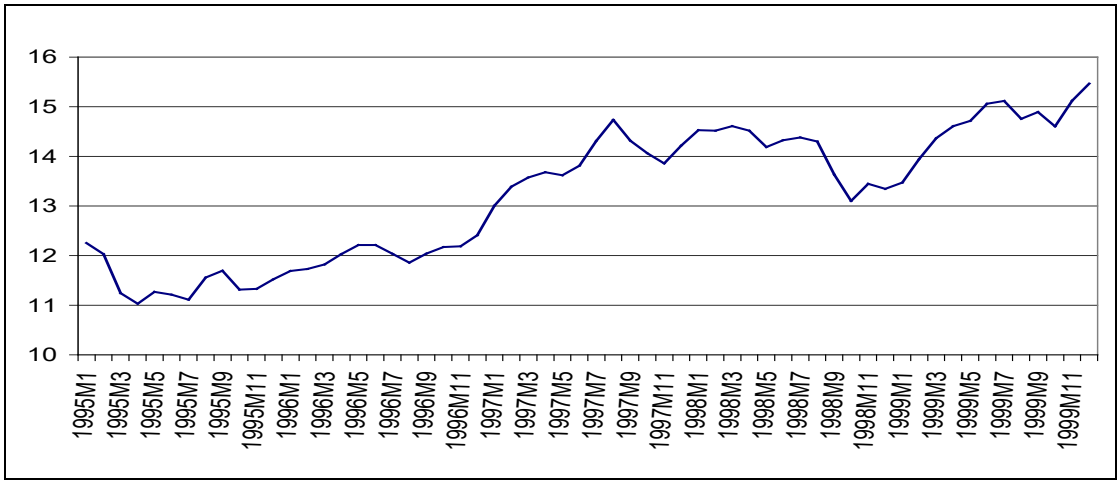


Chart E4: Latvian lats/USD exchange rate

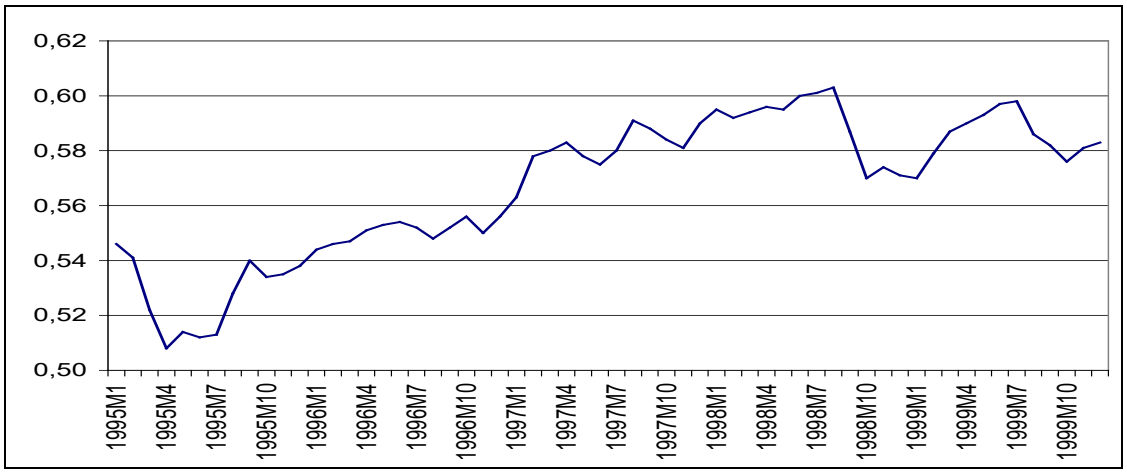


Chart E5: Hungarian forint/USD exchange rate

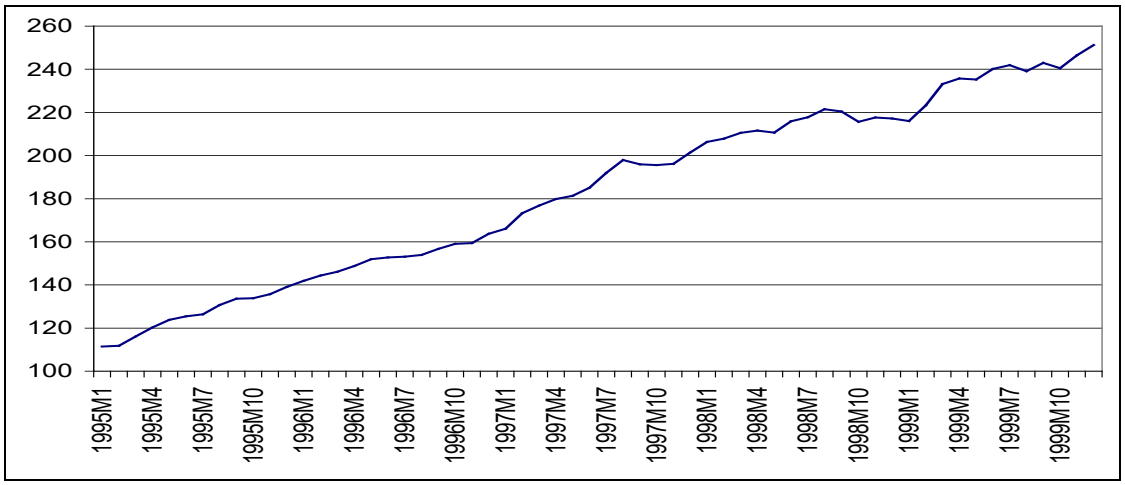


Chart E6: Lithuanian litas/USD exchange rate

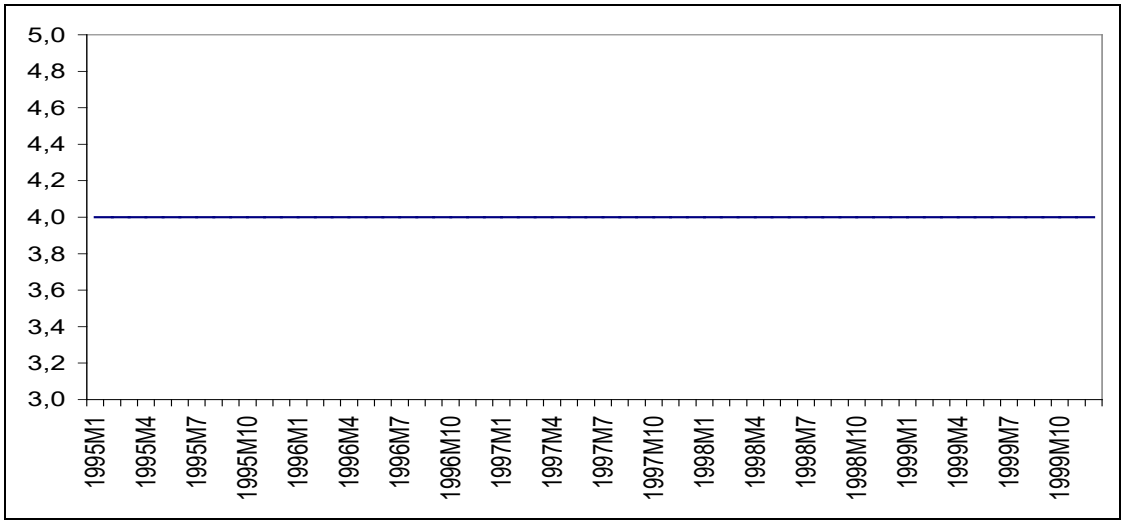


Chart E7: Slovenian tolar/USD exchange rate

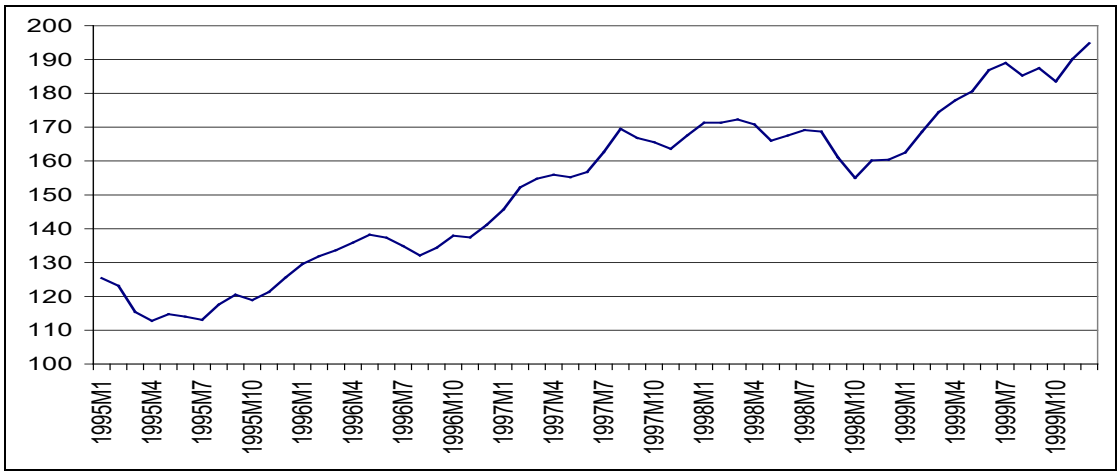


Chart E8: Polish zloty/USD exchange rate

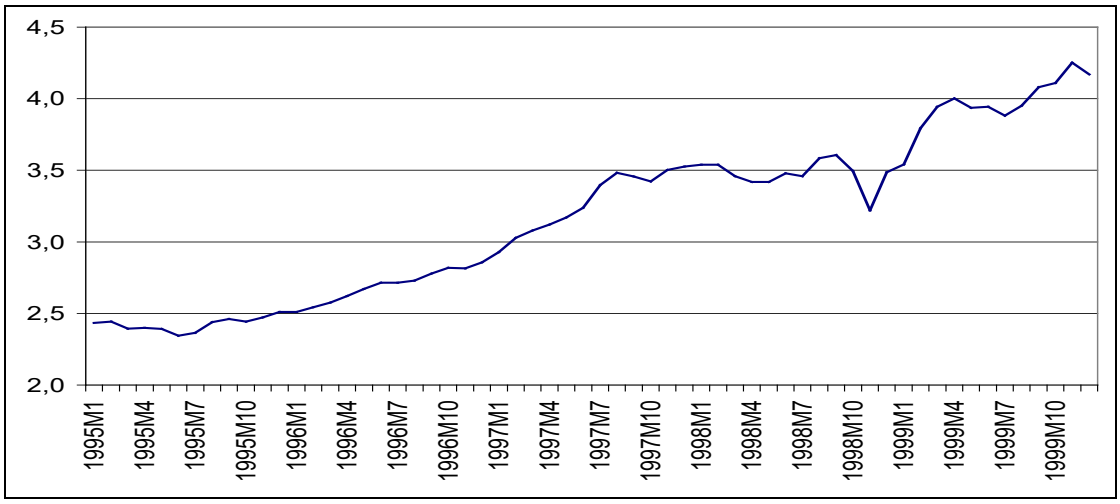


Chart E9: Bulgarian leva/USD exchange rate

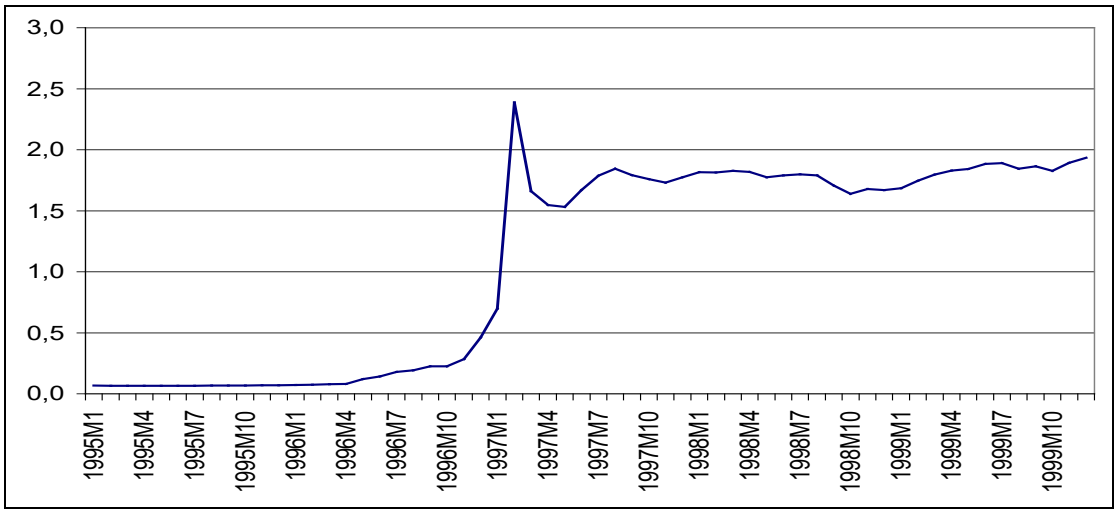


Chart E10: Russian ruble/USD exchange rate

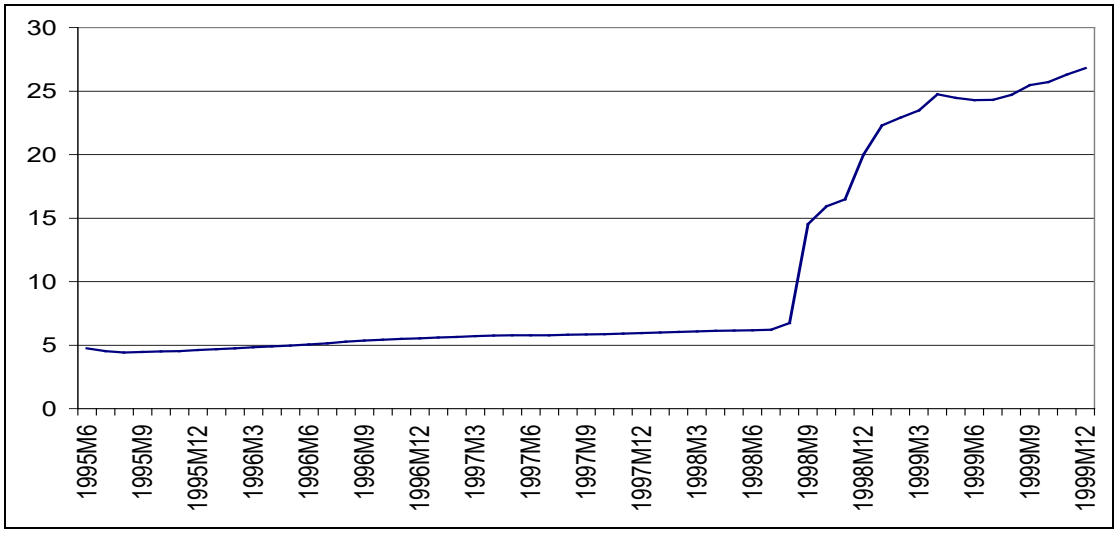
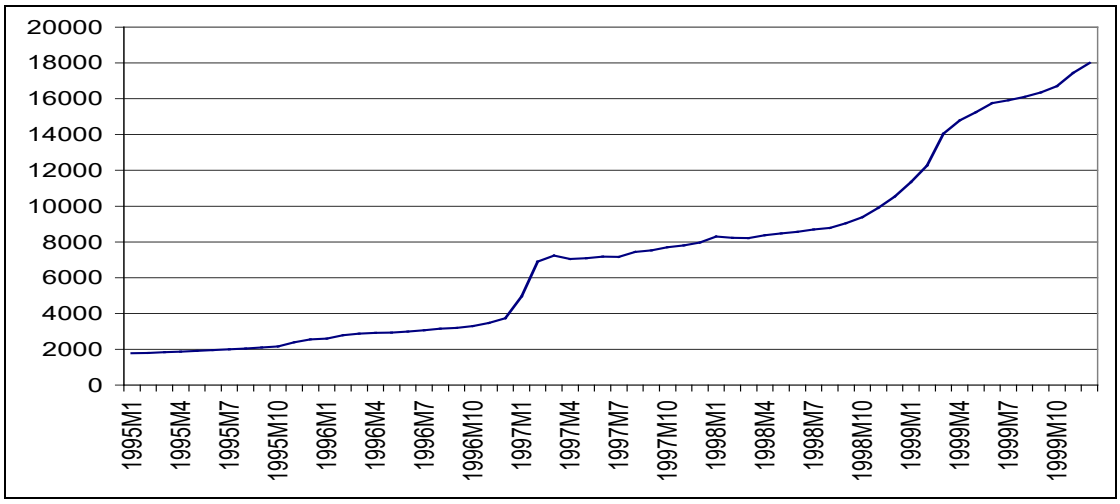


Chart E11: Romanian lei/USD exchange rate



INTEREST RATES

Chart R1: Czech deposit rates

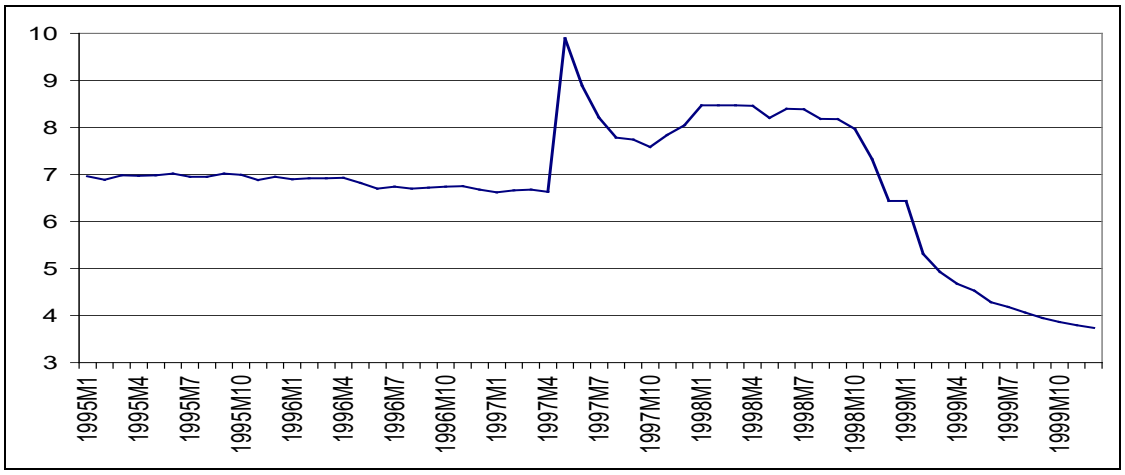


Chart R2: Slovak deposit rates

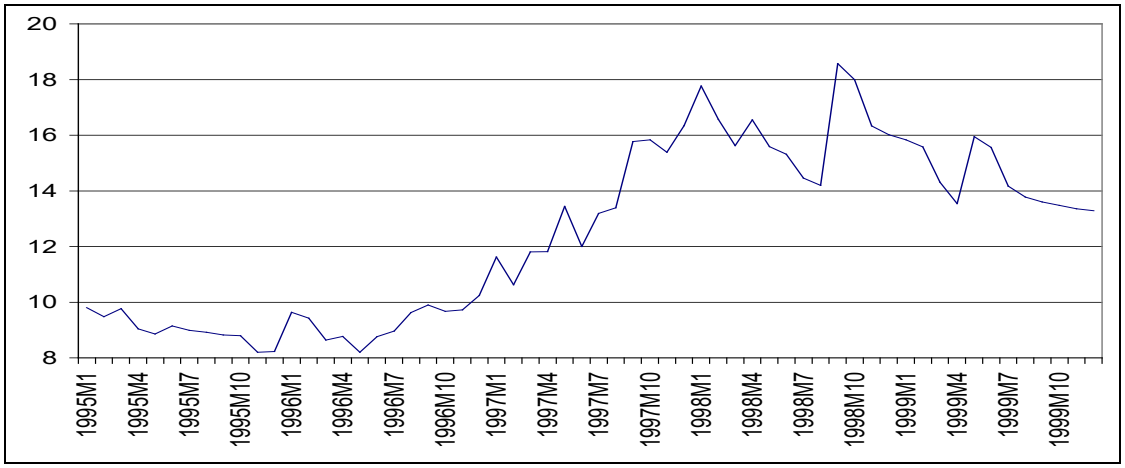


Chart R3: Estonian money market rate

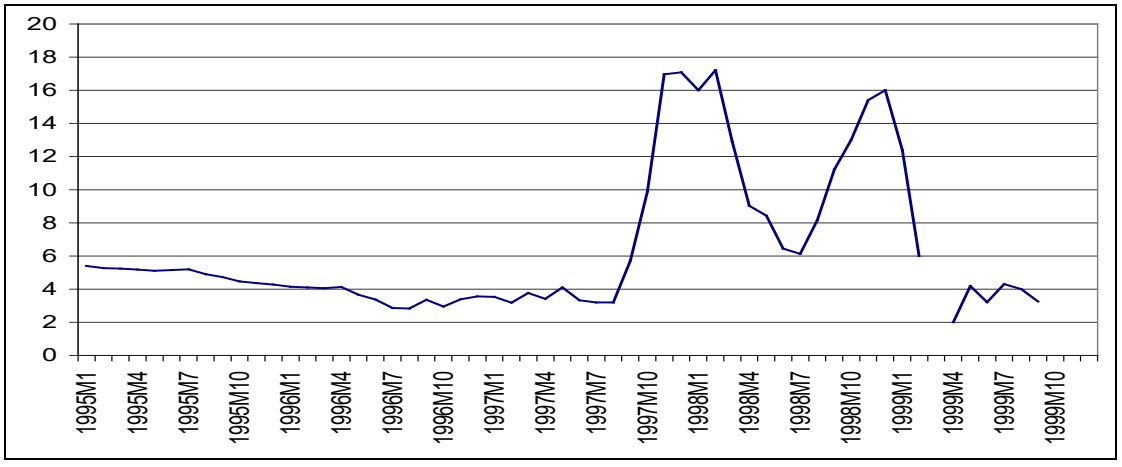


Chart R4: Latvian 90-day T-bill rate

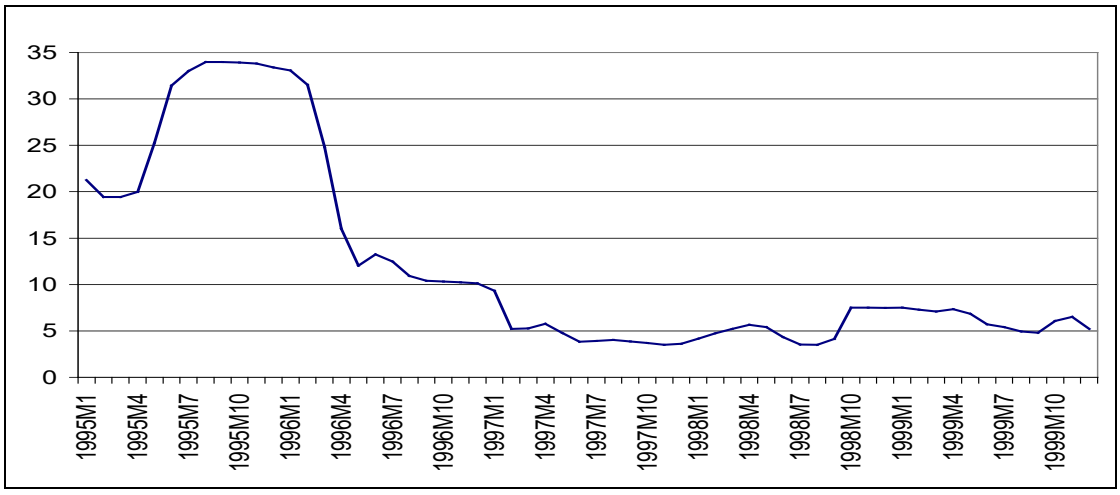


Chart R5: Hungarian 90-day T-bill rate

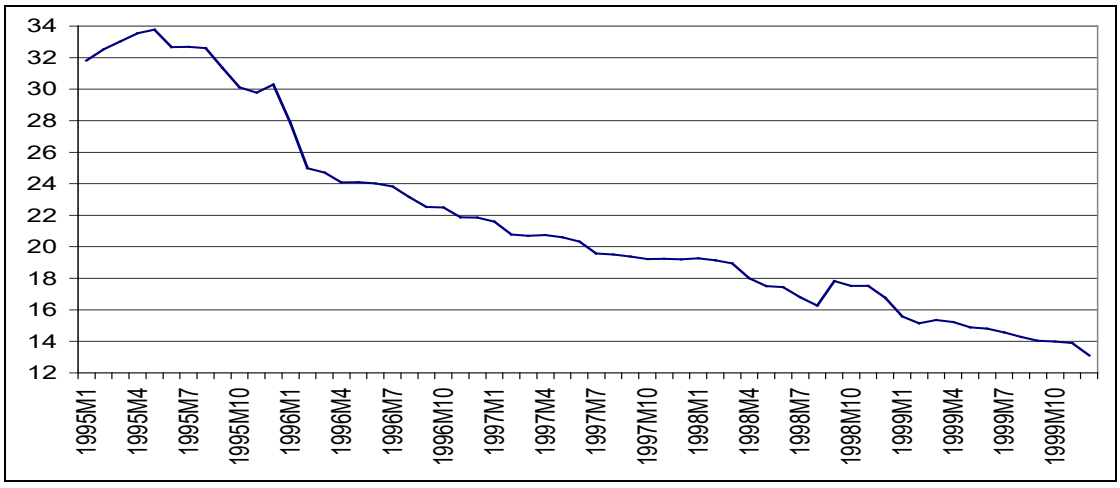


Chart R6: Lithuanian 90-day T-bill rate

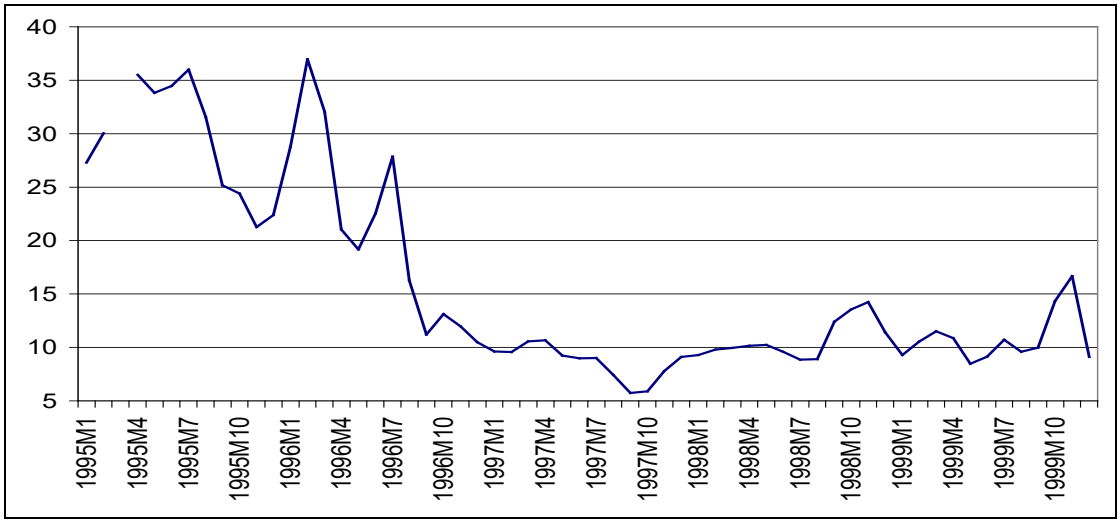


Chart R7: Slovenian 90-day T-bill rate

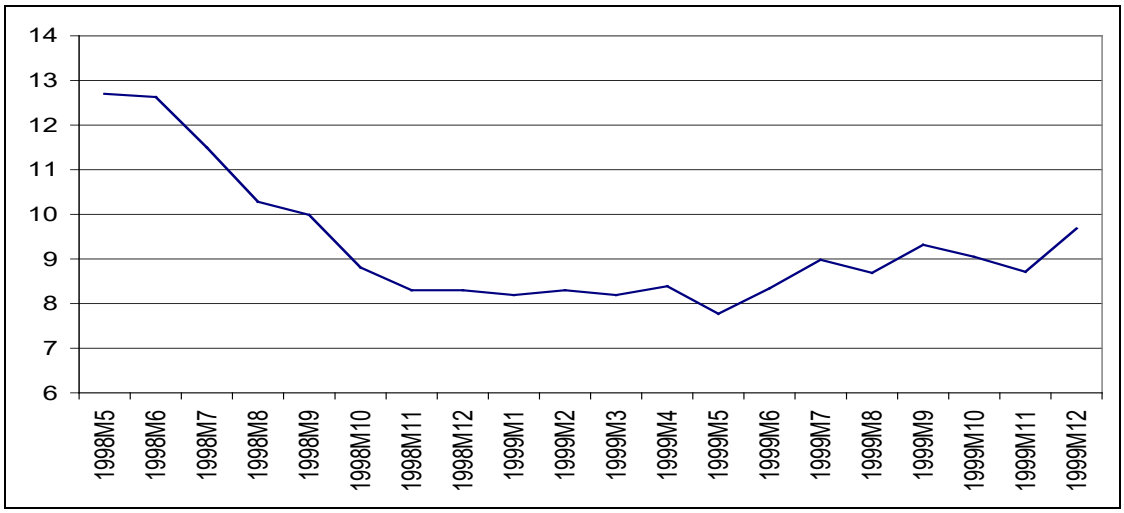


Chart R8: Polish 90-day T-bill rate

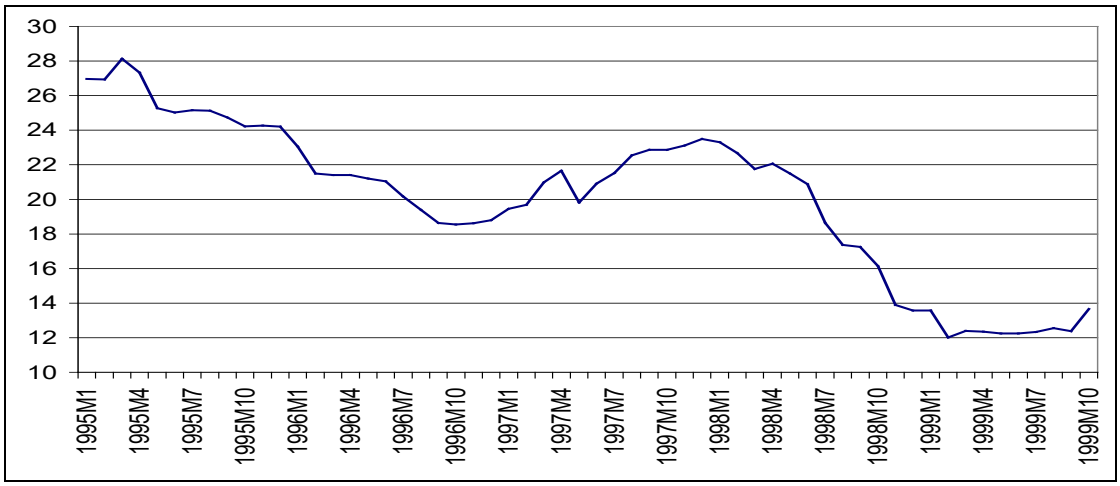


Chart R9: Bulgarian 90-day T-bill rate

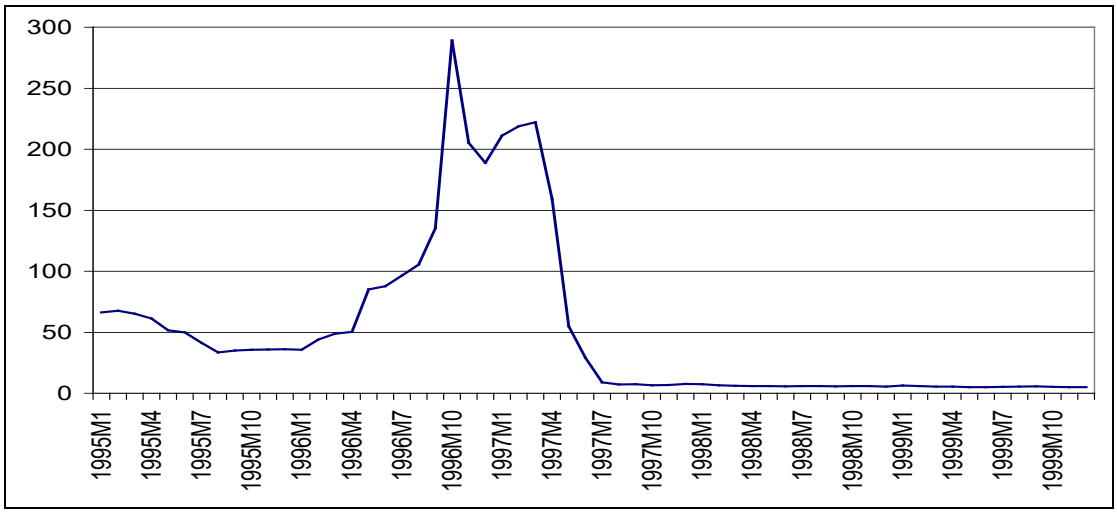


Chart R10: Russian 90-day T-bill rate

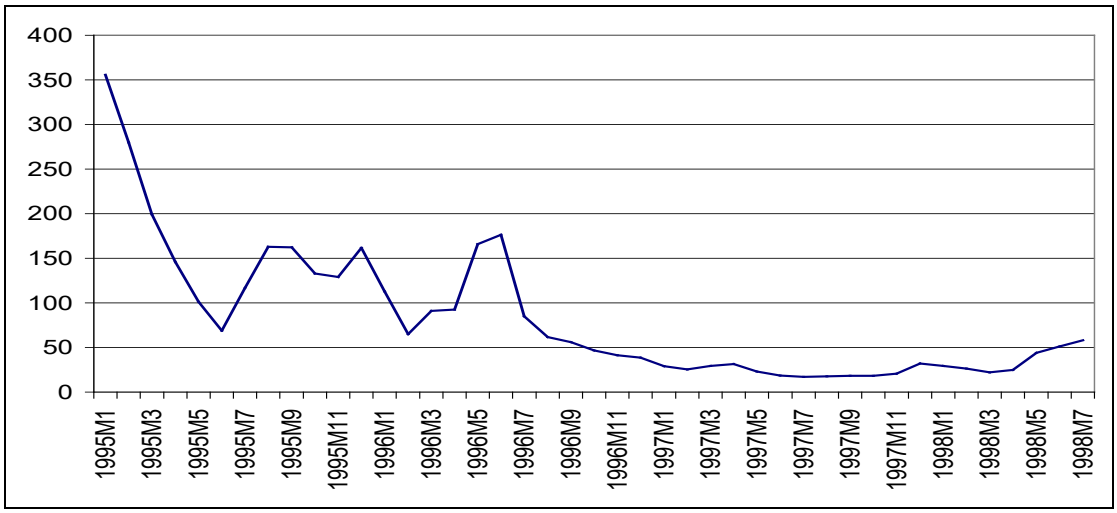
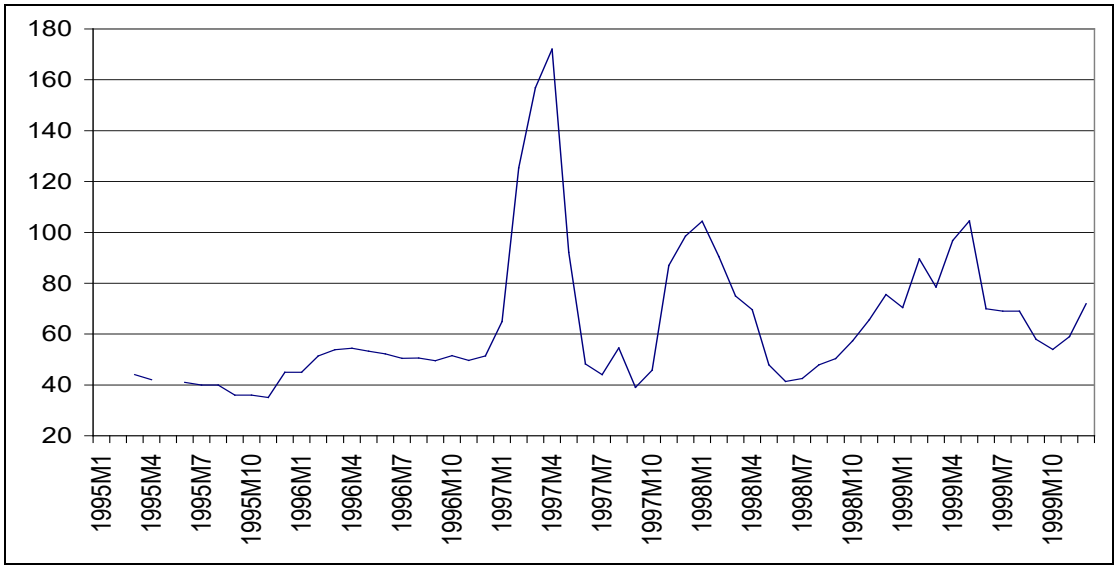


Chart R11: Romanian 91-day T-bill rate



STOCK EXCHANGE INDICES

Chart S1: Prague

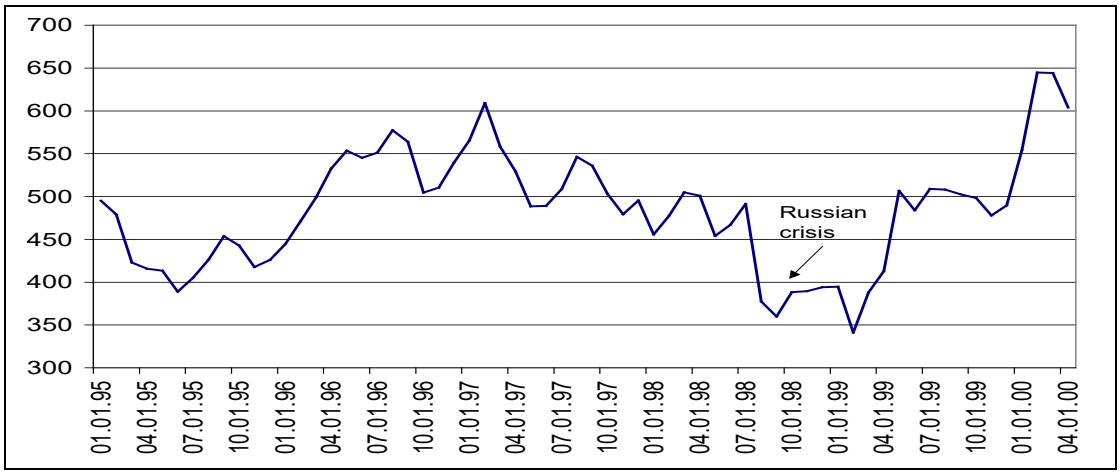


Chart S2: Bratislava

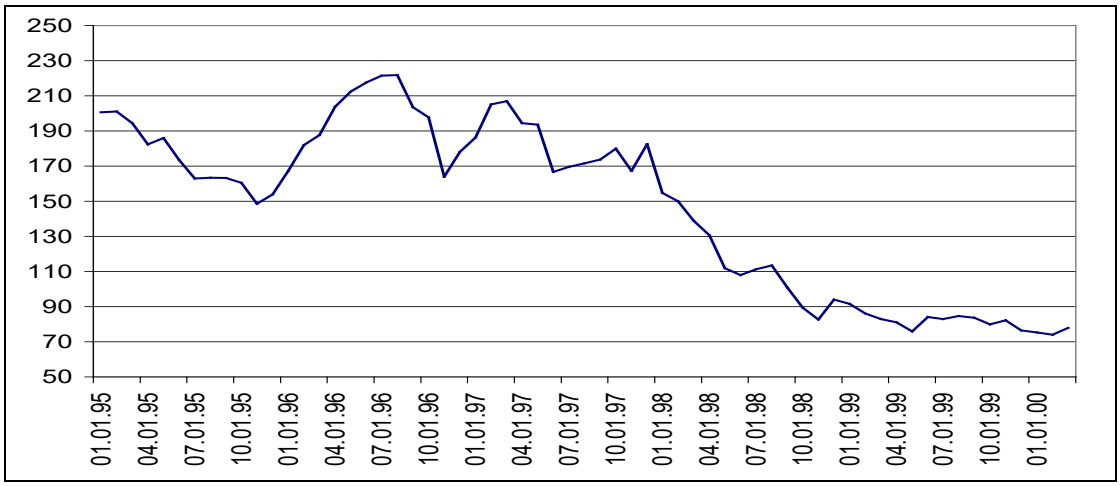


Chart S3: Tallinn

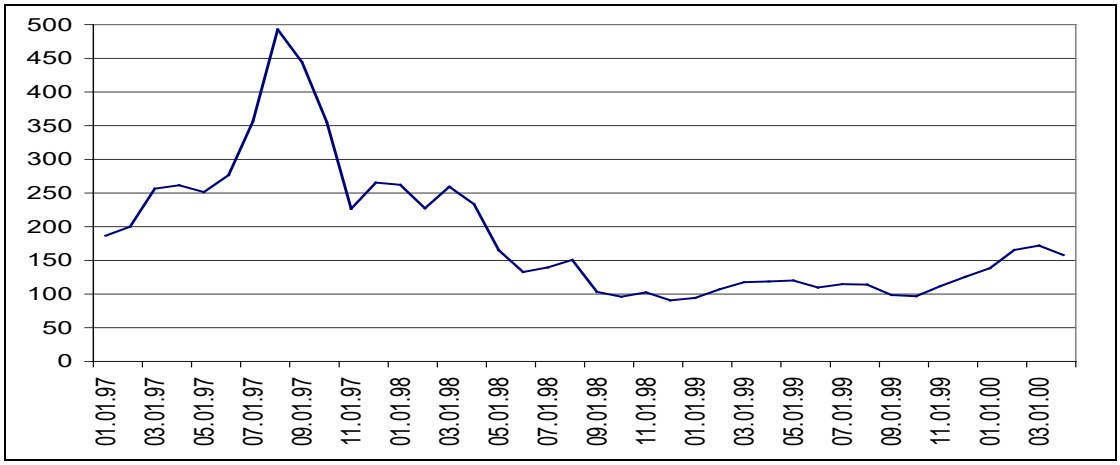


Chart S4: Riga

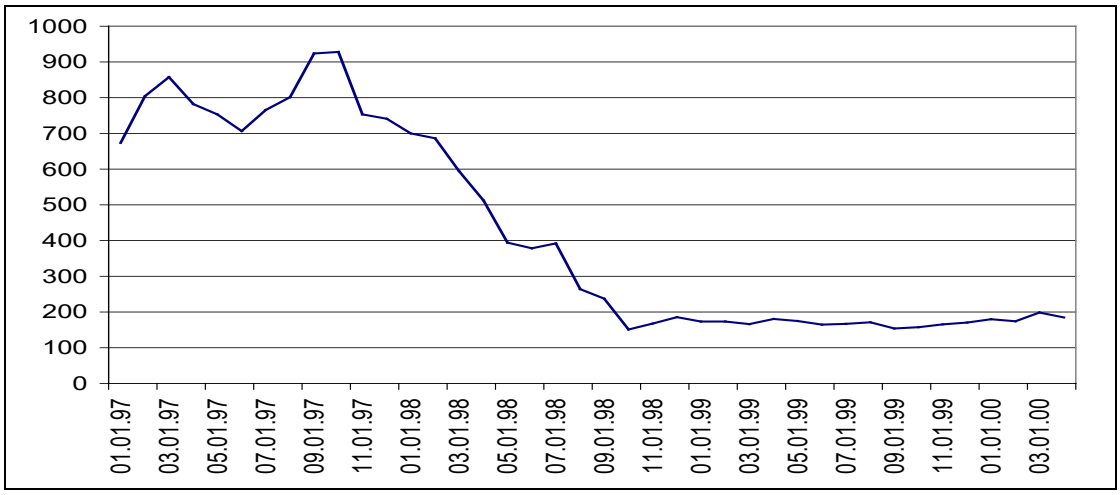


Chart S5: Budapest

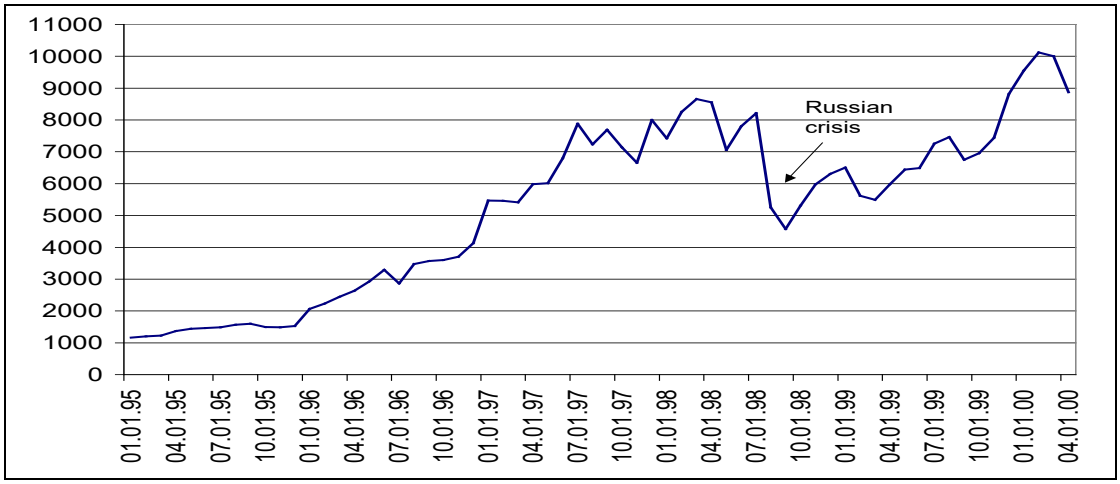


Chart S6: Vilnius

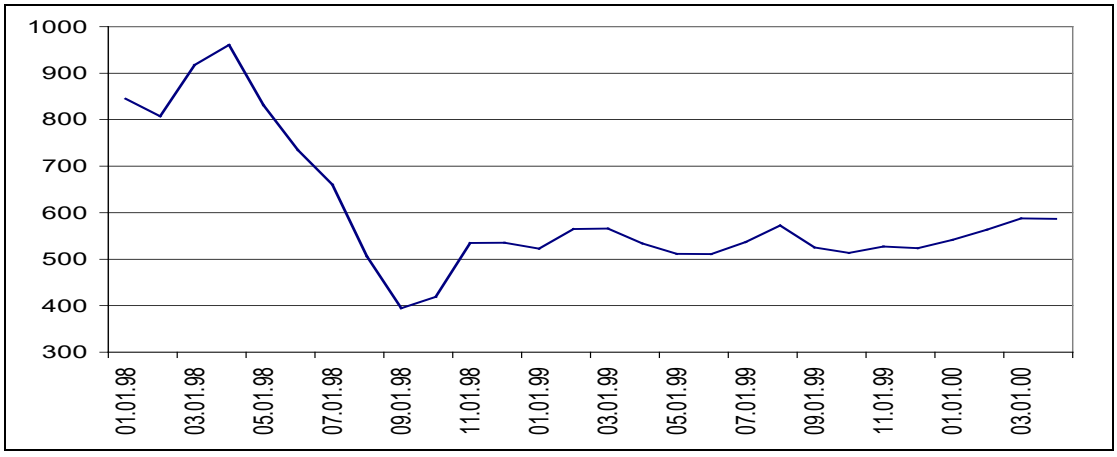


Chart S7: Ljubljana

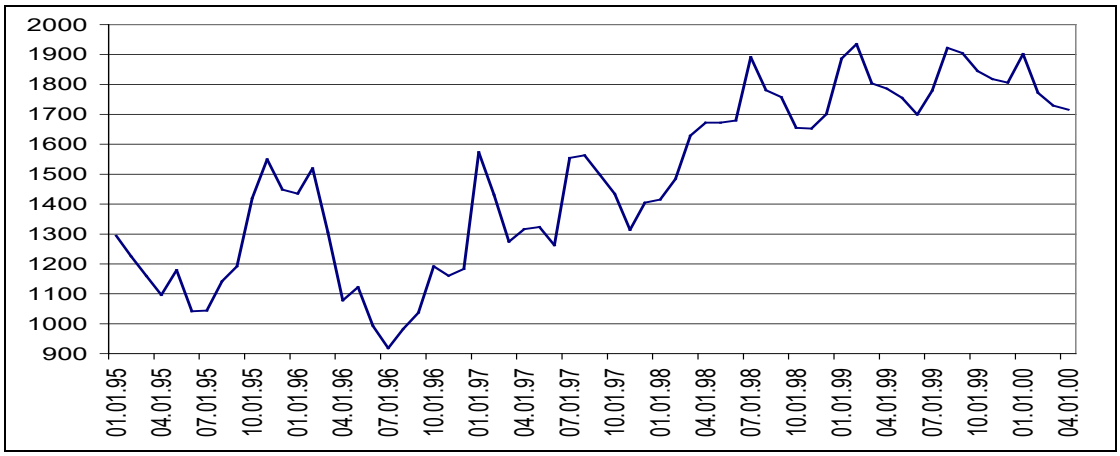


Chart S8: Warsaw

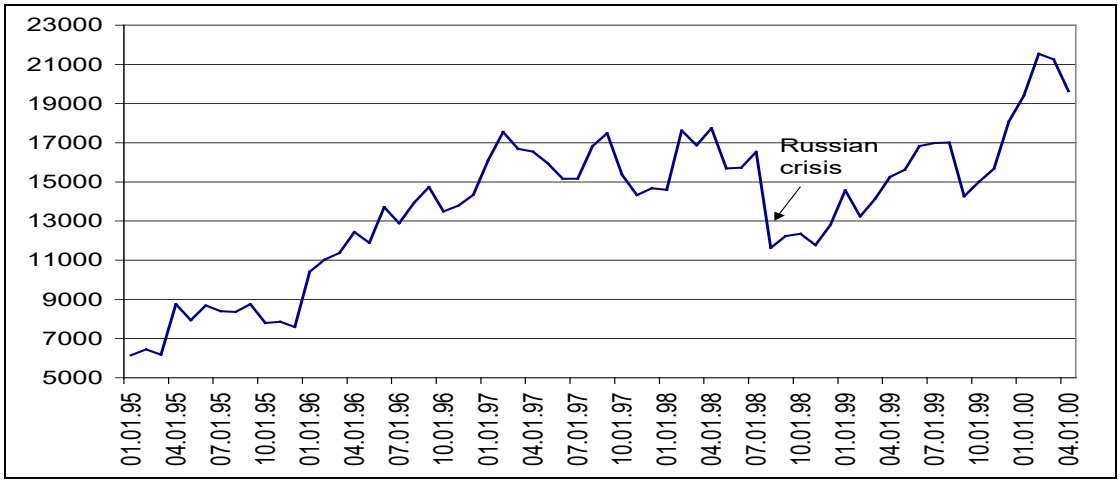


Chart S9: Moscow

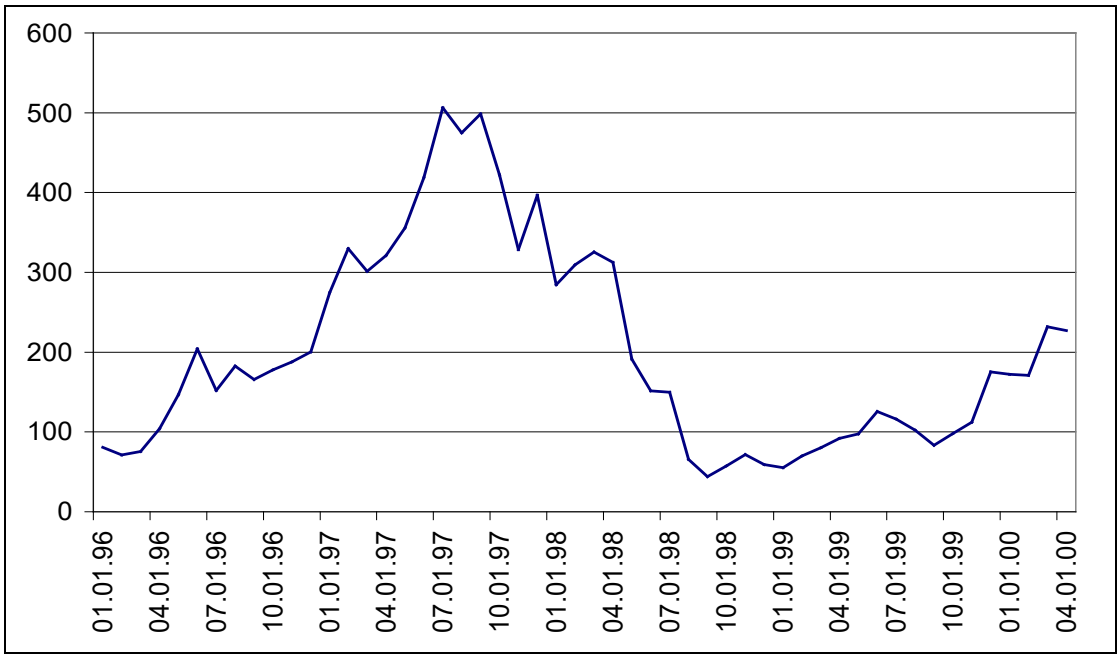
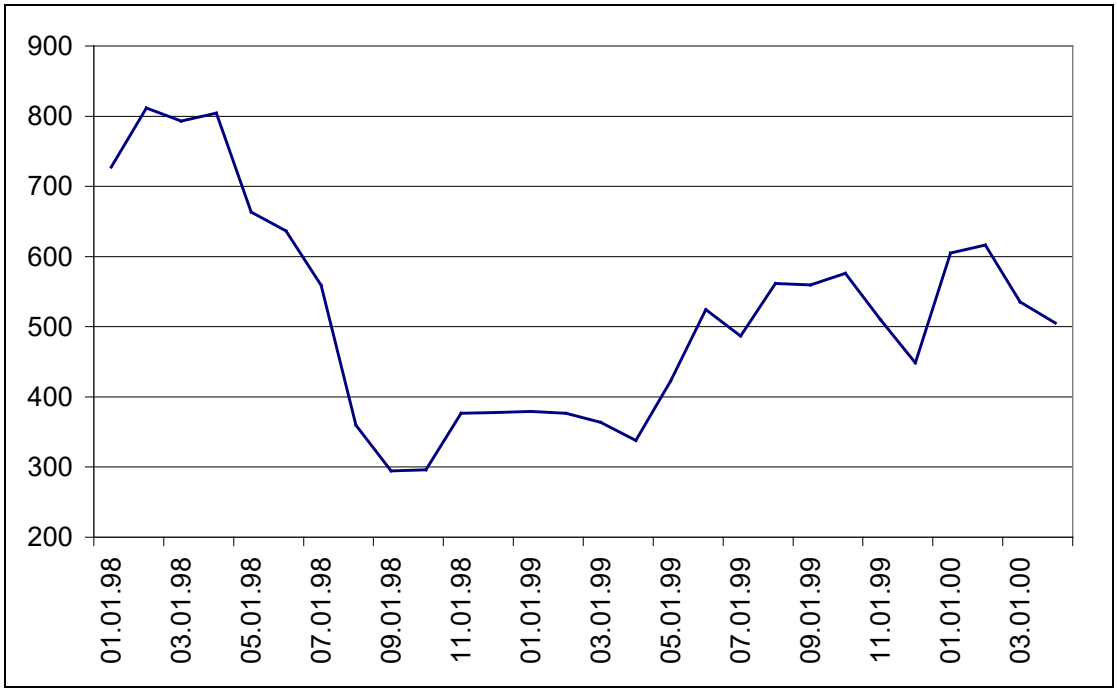


Chart S10: Bucharest



What Causes Currency Crises: Sunspots, Contagion or Fundamentals?

Marcel Fratzscher[1]

Abstract

This paper is an attempt to explain currency crises in open emerging markets during the 1990s. A model is developed in which currency crises can be caused not only by weak economic fundamentals and sunspots, i.e. exogenous shifts in agents' beliefs, but can also be transmitted across countries through contagion. Testing this model empirically through Markov-switching regimes models and panel methodologies reveals that contagion, i.e. a high degree of real integration and financial interdependence among countries, is the core explanation for the financial crises of the 1990s. The model has a remarkably good out-of-sample predictive power for the 1994-95 Latin American crisis and the 1997-98 Asian crisis. These findings suggest that the degree of financial interdependence and real integration among emerging markets is the single best indicator to explain and to predict the transmission of future financial crises.

JEL no. F30, E60, E65, E44.
Keywords: currency crises, contagion, prediction, Markov-switching, panel data.

1 Introduction

An intense debate is currently unfolding between those economists who believe that the weakness of fundamentals and inconsistent policies are the ultimate explanations for currency crises, and those who argue that self-fulfilling beliefs and contagion have played a crucial role in the crises of the 1990s. This debate is far from being resolved as our understanding of currency crises remains rather incomplete. Most empirical work still focuses on fundamentals-based explanations, building on first-generation and second-generation models of crises. These models, however, not only perform poorly in explaining crises, but they have outright failed in predicting them (Berg and Pattillo 1998).

1 European University Institute, Department of Economics, Badia Fiesolana, 50016 San Domenico (FI), Italy; fratzsch@datacomm.iue.it. Comments are very welcome. I would like to thank Michael Artis, Roger Farmer, Søren Johansen, Ramon Marimon, Grayham Mizon and the participants of the 12th World Congress of the International Economic Association in Buenos Aires, the conference on "Global Financial Markets and the International Monetary System" at the Kiel Institute of World Economics, and the 1999 Annual Meeting of the German Economic Association for helpful comments. I am also grateful to Alan Teck for his permission to use the *Financial Times Currency Forecaster* data.

But the tide has started to turn and the latter view has recently gained considerable ground as many economists, including Paul Krugman (1999)[2], concede that self-fulfilling beliefs and contagion are key explanations of recent crises. Current work is concentrating increasingly on the role of private sector expectations and how changes in beliefs can shift markets across multiple equilibria (Chang and Velasco 1998, Jeanne and Masson 1998). Much of this work models the interaction between financial sector crises and balance-of-payments crises in which a loss of investor confidence may set off a vicious cycle of capital flow reversals, a liquidity squeeze and a depreciating currency (Valdes 1996, Goldfajn and Valdes 1997). This self-sustaining dynamic may cause exchange rates to overshoot any level that might be considered sensible from a macroeconomic perspective. Compelling empirical evidence for a strong link between these "twin crises" has indeed emerged (Kaminsky and Reinhart 1999).

Despite the progress, however, these third-generation models leave key questions unanswered: Why did many crises of the 1990s cluster within regions and affect a broad range of countries almost simultaneously? In other words, how and why are crises in different economies linked and interdependent? The key shortcoming of the current literature on financial crises is that it still ignores the crucial importance of contagion, i.e. the transmission of crises across economies. No systematic attempt has yet emerged that takes a thorough approach in comparing and evaluating alternative explanations for currency crises.

The aim of this paper is to help fill this gap by developing such a framework that allows a systematic comparison of three competing explanations for crises: weak economic fundamentals, contagion and sunspots, i.e. exogenous shifts in agents' beliefs. The central hypothesis of the paper is that it is contagion that is the key explanation for the simultaneous occurrence and severity of crises in emerging markets in the 1990s. An *infection function* is presented in section 2 in which the crisis severity of a country is not only determined by the strength of its own fundamentals and exogenous changes in agents' beliefs, but also by the degree to which crises are contagious in being transmitted across economies.

Talk about "contagion" has become widespread with reference to the currency crises of the 1990s, but there is still a lot of confusion and controversy about how to define contagion.[3] I define contagion here as the transmission of a crisis that is not *caused* by the affected country's fundamentals (although, of course, the transmission has an impact on the country's fundamentals ex post) but by its "proximity" to the country where a crisis occurred.

---

2 *Krugman* (1999, p. 8/9) admits: "[T]he power of contagion in the last two years settles a long-running dispute about currency crises in general: the dispute between 'fundamentalists' and 'self-fulfillers'. ... I hereby capitulate. I cannot see any way to make sense of the contagion of 1997-98 without supposing the existence of multiple equilibria, with countries vulnerable to self-validating collapses in confidence, collapses that could be set off by events in faraway economies that somehow served as a trigger for self-fulfilling pessimism. "

3 *Jeanne* and *Masson* (1998), for instance, adopt a broad definition in which contagion is identified as factors other than fundamentals that connect countries. *Rigobon* (1999) adopts a far narrower definition in which links across countries need to intensify in order to constitute contagion.

Two types of "proximity", or channels of contagion, are identified. I refer to the first channel as "real integration contagion": a crisis and sharp devaluation in one economy worsens the competitiveness of others and lowers the trade balance, in particular of close competitors, thus putting more pressure on those currencies to devalue. The second channel is what I call "financial integration contagion": the event of a crisis in one market induces investors to withdraw assets from other markets either (a) to raise cash for redemption's or balance their portfolios ("institutional contagion") or (b) to follow other investors to avoid losses in closely integrated financial markets ("herding contagion"), hence raising the likelihood that these markets will also become victims of attacks.

While there has been a keen interest in the literature to analyze countries' integration with world financial markets (e.g. Bekaert et al. 1998), work on contagion, looking into the extent to which countries are interdependent and integrated with each other, is still lacking.[4] In section 3, I develop a new methodology to measure the strength of the mentioned two contagion channels. I find that real and financial interdependence is particularly strong within regions, and often even more so after controlling for similarities in fundamentals.

The goal of the empirical analysis in section 4 is to compare the power of contagion channels with the role of fundamentals in causing and transmitting currency crises, as suggested by the infection function of section 2. A Markov-switching regimes methodology is used to proxy jumps in market beliefs which are not warranted by changes in economic fundamentals. The Markov-switching model performs well for most of the 24 emerging markets in the sample, indicating that beliefs and asset values in foreign exchange markets may exhibit jumps that cannot be related to fundamentals but are often caused by contagion. Using a panel analysis, I then show that the Latin American crisis in 1994/95 and the Asian crisis of 1997 spread across emerging markets not due primarily to the weakness of those countries' fundamentals but rather to a high degree of financial interdependence among affected economies, thus confirming the importance and predominance of this contagion channel. Section 5 tests the model's ability to predict the Asian and the Latin American crises out-of-sample and shows that taking contagion factors into account would have permitted a quite accurate prediction of which countries were affected by these two crises. The paper concludes by outlining some general policy implications.

2 A Framework of Contagious Currency Crises

Since Krugman's seminal paper (1979), many different theoretical approaches to analyze currency crises have emerged, the essence of which has been nicely summarized by Flood and Marion (1998). However, most of this work focuses exclusively on fundamentals as explanations for financial crises. The aim of this section is to present a stylized model that

4 Most work on contagion is theoretical. *Calvo* and *Mendoza* (1999), for instance, show how herding behavior in financial markets can be fully rational as the globalization of financial markets reduces the incentive for investors to collect first-hand information and encourages them to follow common investment strategies.

allows not only for weak economic fundamentals but also for contagion and sunspots to set off balance-of-payments crises.[5] Thus the model not only synthesizes arguments of first-generation and second-generation type of models but also allows for contagion linkages across countries as the cause of currency crises. The next step in section 2.2 is then to develop a functional form through which the model can be tested empirically.

2.1 Modeling the transmission of currency crises

This simple, two-sector balance-of-payments model is basically a liquidity model in which the occurrence of a devaluation is solely determined by supply and demand factors for foreign exchange (*FX*): the peg $\bar{e}$ is sustainable only if the supply of foreign exchange is greater than or equal to its demand and e is floated otherwise. The government is assumed to be passive in that it has available a fixed amount of foreign exchange $\overline{R}$, which may include not only current reserves but also funds that could be borrowed to defend the currency.[6]

As the first sector, the domestic production sector's net demand for foreign exchange is FX^F to meet expenses from trading and for debt servicing:

$$FX_t^F = D_t(X, \pi, r)_t - TB_t(RER_t) \tag{1}$$

where X measures the strength of the country's economic fundamentals, with $X_t \in [0,1]$, TB_t the trade balance and D_t the net debt service this period. Changes in debt servicing obligations can have three causes: first, an increase in world interest rates i at which the debt stock $\overline{D_t}$ needs to be serviced (external effects); second, a jump in devaluation expectations π_t or weakening fundamentals X (internal effects); third, the danger of a currency crisis in another economy (π_t^j):

$$D_t = r\overline{D_t} + \pi_t(1 - X_t)\overline{D_t} + \gamma\pi_t^j\overline{D_t} \tag{2}$$

An increase in the probability of a crisis in country j (π_t^j) may induce foreign lenders to withdraw funds from the home economy and refuse a roll-over of loans in order to reduce their overall exposure (institutional contagion). The home economy is hit harder by such a shock the more financially connected it is with the crisis economy, which is measured in the model by the weight γ.

The second source for a jump in the demand for foreign exchange by the real sector is via the trade balance TB_t. An appreciation of the real exchange rate, i.e. a drop in *RER*, either vis-a-vis the rest of the world (RER^{ROW}) or vis-a-vis the country *j* where a currency crisis occurred (RER^j) worsens the trade balance:

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5 The model builds on, although it is distinct in important aspects from earlier work by *Jeanne* (1997), *Jeanne* and *Masson* (1998) and *Masson* (1999).

6 For simplification, the model ignores the possibility that multiple equilibria may be caused by non-linearity's in government behavior, as in escape clause models introduced by *Obstfeld* (1986), but this assumption is not crucial for the model implications and results to hold.

$$TB_t = \overline{TB} + \psi RER_t^j + \theta RER_t^{ROW} \quad (3)$$

with ψ, θ as weights that determine how important the impact of a bilateral real exchange rate change is for the home country's trade balance. A currency crisis in country *j* can be contagious in raising the crisis probability in the home country, in this case by worsening the trade balance (real integration contagion).

The second sector in the model is the financial sector, in which investors hold a stock of domestic currency FX_t^S. In each period, investors decide whether or not to convert the domestic currency into US dollars. The total foreign exchange demand by investors FX_t^S is determined by the probability of devaluation in the home country π_t, domestic fundamentals *X*, the degree of capital controls δ (or transaction costs) which constrains how much capital they can withdraw; and by currency crises occurring elsewhere in the world (π_t^j):

$$FX_t^S = \delta\left[\pi_t(1-X_t)\overline{FX_t^S} + \lambda\pi_t^j\overline{FX_t^S}\right] \quad (4)$$

The degree to which a currency crisis in country *j* affects the forex demand in the home country is determined by the degree of herd behavior in the markets (herding contagion) and by institutional contagion: a crisis in country *j* (π_t^j) may induce foreign lenders to withdraw funds from the domestic economy in order to reduce their overall exposure or raise cash for redemption's. The home economy is hit harder by such a shock the more financially connected it is with the crisis economy, which is measured in the model by the weight λ.

Based on these arguments, the devaluation probability in our model is

$$\pi_t = prob_t\left[\overline{R_t} < FX_t^F + FX_t^S\right] \quad (5)$$

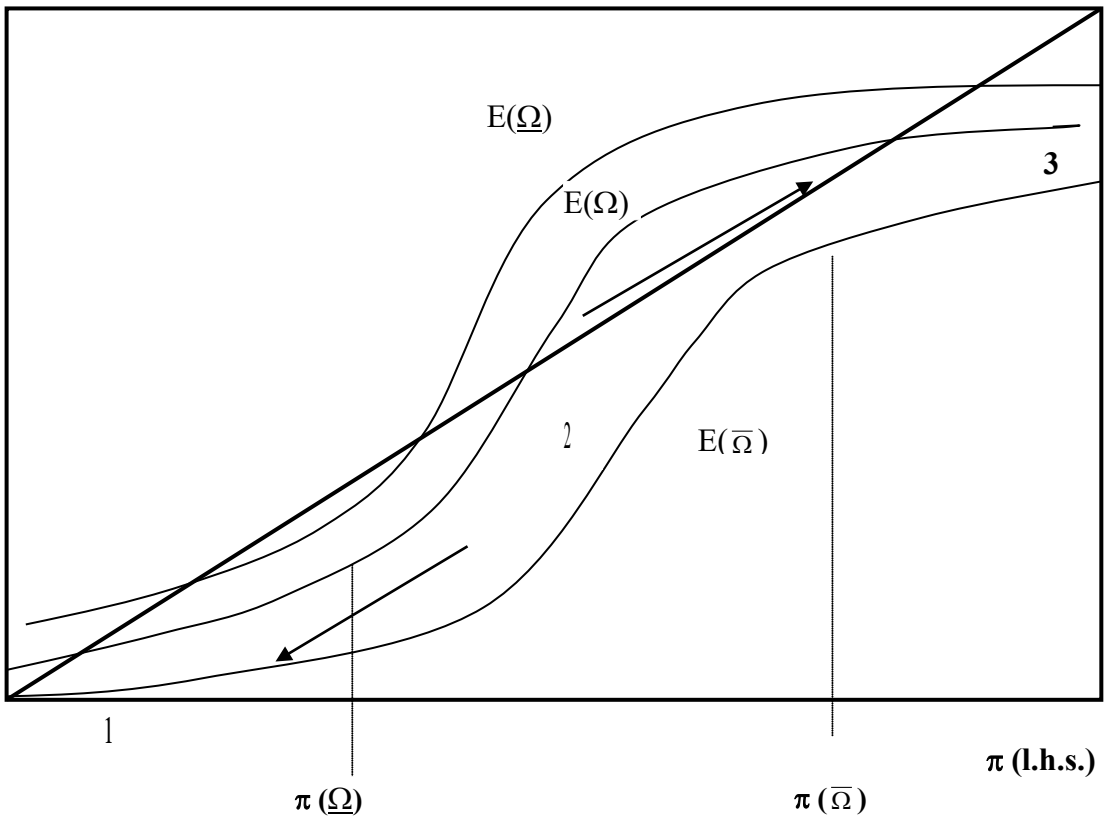
which, by substituting with the relations above, becomes

$$\pi_t = F\left[\pi_t\left((1-X+\gamma\frac{\pi_t^Z}{\pi_t})\overline{D_t} + \psi\frac{\pi_t^j}{\pi_t}(\Delta RER_t^j) + \delta(1-X_t+\lambda\frac{\pi_t^j}{\pi_t})\overline{FX_t^S}\right) - \Omega\right] \quad (6)$$

with F as the cumulative distribution function, $\Omega = \overline{R_t} - i\overline{D_t} - \overline{TB} - \theta RER_t^{ROW}$ as the net excess supply of foreign exchange reserves that is certain and independent of devaluation expectations in either the home country or the foreign country *j*.

When do multiple equilibria arise in this model? The fact that π_t is found on both sides of this last equation implies that multiple equilibria may be possible, though two further conditions have to hold : first, the right hand side of equation (6) must intersect the left hand side, which is represented by the 45° line, at more than one value of π_t (Figure 1). This is possible only if the slope of the r.h.s. is steeper than the l.h.s. for some values of π_t and less steep at others.

Figure 1:
Multiple Equilibria and the "Zone of Vulnerability"



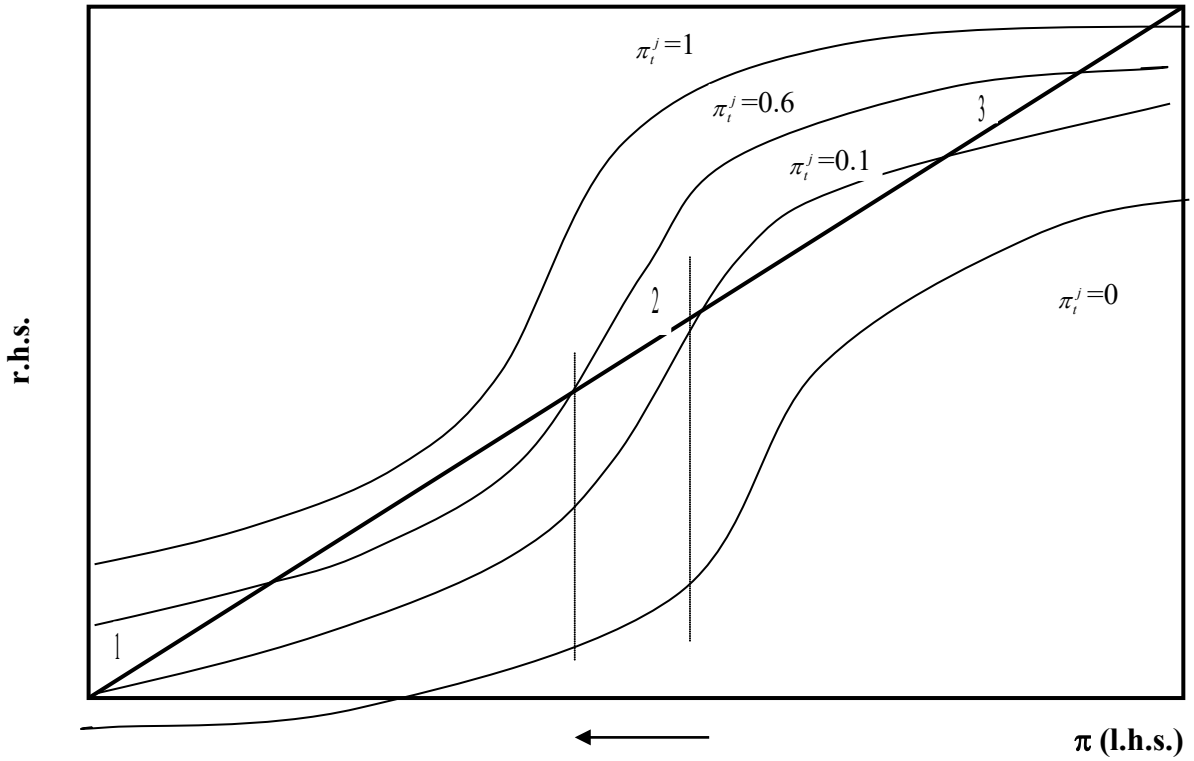
The second necessary condition is that Ω must lie in a zone of vulnerability. If the net foreign exchange supply is high, so that $R_t > FX_t^F + FX_t^S$ with certainty, then the probability of devaluation is determined uniquely and is close to π_t=0. If Ω is below a certain threshold so that $R_t < FX_t^F + FX_t^S$, then there is a unique equilibrium close to π_t =1. Hence only for $\Omega \in \left[\underline{\Omega}, \overline{\Omega}\right]$ do multiple equilibria exist.

In Figure 1, the area of multiple equilibria is between π_t ($\underline{\Omega}$) and π_t ($\overline{\Omega}$). Any curve E(Ω), for which these two conditions hold, has at least three equilibria. The important point is that only the first and the third equilibrium are stable whereas the second one is unstable, i.e. a small deviation from it will lead to either the first or the third equilibrium.

What is the role of contagion or, in other words, what is the impact of π_t^j on the domestic equilibrium of π_t? Figure 2 illustrates that an increase in π_t^j entails an upward shift of the curves, thus raising both the low-level and the high-level equilibrium of π_t. The interesting case is that an actual currency crisis in a related country j (π_t^j =1) might abolish the existence of multiple equilibria and cause an attack on the domestic currency. In

other words, real and financial interdependence between the two economies might be so strong that a devaluation in a closely related economy will necessarily mean that the domestic economy will lack foreign exchange supplies to maintain the peg.

Figure 2:
Multiple Equilibria Arising from Contagion



2.2 Infection function and Markov-switching regimes methodology

The aim now is to derive a functional form of the model that is testable empirically. For this purpose, one can linearize the non-linear model of equation (6) under the assumption that the volatility of the fundamentals is sufficiently small (Jeanne 1997). This linearization yields a reduced form model, or *infection function*, that can be expressed as

$$y_{i,t} = \alpha_i + \beta_R' \sum_{j \neq i} \left(y_{j,t} \times REAL_{ij,t} \right) + \beta_F' \sum_{j \neq i} \left(y_{j,t} \times FIN_{ij,t} \right) + \beta_X' x_{t-1} + u_{i,t} \qquad (7)$$

with $y_{j,t}$ as the exchange market pressure or credibility in country i, and β_R, β_F, β_X as the vectors of coefficients. Thus, this *infection function* allows for two sources for changes in the domestic currency regime: weak economic fundamentals x_{t-1} and contagion. The extent to which the home economy i is affected by crises in country j crucially depends

on the degree of real integration ($REAL_{ij}$) or financial interdependence (FIN_{ij}) among these countries.

The key shortcoming of the linear infection function of equation (7) is that it ignores the possibility that changes in expectations and private sector beliefs, which are caused by neither fundamentals nor contagion, may also be a cause of a crisis. To also analyze the role of exogenous shifts in expectations in causing crises, a more promising approach is to employ a non-linear Markov-switching regimes model that was developed for time series analysis by Hamilton (1989, 1990). Hamilton (1989) initially developed the Markov-switching methodology for the analysis of US business cycles, but this methodology can be extended so that regime shifts represent jumps between multiple equilibria, thus allowing for jumps rather than only smooth realignments in exchange rates.[7]

Exogenous jumps in beliefs can be modeled in different ways within the Markov-switching framework. Given the characteristics of the data, I model exogenous shifts in beliefs as switching intercepts α and changes in the error variance Σ (heteroskedasticity).[8] Thus the infection function with the Markov-switching regimes methodology becomes:

$$\begin{aligned} y_{i,t} \quad = \quad & \alpha_i(s_t) + \beta_R' \sum_{j \neq i} \left(y_{j,t} \times REAL_{ij,t} \right) + \beta_F' \sum_{j \neq i} \left(y_{j,t} \times FIN_{ij,t} \right) \\ & + \beta_X' \, x_{t-1} + \Sigma^{1/2}(s_t) u_{i,t} \end{aligned} \tag{8}$$

where s_t indicates the state in period t, and u_t is *NID* $(0, I_K)$. The reformulation of the infection function as a Markov-switching model thus enables us to now distinguish between three causes of currency crises: weak fundamentals, contagion, and exogenous jumps in beliefs.

The key assumption in this model is that regime switches reflect changes in expectations that are unrelated to fundamentals or contagion. A potential problem with this assumption is that the shifts in the intercept and the variance may not just represent sunspots but possibly also changes in unobservable fundamentals or in expectations about future fundamentals. The empirical investigation of these and other issues is the subject of the following sections.

3 Empirical Methodology

Since the central objective of this paper is to analyze the question whether contagion or

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7 The use of Markov-switching regimes models to analyze foreign exchange markets is still rather new. *Gomez-Puig* and *Montalvo* (1997) and *Engel* and *Hakkio* (1994) estimate a Markov-switching regimes model for ERM currencies. *Jeanne* (1997) and *Jeanne* and *Masson* (1998) find evidence that a Markov-switching regimes model with two regimes performs better for the French Franc in 1987-93 than a linear OLS estimation.

8 Note that a regime shift may also be constituted by a change in the mean or a switch in the autoregressive parameters. Due to the short length of the time series and the limited degrees of freedom these sources could not be analyzed in this context. See *Krolzig* (1997) for a thorough discussion of different sources of regime shifts.

sunspots have played a role in the recent emerging market crises, the focus of the empirical analysis is exclusively on 24 *open* emerging markets, as defined by the IFC plus some transition economies, for the period 1986 to 1998 (see Appendix). The reason for choosing this sample and time period is that contagion as defined above can affect currencies only where capital flows are relatively free. This section discusses the measurement of currency crises and of contagion, while the fundamentals have standard definitions and are explained in the Appendix.

3.1 Measuring private sector expectations and currency crises

The obvious difficulty is how to measure the probability of a devaluation and in particular how to proxy the beliefs of agents. It is this motivation of understanding the subjective perception of markets that has given rise to extensive work on exchange rate expectations over the years. Early work often focused on measuring expectations within target zone bands via the drift-adjustment method that distinguishes between expectations of currency changes within the bands and the realignment probability of the central parity. The drift-adjustment method can sensibly be applied only to target zones, and also due to its reliance on the assumption of uncovered interest parity it is not a useful method for proxying expectations for emerging markets. A more promising approach is one that looks at option prices since these are highly accurate in reflecting market perceptions (e.g. Campa and Chang 1996). The problem is that such markets either do not exist or are very thin for emerging markets.

I therefore employ two alternative credibility measures of an exchange rate regime. First, I construct a credibility measure of a particular currency by using the *Financial Times Currency Forecaster* data, which is a geometric average of exchange rate predictions by traders, multinationals and forecasting agencies. This data is used to measure the credibility ($CRED_t$) of a particular exchange rate regime at time t as the percentage deviation of the three-month prediction ($PRED_t^{t+3}$) from the commitment level for that time ($COMMIT_t^{t+3}$):

$$CRED_t \equiv \frac{PRED_t^{t+3}}{COMMIT_t^{t+3}} \tag{9}$$

The obvious difficulty is to determine what the actual commitment is. This problem is easily solved for pegged exchange rates, but it is trickier for those currencies under a managed float, independent float or crawling peg regime. For regimes with exchange rate bands, I use the deviation from the central parity, implying that a currency has less credibility the more that agents expect the rate to be depreciated relative to the parity. For those few currencies that did not have bands, I employ credibility measures that are based on exchange rate trends over the past three months, one year or two years. For instance, if a currency without bands had depreciated at a steady three-month rate of 1% over previous years, I use for the committed rate in three months the spot rate on the day of the prediction plus a 1% depreciation.

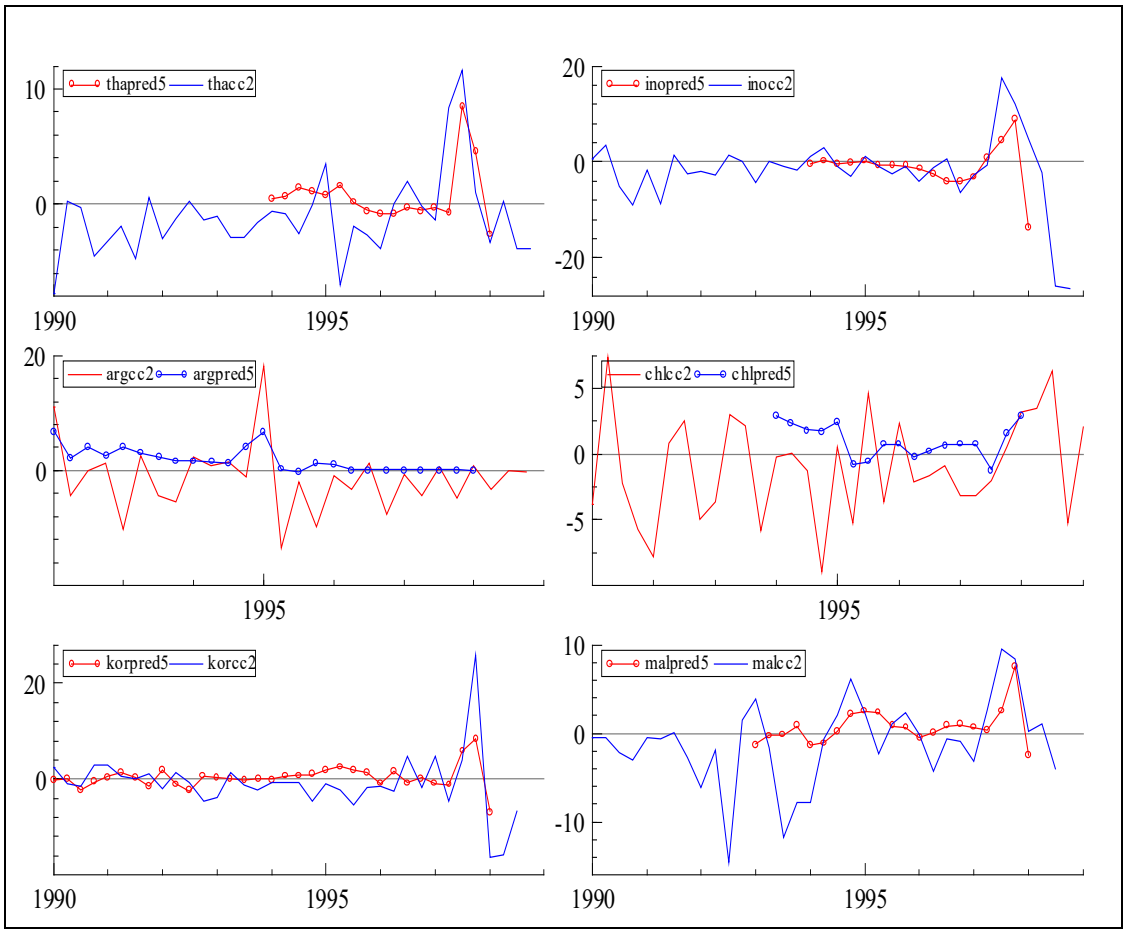
The second measure is the actual exchange market pressure (*EMP*) on a particular cur-

rency. This measure is a weighted average of the changes in the exchange rate *e*, the interest rate *i* and the foreign exchange reserves *R*:

$$EMP_t \equiv \eta(\Delta e_{i,t}) + \varphi(\Delta(i_{i,t} - i_{US,t})) - \psi(\Delta R_{i,t}) \qquad (10)$$

with *i* and i_{US} as the domestic and US interest rates, respectively, Δ as the change of a variable, and η, φ, ψ as weights.[9] The intuition for using this measure is that when facing pressure on its currency, a government has the option of either devaluing the currency, raising interest rates and/or running down reserves. Hence such exchange market pressure (*EMP*) is a fairly good proxy for the strength of the pressure against the existing currency regime and also captures speculative attack episodes which fail to bring about a devaluation.

Figure 3:
Comparisons of CRED (pred5) and EMP (cc2)



9 Each of the three measures is weighted by their relative precision's, calculated as the inverse of the series' variance in the past. It has been employed in various studies of currency crises, including *Eichengreen, Rose* and *Wyplosz* (1996) and *Sachs, Tornell* and *Velasco* (1996).

Figure 3 shows the exchange market pressure (*EMP*) and credibility (*CRED*) measures for a few select countries that were hit hardest by some of the crises in the 1990s. As for other countries, the data show that both measures are fairly similar and, in particular, reveal highly credible exchange rate regimes in Southeast Asia prior to July 1997 and for Latin America, i.e. *CRED* often took on a negative value indicating that investors expected the currencies to strengthen rather than weaken. The data also demonstrate that the crises in the listed countries were widely unanticipated.

3.2 Contagion: measuring real and financial interdependence

The balance-of-payments model in section 2 distinguishes between two channels of contagion, one based on real integration and one on financial interdependence among economies. To measure these two contagion channels, I develop in this subsection a new methodology that builds on Fratzscher (1998).

3.2.1 Real Integration Contagion

Glick and Rose (1999) use a measure of bilateral trade to indicate real linkages across economies and indeed find evidence that bilateral trade linkages might have played some role in the transmission of recent financial crises. While this measure may be useful for countries in the EU, it is an insufficient measure for real integration of emerging markets because bilateral trade among these economies is small and the competition takes place in third markets. I therefore develop a contagion measure that is a weighted average of bilateral trade and competition in third markets. More precisely, the degree of trade integration ($REAL_{ij}$) of the home economy *i* with country *j* is measured as

$$REAL_{ij} = \sum_{c} \sum_{d} \left(\frac{X^{c}_{jd}}{X^{c}_{\cdot d}} \times \frac{X^{c}_{id}}{X_{i\cdot}} \right) + \sum_{c} \left(\frac{X^{c}_{ij} + X^{c}_{ji}}{X^{c}_{\cdot i} + X^{c}_{i\cdot}} \right) \quad (11)$$

The first term indicates the degree of competition of country *j* for the home economy *i* in the export market of commodity *c* (X^c) in the third market *d*. The larger the export market share of country *j* in region *d* $\left(X^{c}_{jd} / X^{c}_{\cdot d}\right)$ and the higher the share for country *i* of total exports of that commodity to region *d* ($X^{c}_{id} / X_{i\cdot}$), the more strongly will country *i* be affected by a devaluation in country *j*. The second term measures the degree of bilateral trade between the two countries, implying that country *i* will be affected more by a devaluation in country *j* the greater the amount of bilateral trade between them.

Table 1 shows that the degree of real integration is particularly high for economies of the same region. Due to the large economic size and trade volume, Southeast and East Asian countries are the strongest competitors outside their own region, although the degree of competition with these economies is mostly much smaller than with those within the same region. The degree of trade competition proved robust to the choice of weights between bilateral and third market trade. Thus, these findings provide a first indication that if a currency crisis occurs in one country, the crisis is likely to spread through real integration mostly to other regional economies and much less to those located elsewhere in the world.

Table 1:
Real Integration of Regions

	Average Real Integration				
Country i: / Country j:	L. America	Asia	SE&E Asia	S Asia	Others
Latin Amerika	35.7	7.8	9.9	1.3	4.4
Asia:	3.8	40.0	49.9	10.3	4.9
Southeast & East Asia	4.2	41.3	53.7	3.9	4.1
South Asia	2.6	36.0	38.2	29.4	7.3
Others	3.7	13.2	16.5	3.4	22.5

Note: Real Integration for 1996, scaled to lie between 0 and 100. Others: Eastern Europe, Middle East, Africa. See Appendix for countries included.

3.2.2 Financial Integration Contagion

How to measure financial integration contagion (FIN_{ij}), the second transmission channel, is a more difficult and controversial matter. While much recent work focuses on the openness of the capital account and the degree and timing of financial integration of emerging markets with developed markets (Bekaert et al. 1998, Phylaktis 1999) the issue I am interested in here for the purpose of measuring contagion is how an investment decision in a financial asset in one emerging market affects investment decisions in other emerging markets, i.e. to what extent underlying asset prices are interdependent.

It is crucial to emphasize that a higher degree of openness of the capital account does not necessarily imply a larger extent of comovements of asset prices. There are three reasons for this: financial interdependence can also result from investors, correctly or incorrectly, considering economies of the same region as having similar prospects, thus having to adjust their portfolio or to raise cash for redemption's when one economy is hit by a crisis ("external institutional contagion") or simply following other investors in withdrawing funds in fear of contagion ("herding contagion"). Moreover, financial interdependence can result from direct cross-border links among financial and non-financial institutions which transmits movements of asset prices across countries ("internal institutional contagion").

Analyzing data on country funds, Frankel and Schmukler (1996) indeed find evidence that herding behavior and institutional factors were partly responsible for the spread of the Mexican crisis in 1994-95 to other emerging markets. Using daily data, Baig and Goldfajn (1998) show that news about economic or political events in one Asian country strongly affected exchange rates and stock markets of other regional countries during the Asian crisis.

In order to obtain a meaningful measure of financial interdependence for a larger cross-section of countries over a longer term horizon, I use the monthly averages of the correlation of weekly stock market returns across emerging markets.[10] Since a high correlation of returns may be partly explained by similarities in fundamentals or by the exposure to common external shocks in developed markets, I control for these factors by regressing the country return index (*RI*) on country-specific fundamentals as well as on weighted returns of the S&P 500, FTSE 100 and NIKKEI (*GRET*):

$$RI_{i,t} = \beta_0 + \beta_1 CAP_{i,t} + \beta_2 TB_{i,t} + \beta_3 r_{i,t} + \beta_4 P_{i,t} + \beta_5 S_{i,t} + \beta_6 GRET_t + \mu_{i,t} \qquad (12)$$

with the independent variables of portfolio capital inflows (*CAP*), the trade balance (*TB*), the change in a country's interest rate (*r*), the rate of inflation (*P*) and the spot exchange rate (*S*) for each country *i*. The correlation's of the residual μ should give a reasonably good idea about the true interdependence of various emerging stock markets.[11]

Table 2:
Financial Interdependence of Regions

	Avg. Return Residual Correlation's					Avg. Return Correlation's				
	L Amerika	Asia	SE&S Asia	S Asia	Others	L Amerika	Asia	SE&S Asia	S Asia	Others
Latin Amerika	30.1					34.9				
Asia:	14.7	29.4				15.9	16.5			
Southeast & East Asia	13.1	36.1	57.2			17.9	19.9	31.2		
South Asia	17.3	18.3	11.9	47.2		12.4	10.7	12.2	26.4	
Others	18.7	10.1	13.9	3.5	23.3	6.6	9.5	10.1	8.6	19.8

Note: Correlation's are for the period of 1992/Q1-1996/Q4. The correlation coefficients were multiplied by 100. Others. Eastern Europe, Middle East, Africa. See Appendix for countries included.

10 *Baig* and *Goldfajn* (1998) also look at cross-country correlation's of exchange rates, interest rates and sovereign risk spreads during the Asian crisis. None of these three measures is appropriate in the context of this paper because the first two were a policy tool under managed exchange rates prior to the crisis and sovereign risk spreads reflect the market perception of the default risk rather than the interdependence of financial markets.

11 *Wolf* (1998) shows that another potential bias, apart from similarities in fundamentals, may result from the similarity of the Sectoral composition of countries' stock market indices. I.e., if the Sectoral composition of two indices is similar, then it is possible that comovements of these indices are caused by changes in one particular sector which in turn may be due to global developments. However, Wolf finds that the correlation of returns in many cases is higher after controlling for such similarities, thus confirming the importance of contagion.

Table 2 confirms that financial interdependence is significantly higher among markets of the same region. Two results stand out: first, controlling for global and country-specific factors mostly raises the degree of financial interdependence; and second, the residual correlation's are particularly high among Southeast and East Asian markets. This suggests that financial integration contagion is stronger both within regions and in particular within Southeast and East Asia. For instance, South Asian markets have a low degree of financial interdependence with Southeast and East Asia, possibly offering an explanation as to why contagion did not hit South Asia during the 1997-98 Asian financial crisis. The empirical analysis of the role of contagion is the subject of the following sections.

4 Empirical Results: Explaining Currency Crises

I follow a three-pronged testing strategy. First, the power of contagion versus the role of fundamentals and sunspots in explaining movements in foreign exchange markets is tested in a univariate, individual-country framework using Markov-switching regimes models. Second, a panel analysis then investigates to what extent these results for individual countries are robust for a broad sample of 24 emerging markets. And third, the predictive power of the model will be tested in section 5 in order to examine critically the quality of the model.

4.1 Contagion versus fundamentals in an individual-country framework

Is it fundamentals or rather contagion that is responsible for the exchange market movements and crises in emerging markets in the 1990s? And how important are exogenous shifts in investors' beliefs? The key finding of this subsection is that contagion is important for most countries in understanding exchange rate dynamics. While Markov-switching models with two or more regimes perform well for most of the countries, the inclusion of contagion often eliminates the existence of regime shifts. This suggests that contagion is the main explanation for jumps in exchange rates in the analyzed emerging markets.

First, the Markov-switching regimes model with three regimes performs well for most countries, but only if the contagion variables are not included (regressions 1 and 2, Table 3).[12] This finding is intuitively convincing because when looking at the data on exchange market pressure, one can easily detect three regimes: a tranquil one where the exchange market pressure is around zero; a second one where there is a high degree of exchange market pressure and low credibility as during times of speculative attacks and crises; and a third one where there is a negative exchange market pressure, i.e. a currency appreciates, interest rate differentials fall and reserves rise, which often occurs immediately after devaluation's.

12 Using the methodology developed by *Krolzig* (1998), the MSVAR model is implemented empirically by applying the expectation maximization (EM) algorithm, programmed in Ox. With this, maximum likelihood estimates for the regime-switching models are obtained.

Table 3:
Markov-Switching Regimes Models (MSI-VAR): Exchange Market Pressure (EMP) and Exchange Rate Credibility (CRED)

	MEXICO							
	EMP				**CRED**			
	(1)	**(2)**	(3)	**(4)**	(1)	**(2)**	(3)	**(4)**
Const. (Regime 1)	*-66.05	***-52.00**	-66.91	***-64.38**	-5.604	**3.382**	-5.790	**3.632**
Const. (Regime 2)		***-51.98**		***-33.15**		***5.571**		***5.757**
Const. (Regime 3)		***-26.87**				***10.72**		***10.94**
Capital Flows	0.136	**0.095**	0.058	**0.049**	0.048	**0.044**	0.048	**0.044**
Lending Boom	-12.49	**-8.959**	-37.17	**5.221**	-3.961	***-7.353**	-8.908	***10.83**
Foreign Debt	*24.98	***19.21**	*26.86	***22.39**	*4.676	***5.727**	4.372	**-1.416**
Overvaluation	*0.716	**0.482**	*0.816	***0.549**	*0.100	**-0.013**	*0.983	***0.912**
Reserves	-3.248	**2.544**	-18.33	**15.94**	-3.071	**-3.159**	-3.463	**-4.417**
Trade Balance	131.6	**57.95**	116.9	**122.1**	43.21	**25.22**	22.04	**16.93**
Real Contagion			*4.514	***6.558**			1.431	***1.244**
Financial Cont.			0.465	**0.450**			2.757	***2.511**
Log-likelihood	-132.4	**-114.2**	-101.2	**-82.44**	-66.71	**-51.09**	-57.45	**-43.05**
Variance	43.95	**10.84**	49.73	**9.597**	3.339	**0.741**	3.078	**0.654**
P_{11}		**0.673**		**0.964**		**0.424**		**0.592**
P_{22}		**0.716**		**0.382**		**0.959**		**0.955**
P_{33}		**0.299**				**0.644**		**0.697**
	THAILAND							
	EMP				**CRED**			
	(1)	**(2)**	**(3)**	(4)	(1)	**(2)**	**(3)**	(4)
Const. (Regime 1)	4.346	***3.695**	**14.30**	*14.70	13.83	**13.83**	**14.62**	14.61
Const. (Regime 2)		**-0.26**		*14.76		**13.82**		14.60
Const. (Regime 3)		***17.37**		*14.98		**13.86**		14.64
Capital Flows	-0.214	**0.708**	**0.641**	-0.686	-1.584	**-1.534**	**-1.135**	-1.135
Lending Boom	0.108	***-17.32**	**-3.578**	-3.579	-0,428	**-0.483**	**1.519**	1.519
Foreign Debt	*6.725	***6.081**	***9.962**	*9.964	*20.28	***21.78**	***18.53**	*18.53
Overvaluation	-48.66	***40.95**	***54.99**	*54.99	*34.74	***14.74**	***39.02**	*39.02
Reserves	0.208	***5.871**	**-2.663**	-2.663	-7.993	**-7.993**	**-8.737**	-8.737
Trade Balance	75.36	**22.20**	**92.16**	92.16	0.354	**0.354**	**5.701**	5.701
Real Contagion			**1.178**	1.178			**0.567**	0.567
Financial Cont.			***12.79**	*12.83			***4.003**	*4.013
Log-likelihood	-104.7	**-77.40**	**-72.95**	-72.95	-27.75	**22.31**	**-26.46**	-26.46
Variance	11.00	**1.141**	**7.582**	7.581	1.880	**0.531**	**1.599**	1.599
P_{11}		**0.686**		0.686		**0.490**		0.480
P_{22}		**0.912**		0.912		**0.540**		0.529
P_{33}		**0.499**		0.499		**0.531**		0.518

continued Table 3

	ARGENTINA							
	EMP				CRED			
	(1)	**(2)**	(3)	**(4)**	(1)	**(2)**	(3)	**(4)**
Const. (Regime 1)	*-9.497	***-18.28**	-2.298	***-7.041**	3.221	**1.066**	-3.711	***-9.815**
Const. (Regime 2)		***-16.72**		**-5.739**		**1.052**		***-9.545**
Const. (Regime 3)		***-13.61**		**-2.654**		***5.060**		***-6.399**
Capital Flows	-0.015	**-0.091**	-0.110	**-0.080**	-0.062	**-0.002**	-0.285	**-0.146**
Lending Boom	*10.11	***14.04**	63.41	***9.358**	20.45	**8.654**	*96.21	***90.96**
Foreign Debt	-12.38	**-13.70**	-7.167	**-8.323**	-4.177	***-5.227**	2.974	***1.946**
Overvaluation	*12.61	***12.46**	*13.99	***17.25**	*1.897	***4.039**	*0.585	***6.741**
Reserves	-11.24	**-9.721**	-12.58	**-14.87**	-2.710	**0.378**	4.482	**11.51**
Trade Balance	*-25.51	***-21.10**	*-25.61	***-29.31**	-47.72	**26.21**	68.90	**152.9**
Real Contagion			1.228	***1.689**			0.984	**0.393**
Financial Cont.			*10.11	***9.109**			*21.32	***11.39**
Log-likelihood	-50.84	**-40.57**	-46.89	**-36.62**	-40.93	**-32.93**	-34.15	**-19.81**
Variance	2.926	**0.317**	2.719	**0.261**	1.547	**0.441**	0.899	**0.141**
P_{11}		**0.531**		**0.571**		**0.769**		**0.941**
P_{22}		**0.442**		**0.584**		**0.742**		**0.059**
P_{33}		**0.150**		**0.333**		**0.413**		**0.303**
	INDONESIA							
	EMP				**CRED**			
	(1)	**(2)**	**(3)**	(4)	(1)	**(2)**	**(3)**	(4)
Const. (Regime 1)	*-47.62	***-71.57**	***-43.39**	*-43.53	*-41.76	***-52.77**	**-21.99**	-22.06
Const. (Regime 2)		***-66.38**		*-43.44		***-47.13**		-21.98
Const. (Regime 3)		**-60.32**		*-43.26		***-42.13**		-21.93
Capital Flows	0.276	**-0.612**	**0.030**	0.030	-0.503	**-0.808**	**-0.239**	-0.239
Lending Boom	*49.97	***89.69**	***61.99**	*61.99	*23.06	***26.74**	***84.98**	*84.86
Foreign Debt	*25.02	***19.31**	***15.37**	*15.37	-11.825	**-9.268**	**4.234**	4.237
Overvaluation	*-19.45	***-8.342**	***-22.78**	*-22.77	*53.76	***64.52**	***84.13**	*84.13
Reserves	59.89	***90.00**	**54.86**	54.85	36.39	**40.38**	**14.15**	14.15
Trade Balance	52.14	***-88.64**	**52.99**	53.08	178.1	**281.4**	**243.4**	243.4
Real Contagion			***1.336**	*1.333			**1.101**	1.100
Financial Cont.			***12.32**	*12.31			***2.799**	*2.801
Log-likelihood	-77.72	**-66.81**	**-65.91**	-65.90	-41.80	**-34.26**	**-34.49**	-34.49
Variance	12.46	**1.383**	**5.518**	5.518	8.003	**0.887**	**4.367**	4.364
P_{11}		**0.198**		0.537		**0.653**		0.454
P_{22}		**0.784**		0.629		**0.595**		0.529
P_{33}		**0.690**		0.590		**0.653**		0.487
	PHILIPPINES							
	EMP				**CRED**			
	(1)	**(2)**	**(3)**	(4)	(1)	**(2)**	**(3)**	(4)
Const. (Regime 1)	3.512	**2.079**	**0.656**	0.603	-10.822	***-18.73**	**-7.644**	-7.673
Const. (Regime 2)		***13.30**		0.695		***-16.62**		-7.651
Const. (Regime 3)						***-13.36**		
Capital Flows	0.043	**0.077**	**-0.084**	-0.084	0.085	***0.062**	**0.051**	0.051
Lending Boom	12.06	**16.68**	**-52.60**	-52.61	-8.488	***7.173**	***8.796**	*8.795
Foreign Debt	*4.412	***8.796**	***14.67**	*14.67	-5.084	***-4.424**	**-2.940**	-2.940
Overvaluation	*14.42	**2.800**	***13.79**	*13.79	*0.120	***0.178**	***0.091**	*0.091

continued Table 3

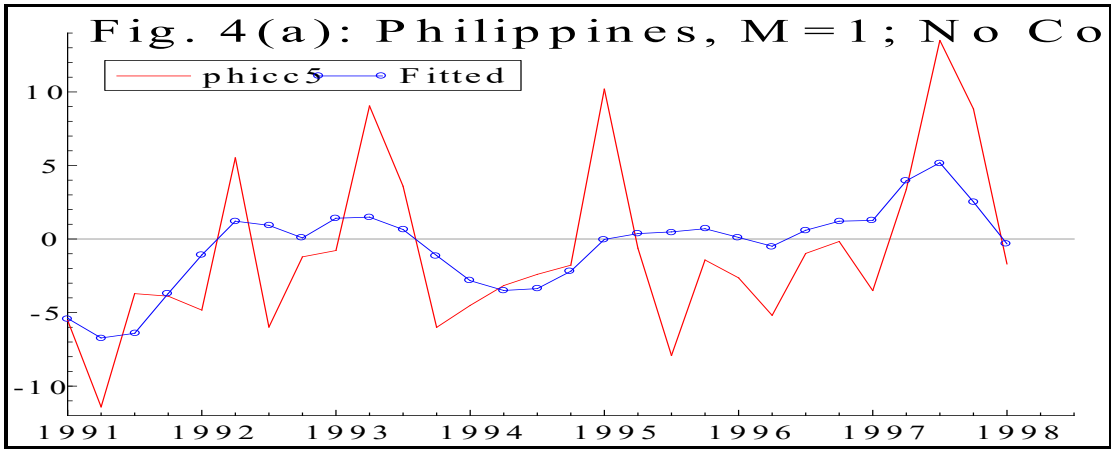
Reserves	7.023	***14.67**	***14.46**	*14.46	1.126	***1.629**	**1.579**	1.579
Trade Balance	88.99	**155.5**	**81.71**	81.71	-5.916	**3.911**	**-11.13**	-11.13
Real Contagion			***8.889**	*8.889			**4.802**	4.802
Financial Cont.			***14.29**	*14.29			***6.359**	*6.358
Log-likelihood	-111.9	**-105.7**	**-69.49**	-69.49	-67.35	**-57.91**	**-54.67**	-54.67
Variance	24.83	**6.869**	**7.063**	7.063	3.479	**0.359**	**2.542**	2.541
P_{11}		**0.849**		0.623		**0.393**		0.505
P_{22}		**0.588**		0.744		**0.635**		0.573
P_{33}						**0.345**		0.475
	KOREA							
	EMP				**CRED**			
	(1)	**(2)**	**(3)**	(4)	(1)	**(2)**	**(3)**	(4)
Const. (Regime 1)	2.573	**4.992**	**15.237**	15.16	*-13.82	***-12.10**	***-17.12**	*-17.24
Const. (Regime 2)		**5.087**		15.20		***-9.522**		*-17.11
Const. (Regime 3)		**5.235**		15.36		***-3.916**		*-17.02
Capital Flows	*69.64	**-0.052**	**-0.092**	-0.092	-0.003	**-0.023**	**0.003**	0.003
Lending Boom	*30.55		***90.63**	*90.62	*43.63	***13.38**	***58.93**	*58.93
Foreign Debt	*18.81	***59.39**	***48.69**	*48.69	*20.89	***19.84**	***17.79**	*17.79
Overvaluation	-8.618	***19.17**	***25.92**	*25.32	*0.271	***0.193**	***0.316**	*0.316
Reserves	-255.7	***23.91**	**-23.24**	-23.24	*-17.68	**-11.23**	**-17.28**	-17.27
Trade Balance		**-11.33**	**-245.2**	-245.2	84.45	**114.7**	**107.8**	107.8
Real Contagion		**-184.8**	***10.04**	*10.04			**2.032**	2.032
Financial Cont.			***10.21**	*10.52			***4.974**	*4.976
Log-likelihood	-121.2	**-101.7**	**-90.44**	-90.44	-66.91	**-51.83**	**-55.98**	-55.98
Variance	25.16	**22.19**	**24.32**	24.32	3.379	**0.531**	**2.781**	2.774
P_{11}		**0.686**		0.688		**0.668**		0.447
P_{22}		**0.786**		0.669		**0.686**		0.573
P_{33}		**0.001**		0.615		**0.642**		0.462
	CHILE				**INDIA**			
	EMP				**EMP**			
	(1)	**(2)**	(3)	**(4)**	(1)	**(2)**	(3)	**(4)**
Const. (Regime 1)	3.513	**-1.722**	*-23.26	***-32.27**	-14.12	**-55.14**	-13.19	***74.84**
Const. (Regime 2)		***4.469**		***-25.80**		**-49,65**		***80,29**
Const. (Regime 3)		**2.449**		***-22.62**		**-42.78**		***85.48**
Capital Flows	-0.509	**-0.776**	-0.417	**-1.126**	*0.316	***0.496**	-0.324	***0.309**
Lending Boom	-13.04	**-17.52**	-62.12	**-52.87**	-98.71	**-21.62**	-38.48	***-4.854**
Foreign Debt	*9.549	***10.06**	*6.502	***4.358**	*24.63	***3.591**	*.19.94	***17.00**
Overvaluation	-2.160	**0.743**	*37.02	***31.78**	0.382	**0.678**	0.200	***0.351**
Reserves	-1.632	**-1.212**	7.158	**8.187**	1.247	**0.770**	1.156	**-0.275**
Trade Balance	-16.38	**-16.98**	-112.6	**-93.23**	*30.68	***27.48**	220.3	**186.2**
Real Contagion			5.367	**2.774**			0.939	***0.764**
Financial Cont.			2.679	***4.705**			*7.942	***16.79**
Log-likelihood	-108.6	**-101.4**	-72.32	**-52.71**	-64.35	**-50.37**	-62.86	**-52.95**
Variance	7.321	**1.832**	7.264	**0.388**	10.08	**0.906**	8.947	**0.954**
P_{11}		**0.623**		**0.568**		**0.701**		**0.701**
P_{22}		**0.407**		**0.703**		**0.916**		**0.916**
P_{33}		**0.075**		**0.109**		**0.573**		**0.573**

Note: Columns in bold indicate the best number of regimes for the specific model. P_{jJ} denotes the regime switching probabilities. * indicates statistical significance at the 10% level.

Second, when including contagion (regressions 3 and 4), the coefficients for financial contagion, and sometimes for real contagion, are mostly large and significant. The explanatory power and the fit of the model are mostly improved (i.e. lower variance and log-likelihood) and the need for regime switches is eliminated or reduced in many cases. What this implies is that the existence of contagion explains many of the regime shifts that can not be explained by fundamentals alone.

The cases of the Philippines and Indonesia provide good examples: a Markov-switching model with multiple regimes and no contagion (Fig. 4(b) and 4(e), and Table 3) perform much better than the same model with only one regime (Fig. 4(a) and 4(d)). The linear model with no regime change but with contagion (Fig. 4(c) and 4(f)), however, perform about as good and thus eliminates the need for regime shifts that are not due to changes in fundamentals. Note that contagion not only helps to explain the countries increased exchange market pressure during the Asian crisis and Latin American crisis but also during tranquil periods. Similar conclusions apply to a number of other countries which were victims of either of these two crises (Korea, Thailand, Mexico; Table 3) while contagion does not explain regime shifts for other countries which were affected less by the crises (Chile, India).

Third, there is no single economic fundamental that seems to have played a role in explaining the movements of the dependent variables in *all* countries over time. This indicates that what drives exchange rate movements and causes currency crises to spread across countries can differ significantly from country to country and across episodes. This renders it much harder to find common explanations for different crises and makes it obviously very difficult to predict crises reliably with fundamentals alone. Nevertheless, either the large size of foreign debt, fast domestic credit expansion ("Lending Boom") or an overvalued exchange rate (or often a combination of these three) is important in understanding movements in foreign exchange markets and expectations. Thus, looking at these three variables *together* should provide a more promising idea of what is likely to happen in foreign exchange markets.



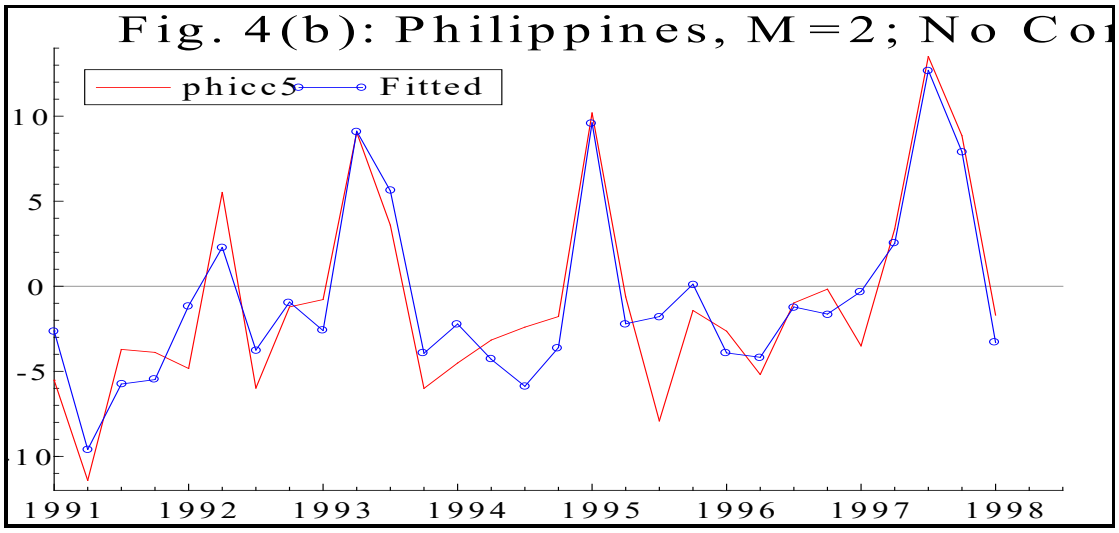


Fig. 4(b): Philippines, M=2; No Co
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1991
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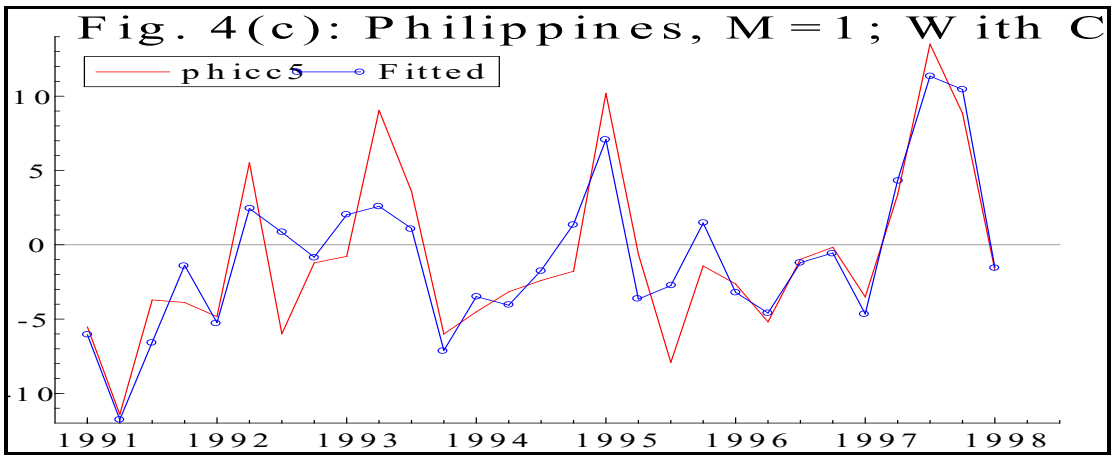
Fig. 4(c): Philippines, M=1; With C
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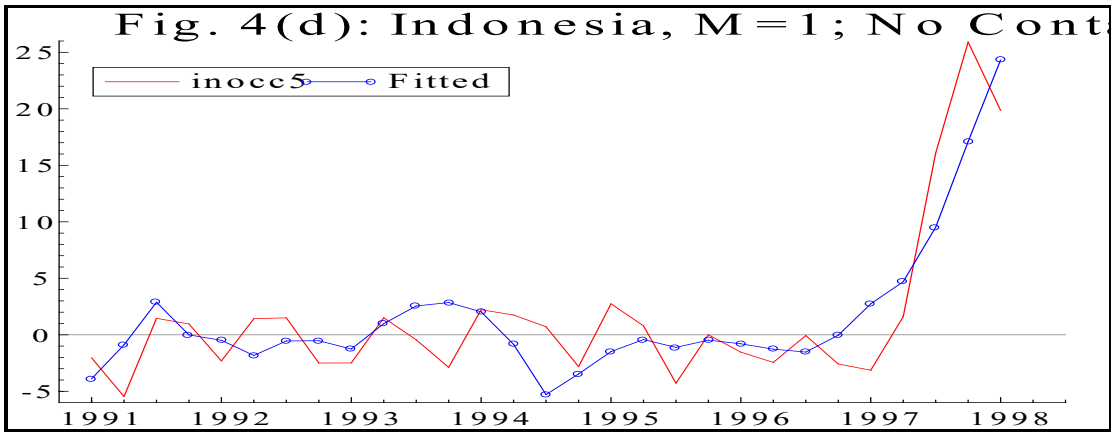
Fig. 4(d): Indonesia, M=1; No Cont
inocc5
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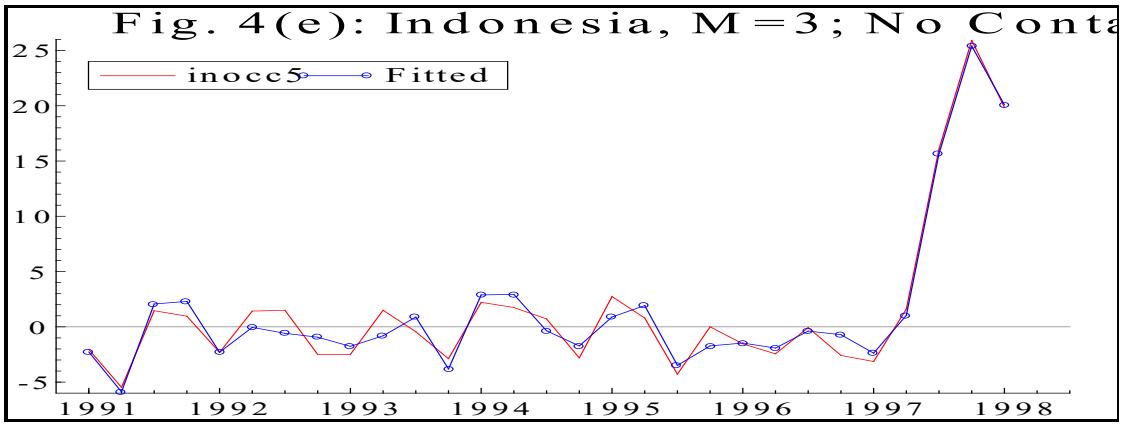

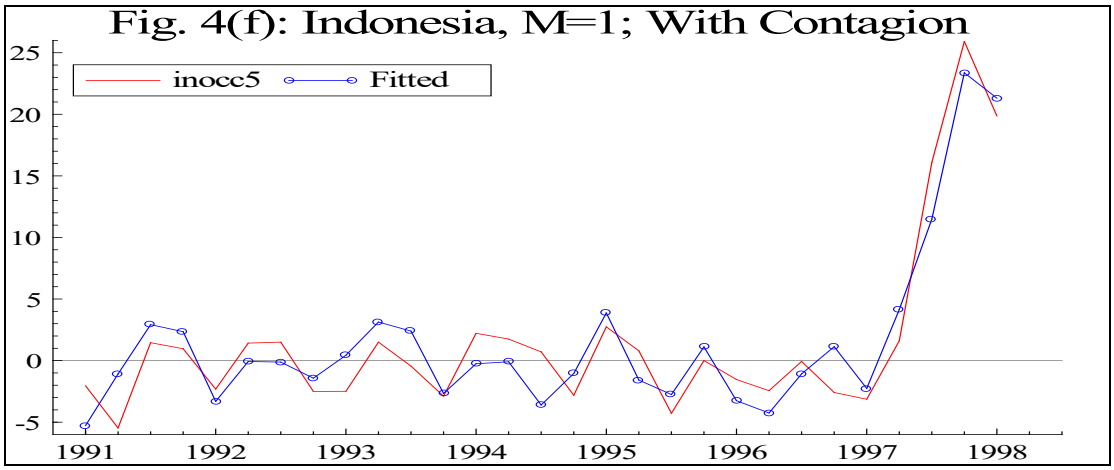

Two other striking results are (1) that the size of capital flows (both total and short-term) has no explanatory power for almost any of the countries that were affected by the Asian or Latin American crises, and (2) that it is the change over the past years, and not the level, of domestic credit expansion which is significant. What these findings suggest is that large capital inflows and a permanently high level of domestic credit expansion may not necessarily constitute a problem for an economy as long as those resources are used in a sound way. For instance, Asian economies experienced large capital inflows since financial liberalization, but were unaffected by the Latin American crisis which hit countries that did not receive such large inflows of foreign capital.

A number of robustness checks were conducted. Most importantly, other fundamentals than those listed in Table 3 did not prove significant, such as external variables (growth and interest rates in industrialized countries) and other domestic variables (government deficit, capital flows). It is also important to emphasize the shortcoming of the MSVAR methodology of tending to "over-fit" the data by using maximum likelihood estimation. I.e. the model with multiple regimes has a good fit but also in some cases produces coefficient estimates that do not make sense (showing either a large change in the coefficient or a wrong sign). Otherwise the MSVAR methodology appears sound from various test

statistics, such as the switching probabilities (P_{ij}) shown in Table 3. The Markov transition matrices confirm that the probability of remaining in a particular state is usually about 50 % or higher. Only very few regimes are characterized by one or two events, and most regimes are reached at least three times over the time span of ten or eleven years for *EMP*.[13]

In conclusion, the Markov-switching regimes model is a superior alternative to the linear models used in most of the empirical literature on currency crises, but only when contagion variables are not included. The inclusion of contagion eliminates the need for regime switches in many cases and shows that shifts in exchange rates are often explained by contagion rather than external shifts in investors' beliefs or changes in fundamentals.

4.2 Contagion versus fundamentals in a panel framework

The key purpose of the panel analysis is to test whether the results for individual countries outlined in the previous subsection are robust across countries and whether we can detect factors that were common to the majority of countries. In particular, the weakness of the analysis for individual countries is that it fails to explain why some countries with more healthy fundamentals were affected so severely while others with worse economic conditions manage to escape unscathed. The answers to these issues can be found only in a panel framework, which uses the infection function of equation (7) as discussed in section 2.2.[14]

The most striking result of the panel estimation (Table 4) is that contagion has been a key driving force behind exchange market movements in emerging markets. The primary channel of contagion was the channel of financial sector interdependence, whereas the coefficient of trade integration is smaller though still significant. The importance of contagion is underlined when comparing the Full Model (including both fundamentals and contagion variables) with the Fundamentals Model (with only fundamentals) and the Contagion Model (with only contagion variables) and their log-likelihood's: the Full Model has a much better fit than the Fundamentals Model.

Second, contagion seems to be of particular importance during crisis periods (the 1994-95 Latin American crisis and the 1997-98 Asian crisis) as indicated by the increase in the size of the coefficients (regressions 4, 5, 9, 10). However, contagion is still relevant

13 Note also that there are in some cases significant differences between the estimates for *CRED* and those for *EMP*. This may partly reflect the differences between these two variables and also the shortened time period for the estimations using *CRED* for some countries.

14 The ordinary panel model with random effects or with fixed effects does not explicitly allow for exogenous shifts in beliefs as the Markov-switching model does. The reason for why an MSVAR analysis can not be conducted in this panel context is that regime shifts across the set of 24 emerging markets are very distinct. Although comovements and common regime shifts exist for some regional groups, such as in Southeast Asia, no common regime shifts are present for countries of different regions because there are few similarities across currencies to be found within regimes. E.g., a particular regime may indicate an appreciation and high volatility for some countries while at the same time showing depreciating currencies and low volatility for others.

during tranquil periods, suggesting that exchange market movements are transmitted not only during crises.

Table 4:
Panel Estimation: Random Effects Model (MLE) for 24 Emerging Markets Worldwide, 1989/Q1-1998/Q2

	EMP					CRED				
	Fund. Model	Full Model Con-tin.	Cont. Model Conta-gion	Full Model Crises	Cont. Model Conta-gion	Fund. Model	Full Model Con-tin.	Cont. Model Conta-gion	Full Model Crises	Cont. Model Conta-gion
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Capital Flows	0.045	0.045		0.041		0.011	0.003		0.006	
short-term Cap. Flows	0.001	0.001		0.001		0.001	0.001		0.001	
Lending Boom	*7.021	*7.754		*5.059		1.748	1.992		*2486	
Foreign Debt	*10.71	*9.295		*8.327		*3.139	*2.748		*1.135	
short-term Debt	*4.719	*4.322		*4.479		*1.007	*0.824		0.210	
Overvaluation	*6.225	*5.303		*5.558		*5.289	*4.437		*4.274	
Reserves	-0.559	-0.587		-0.460		-0.227	-0.187		0.071	
Trade Balance	2.141	1.980		1.382		*-8.454	*-7.726		*-7.930	
Real Contagion		*1.473	*1.497	*2.665	*3.002		*1.292	*1.407	*2.992	*3.098
Financial Contagion		*13.63	*15.65	*14.36	*16.55		*3.884	*3.831	*7.213	*6.467
Constant	*-4.639	*-3.810	*-0.459	*-4.370	*-0.777	*1.522	*1.841	*1.197	*1.457	*0.912
Log Likelihood	-1178	-1647	-1830	-1765	-2214	-596	-590	-600	-586	-597

Note: Estimations for CRED are only for 15 countries and 1994/Q1-98/Q2 due to the data availability (see Appendix). Regressions for „Crisis contagion“ include the contagion variables only for the crisis episodes of 1994/Q4-1995/Q2 and 1997/Q3-1998/Q1. * denotes statistical significance of coefficients at the 90% level.

Third, the fundamentals that are significant are the level of total and short-term foreign debt/GDP, a prior change in the ratio of domestic credit expansion to GDP (*"Lending Boom"*), and the overvaluation of the exchange rate. Many other variables were tested but did not show any significance (such as changes in the US dollar value vis-a-vis the mark and the yen, a country's government deficit, the current account, the trade balance).

Finally, the results are robust to changes in variable definitions and the time span but are sensitive to country groupings. To test for differences across regions, I employ an analysis of variance (ANOVA) methodology that takes for each country i, analogously to equation (7), the following form:

$$y_{i,t} = \alpha_i + \gamma_i z_{i,t-1} + u_{i,t} \qquad (13)$$

with z as the vector of fundamentals and contagion variables. The null hypothesis of interest is that the coefficient for an individual country (γ_i) is equal to the coefficient for the country grouping as a whole (β):

$$H_0: \quad \gamma_i = \beta$$

The results reveal significant differences in the size and significance for most coefficients across regional groups whereas the size of the coefficient is reasonably robust within those regional groups (Table 5). Another important finding is that financial contagion seems to have been particularly strong across Asian countries and less significant, though still positive, in Latin America. On the contrary, the overvaluation of the exchange rate was more of a driving force in Latin America than in Asia.

Table 5:
Analysis of Variance (ANOVA) of Panel Estimation for Full Model (EMP)

	Global		Asia		Latin America		Others	
	Global	ANOVA	Regional	ANOVA	Regional	ANOVA	Regional	ANOVA
	Coefficient accept H_0		Coefficient accept H_0		Coefficient accept H_0		Coefficient accept H_0	
Capital Flows	0.045	12/24	0.111	4/9	0.058	6/8	-0.075	3/7
short-term Cap. Flows	0.001	11/24	0.008	5/9	-0.008	2/8	0.007	2/7
Lending Boom	*7.754	13/24	3.473	4/9	*15.99	5/8	*7.164	3/7
Foreign Debt	*9.295	10/24	18.99	4/9	*5.887	3/8	*7.061	4/7
short-term Dept	*4.322	11/24	*4.431	5/9	*2.968	5/8	2.086	3/7
Overvaluation	*5.303	10/24	0.717	4/9	*13.06	5/8	*4.517	4/7
Reserves	-0.587	10/24	-0.831	4/9	-0.731	5/8	-0.201	3/7
Trade Balance	1.980	9/24	2.525	4/9	-13.72	2/8	1.523	2/7
Real Contagion	*1.473	14/24	*1.843	6/9	1.235	6/8	-0.257	2/7
Financial Contagion	*13.63	14/24	*14.99	7/9	*6.189	6/8	*19.38	3/7

Note: ANOVA shows how many of the countries' coefficients are statistically equal to their group's coefficient at the 90% significance level. The contagion variables are continuous variables as defined in the infection function of equation (7). * denotes statistical significance of coefficients at the 90% level.

5 The Full Model's Predictive Power

The ultimate test of the quality of an empirical model is its out-of-sample forecasting ability. How would the Full Model have predicted the two major crises of the 1990s in Latin America and in Asia? And how does this predictive power compare to alternative models of currency crises?

Berg and Pattillo (1998) show that the fact that a model is good in explaining particular crises is no guarantee that it is capable of forecasting future crises. They evaluate and compare the predictive power of three of the most cited models, each representing a dif-

ferent type of model: Kaminsky, Lizondo and Reinhart's (1997) signaling approach which identifies when fundamentals provide signals for potential future crises, Frankel and Rose's (1996) panel data analysis with probity techniques reaching back to the 1970s, and Sachs, Tornell and Velasco's (1996) cross-sectional approach which focuses on a set of 20 open emerging markets during the Latin American crisis in 1994-95.

Even after improving on these methodologies, Berg and Pattillo find that none of the models would have predicted the 1997 Asian crisis in a satisfactory way. Table 6, repro-

Table 6:
The 1997 Asian Crisis: Comparing the Predictive Power of Models by Kaminsky, Lizondo, Reinhart (KLR), Berg and Pattillo (BP), Frankel and Rose (FR) and Sachs, Tornell, Valesco (STV)

	KLR			BP		FR			STV		
	Actual Crises Index 1997	Predicted Probabilities of Crisis in 1997 Noise-to-signal Weighted Sum of Indic.[a]		Predicted Probabilities of Crisis in 1997 Indicators Lincar		Actual Crises Index 1997	Predicted Probabilities of Crisis in 1997[d]		Actual Crises Index 1997	Predicted Severity of Crisis in 1997	
		Original[b]	Augm.[c]	Model 1	Model 2		Model 2	Model 4		Model 3	Model 4
Thailand	1	16	7	4	2	3	7	11	2	7	5
Korea	2	4	5	3	9				3	12	11
Indonesia	3	18	11	8	8	2		7	1	14	9
Malaysia	4	8	13	5	1				4	6	6
Zimbabwe	5	3	3						5	23	12
Taiwan (POC)	6	5	4	6	5				9	11	22
Colombia	7	9	12	7	4	8	8	6	8	18	4
Philippines	8	1	1	2	12	7		8	6	1	1
Brazil	9	2	2	1	10	10	6	5	14	4	21
Turkey	10	7	10	13	18	1	3	2	7	9	13
Venezuela	11	14	16	13	20	5	10	12	21	22	13
Pakistan	12	10	9	11	6	6	11	9	10	17	20
South Africa	13	6	8	12	11				12	15	16
Jordan	14	15	18	13	13				17	20	15
India	15	20	21	13	19	14	13		13	5	19
Sri Lanka	16	17	19	13	14	11	14	13	15	16	17
Chile	17	18	20	13	15	15	9	10	16	19	14
Bolivia	18	20	21	13	21	13	12		22	13	10
Argentina	19	12	17	13	17	16	5	3	23	2	7
Mexico	20	13	14	13	22	12	4		18	21	18
Peru	21	11	6	10	7	9	1	4	20	8	23
Uruguay	22	20	21	13	16	4	2	1	11	3	3
Israel	23	20	15	9	3				19	10	8
Correlation[e]		0.54	0.60	0.67	0.48		0.33	0.12		0.11	0.23
P-value		0.007	0.003	0.001	0.026		0.253	0.694		0.612	0.295
R^2		0.29	0.36	0.47	0.23		0.11	0.02		0.01	0.05

[a] Based on average of weighted-sum probabilities during 1996:1-12, using out-of-sample estimates. – [b] Original KLR variables. – [c] Addition of current account and M2/reserves in levels to original variables. – [d] Average predicted probabilities for 1996:1-12 where model was estimated up to 1995:4. – [e] Spearman Rank Correlation of the fitted values and the actual crisis index and its p-value. The R2 is from a regression of fitted values on actual values.

Source: Berg and Pattillo (1998), Table 14, p. 54.

duced from Berg and Pattillo (1998), provides a comparison of the models. Frankel and Rose's panel model and Sachs, Tornell and Velasco's cross-sectional approach are both very poor in forecasting the 1997 Asian crisis. They tend to predict crises in countries that were relatively unscathed and often fail to anticipate crises where they did occur. The revised signaling approach by Berg and Pattillo (BP) is by far the most promising model with a reasonably high Spearman rank correlation indicating that the model correctly forecasts which countries will be most severely affected by a crisis *if* the crisis occurs. The key weakness of this methodology, however, is that it is not able to predict the timing of a crisis and that false alarms, i.e. a signal that a crisis will occur but then in fact does not take place, are far more numerous than correct signals.

In comparison, Table 7 shows that the predictive power of our Full Model for the Asian crisis is superior in terms of ranking to all of the models tested by Berg and Pattillo. This superiority is particularly strong when the Full Model is compared with the models by Frankel and Rose and by Sachs, Tornell and Velasco, i.e. the models that have the most similar methodology. The superiority mostly stems from the inclusion of the contagion variables in the Full Model because the Fundamentals Model alone does not have a much better predictive power than the models by Frankel and Rose and by Sachs, Tornell and Velasco which are both built entirely on fundamentals.

The Full Model does not only forecast accurately the *ranking* of how strongly countries were affected by the Asian crisis, but it also performs relatively well in forecasting the *degree* of severity. Indonesia and Korea are the only countries for which the Full Model underestimates the degree of the crises substantially, indicating that fundamentals and the extent of real and financial interdependence did not seem to warrant the severity with which these countries were hit.[15] The overall results prove robust to various sensitivity analyses, such as altering the forecasting horizon and using in-sample prediction (Table 7) to test for parameter constancy, and altering the size of the country sample to check for the impact of individual countries.

What makes us believe that the model presented in this paper is superior to the signaling approach and other models developed to-date, as it is for instance presented in the paper by Berg and Pattillo? First, despite the good performance in terms of Spearman rank correlation, the signaling approach has the mentioned shortcoming that it fails to predict the timing of crises. The fact that it provides many false signals makes it questionable as a forecasting tool. Second, the signaling approach only estimates crisis probabilities and is not designed to forecast their severity.

On the contrary, the Full Model presented in this paper has the advantage of being able to estimate both the rankings of countries and the absolute severity of a crisis, i.e. it allows us to understand not only why some countries are affected more than others, but also why a particular country is hit so severely. It seems that currency crises in emerging markets in the 1990s have some essential differences from those in the past: most im-

15 Political factors were probably another important reason for why Indonesia was the main victim of the Asian crisis. Such factors are not analyzed in this paper and are difficult to include on a cross-sectional basis; a discussion of the role of political factors can be found in *Drazen* and *Masson* (1994).

portantly, they occurred in relatively open and financially integrated economies. It therefore seems imperative to look only at emerging markets that are relatively open (both financially and in trade), and thus the model estimation in this paper was conducted only for 24 open economies during the 1990s. Using a panel approach has the added advantage of allowing a better understanding of the dynamics of exchange rate changes and their credibility. The results confirm that factors that help explain exchange rate movements during tranquil periods may become even more important during crises. This was shown to be the case in particular for contagion through real and financial interdependence among economies.

Table 7:
The 1997-98 Asian Crisis: Comparing the Predictive Power of the Full Model, the Fundamentals Model and the Contagion Model

Prediction: 1997/Q3 - 1997/Q4			Out-of-Sample Prediction						In-Sample Prediction					
	Actual Crisis EMP		Full Model		Fundamentals Model		Contagion Model		Full Model		Fundamentals Model		Contagion Model	
Country:	rank	severity	rank	severity	rank	severity	rank	severity	rank	severity	rank	severity	rank	severity
Indonesia	1	42.0	5	12.0	19	-2.7	4	12.8	4	15.4	4	6.8	3	13.9
Korea	2	32.6	6	8.5	16	-0.4	9	3.4	6	7.8	5	6.2	7	4.3
Thailand	3	27.4	3	19.2	10	1.4	2	15.3	2	21.0	1	16.4	2	14.7
Malaysia	4	27.0	1	24.1	6	3.5	1	17.5	1	26.3	2	14.9	1	17.9
Philippines	5	22.4	2	20.4	2	4.8	3	13.1	3	17.3	3	7.4	4	12.0
Colombia	6	9.1	8	7.2	5	3.7	21	-2.5	9	4.6	9	1.5	21	-2.1
Russia	7	4.5	11	6.8	9	1.9	16	0.3	13	2.6	12	0.1	17	1.1
Sri Lanka	8	4.3	7	8.5	3	4.7	10	3.4	11	3.6	17	-3.7	11	3.3
India	9	2.6	16	3.7	17	-0.8	11	3.3	12	2.7	22	-5.1	8	4.2
Poland	10	1.6	14	4.6	11	1.3	12	1.9	14	1.7	19	-4.0	13	2.2
Jordan	11	1.4	12	5.9	1	5.8	19	-0.9	16	1.4	10	0.7	19	-0.6
South Africa	12	1.1	9	6.9	18	-2.1	6	6.7	8	7.5	8	2.5	6	6.3
Brazil	13	0.6	19	0.3	14	0.3	17	0.1	20	0.2	15	-2.1	15	1.6
Pakistan	14	0.1	22	-7.7	21	-2.7	22	-6.9	22	-6.5	18	-3.9	22	-5.7
Chile	15	-0.6	4	12.9	8	2.7	5	8.9	5	10.9	6	4.8	5	8.2
Hungary	16	-1.3	20	0.0	15	0.0	18	0.0	21	-0.9	20	-4.7	12	2.3
Peru	17	-2.4	17	3.0	7	2.9	20	-1.2	19	0.6	13	-1.1	20	-1.0
Argentina	18	-3.4	13	5.7	13	0.4	8	3.7	10	4.6	11	0.7	10	3.4
China	19	-4.5	10	6.9	4	3.7	15	0.5	7	7.6	7	2.9	16	1.6
Mexico	20	-5.9	18	1.6	22	-4.0	7	6.0	17	1.3	21	-5.0	9	3.8
Venezuela	21	-6.9	21	-0.4	20	-2.7	14	0.5	18	0.7	14	-1.7	18	0.6
Turkey	22	-9.0	15	4.0	12	1.1	13	1.6	15	1.4	16	-2.5	14	1.9
Spearman correlation			0.694		0.228		0.380		0.636		0.535		0.467	
P-value			0.000		0.309		0.081		0.001		0.010		0.028	
R^2			0.457		0.407		0.431		0.581		0.558		0.496	

Note: R^2 is obtained from a regression of predicted on actual values of EMP.

In summary, the findings of this section confirm the importance of contagion during the Asian crisis and also the Latin American crisis (Table 8, Appendix). The results suggest that one of the most important if not the single most important indicator for predicting which countries will be affected most severely by a crisis are the degree of real integration and financial interdependence with other affected countries. Moreover, the panel model developed in this paper seems to be a more appropriate methodology in understanding the dynamics and contagious character of the emerging market crises of the 1990s than other approaches developed to-date.

Table 8:
The Latin American Crisis: Comparing the Predictive Power of the Full Model, the Fundamentals Model and the Contagion Model

Prediction: 1995/Q1 - 1995/Q2	Out-of-Sample Prediction						In-Sample Prediction					
	Actual Crisis EMP		Full Model		Fundamentals Model		Contagion Model		Full Model		Fundamentals Model		Contagion Model	
Country:	rank	severity	rank	severity	rank	severity	rank	severity	rank	severity	rank	severity	rank	severity
Mexico	1	26.1	2	8.7	18	-4.2	2	5.2	2	9.5	7	-0.4	1	7.0
Brazil	2	17.5	1	9.3	1	9.4	3	4.4	1	9.9	1	5.4	2	6.9
Philippines	3	10.2	4	4.2	16	-2.0	7	0.4	4	3.7	11	-1.0	5	3.0
Argentina	4	6.9	3	4.7	10	-0.5	1	6.4	3	4.9	12	-1.2	3	6.4
Jordan	5	6.7	16	-0.4	21	-11.4	20	-1.3	20	-2.4	10	-0.8	21	-1.4
Peru	6	4.7	5	3.6	2	6.4	10	0.1	8	1.8	15	-2.2	9	1.8
Sri Lanka	7	4.7	12	0.6	11	-0.5	14	-0.6	16	-0.7	21	-4.4	8	1.9
Pakistan	8	4.0	17	-0.5	14	-1.7	18	-0.9	18	-1.3	16	-2.4	19	-0.6
Chile	9	3.5	9	2.6	3	4.4	11	-0.3	5	3.4	4	1.1	4	3.2
Hungary	10	3.4	20	-2.1	20	-7.2	21	-1.4	19	-2.4	14	-1.3	18	-0.2
Malaysia	11	3.4	8	3.1	7	0.3	4	1.9	9	1.7	8	-0.8	12	1.3
South Africa	12	2.7	15	0.0	17	-2.7	15	-0.7	12	1.3	13	-1.3	7	2.1
Indonesia	13	2.7	6	3.3	6	0.5	6	1.0	7	2.0	3	2.0	13	1.2
Thailand	14	2.6	7	3.2	9	-0.5	5	1.4	6	2.9	2	4.9	10	1.6
Colombia	15	1.5	10	1.9	5	0.7	13	-0.5	11	1.5	6	0.5	16	0.5
Korea	16	0.9	11	1.2	15	-1.7	9	0.2	10	1.6	9	-0.8	11	1.5
India	17	0.7	14	0.4	8	-0.3	8	0.3	14	0.2	19	-3.9	6	2.3
China	18	0.6	19	-1.6	19	-4.8	12	-0.4	17	-1.1	18	-2.7	17	0.3
Poland	19	-4.1	13	0.4	12	-1.4	16	-0.7	15	-0.4	17	-2.4	15	0.5
Venezuela	20	-6.8	18	-0.6	4	3.0	17	-0.8	13	0.5	5	0.9	14	0.6
Turkey	21	-7.1	21	-3.1	13	-1.6	19	-1.3	21	-3.6	20	-4.0	20	-0.7
Spearman correlation			0.644		0.053		0.401		0.518		0.227		0.530	
P-value			0.002		0.819		0.071		0.016		0.322		0.014	
R^2			0.663		0.052		0.464		0.611		0.102		0.544	

Note: R2 is obtained from a regression of predicted on actual values of EMP.

6 Conclusions

This paper has argued that the main reason for the poor performance of standard models of currency crises lies in their neglect of the role of contagion – the fact that crises may be transmitted across countries. A model was developed which allows a systematic comparison of weak fundamentals, contagion and sunspots as the causes for crises. The empirical analysis found compelling evidence that the Latin American crisis of 1994-95 and the Asian crisis of 1997-98 were indeed contagious, spreading across countries which were not only vulnerable economically but which were closely linked financially. The model performs remarkably well out-of-sample in predicting the Asian and Latin American crises. The implication is that the single most powerful factor in predicting which countries would be affected most severely by a crisis is the degree of financial interdependence and real integration across economies.

Three different types of policy proposals have emerged in recent years with the aim of preventing and resolving future currency crises. The first one, pursued by the IMF among others, has been to improve transparency with the idea of providing investors with better information about fundamentals. The rationale of this approach is to prevent investors from making decisions based on faulty beliefs or uncertainty about fundamentals, and thus to reduce the scope for investors' expectations to become self-fulfilling. The problem with this approach is that it ignores that crises can spread across countries even if these have sustainable fundamentals and investors are aware of this.

In response to this shortcoming, a second type of proposal is one that aims at making open economies less open in order to lessen the transmission of external shocks by, for instance, putting "sand in the wheels" of international finance (e.g. Eichengreen et al. 1995). This approach has lost appeal as most governments have come to realize that capital controls imposed by individual countries can either be circumvented easily or may lead to a stop of foreign investment altogether. As a result, only a few countries have recently dared to impose controls while others, such as Chile, have abandoned them completely.

The global community, however, has so far chosen a third way, following neither of the first two approaches and effectively leaving regulation to the markets. Some emerging markets, therefore, have turned to regional initiatives, such as the recently increased regional economic cooperation in Southeast Asia, though it is unlikely that such regional cooperation is sufficient to prevent future crises.

The central lesson from the findings of this paper is that no open emerging market, even one with relatively sound fundamentals and policies, is capable of insulating itself from events in the rest of the world. The powerful role of contagion suggests that effective crisis prevention and resolution requires a global, coordinated policy approach. Current proposals include the creation of a global lender of last resort, contingency funds and "debtor-in-possession financing" (e.g. Radelet and Sachs 1999), but so far have been ignored. Given a lack of political will and the waning urgency due to the strong recovery in Asia in 1999, it will probably take another round of financial crises until policymakers become serious about implementing a global policy approach for more effective crisis prevention and resolution.

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Appendix: Data Definitions and Sources

Country Sample

The 24 countries of the sample are: Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Peru, Venezuela; China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand; Czech Republic, Hungary, Jordan, Poland, Russia, South Africa, Turkey.

Fundamentals

The set of fundamentals covers a fairly wide range of variables, many of which have been mentioned in the academic literature as potential culprits for some currency crisis or another. Kaminsky, Lizondo, and Reinhart (1997) provide a comprehensive review of empirical work on currency crises and emphasize the lack of empirical consensus on what may cause crises. The empirical analysis above started from a broad approach to avoid ignoring potentially powerful factors in the analysis:

- foreign debt: total foreign debt/GDP, total short-term debt/GDP, and short-term debt/total foreign debt. Source: *IMF/WB/OECD/BIS* joint publication.
- capital inflows: total capital inflows/GDP, short-capital inflows/GDP and short-term to total capital inflows. Source: *IMF*.
- trade balance: (exports+imports)/GDP and current account. Source: *IMF*.
- overvaluation of exchange rate: real effective exchange rate (REER) relative to 1990, and the change in REER during the prior one or two years.
  Source: *JP Morgan*.
- foreign exchange reserves: ratio of total foreign exchange reserves to either M2 or to imports. Source: *IMF*.
- lending boom: rate of credit expansion to the private sector relative to GDP.
  Source: *IMF*.
- government deficit/GDP and government debt/GDP. Source: *IMF*.
- changes in interest rates and growth rates in industrial countries. Source: *IMF*.
- US$ exchange rate changes to Japanese yen and German mark. Source: *IMF*.

Exogenous Variables

- Exchange Rate Credibility (CRED): definition in text. Source: *Financial Times Currency Forecaster* data of exchange rate predictions by traders and forecasting agencies; various issues of *IMF Annual Report on Exchange Arrangements and Exchange Restrictions* for exchange rate commitments. The FT prediction data is

available for a sufficiently long time span only for the following 15 countries: Argentina, Brazil, Chile, Colombia, Mexico, Venezuela; India, Indonesia, Korea, Malaysia, Philippines, Thailand; Hungary, Poland, South Africa.

- Exchange Market Pressure (EMP): definition in text. Source: *IMF* and national central banks.

Contagion Variables

- Real Integration Contagion: definition in text. Source: *World Trade Analyzer* (1989-97); commodities measured at the 3-digit SITC level, excluding agriculture and natural resources.
- Financial Integration Contagion: definition in text. Source: *Datastream/Reuters* and *IMF*.

The Volatility of Capital Flows to Emerging Markets and Financial Services Trade

Roland Beck[1]

Abstract

This paper examines empirically the question whether the presence of foreign banks and a liberal trade regime with regard to financial services can contribute to a stabilization of capital flows to emerging markets. Since foreign banks, so the argument goes, provide better information to foreign investors and increase transparency, the danger of herding is reduced.

Previous findings by Kono and Schuknecht (1998) confirmed empirically that such an effect does exist. This study expands their data set with respect to the length of the time period and the number of countries. Contrary to Kono and Schuknecht, it is found that foreign bank penetration tends to rather increase the volatility of capital flows. The trade regime variables are not significant in explaining cross-country variations in the volatility of capital flows. This result does not change significantly when alternative measures of volatility are considered.

JEL Classification Numbers: F13, F30, G20

Key words: Financial Services Trade, Capital Flows

1 Introduction

It is often claimed, with regard to the emerging market financial crisis in 1997/1998, that a lack of transparency contributed to an incorrect risk assessment in emerging markets. According to this view, the large capital inflows in the 1990s were based in part on an overly optimistic perception of investment opportunities, especially in Asia. The International Monetary Fund (1999a, p. 63) points out that a dramatic reassessment of risk in emerging markets was a "cause and a symptom" of the crisis which resulted in reversing net capital flows. The observed volatility of capital flows to emerging markets, which many observers view as only somewhat linked to economic fundamentals, have stimulated a new discussion about the risks and benefits of financial liberalization. There are at least four distinct aspects of financial liberalization which might have different impacts on the stability of capital flows and financial stability in general: capital

1 Taunusanlage 6, 60329 Frankfurt/Main, Germany, email: beck@ifk-cfs.de. I thank Beatrice Weder, Ludger Schuknecht, Axel Weber and the participants of the conference on "Financial crisis in transition countries: recent lessons and problems yet to solve" on 13-14 July 2000 at the Halle Institute for Economic Research (IWH) and ZEI, especially my discussant Lukas Menkhoff, for valuable comments. All errors are mine.

account liberalization, liberalization of trade in financial services, domestic deregulation and the introduction of new financial instruments.

This paper focuses on the role of trade in financial services.[2] Following Tamirisa (1999, p. 4), *capital account liberalization* is defined as the access of residents to international financial markets and of non-residents to domestic financial markets. *Trade in financial services* is defined as the provision of financial services, such as retail and wholesale banking, securities trading and portfolio management, in exchange for fees across borders. This means that residents may use financial services of foreign financial institutions and that domestic financial institutions may provide financial services to non-residents. These two aspects of financial liberalization are distinct, but somewhat related: If financial services are provided "cross-border", capital inflows or outflows are necessarily associated.[3] On the other hand, if the services are supplied by a subsidiary or a local branch of the foreign bank, capital in- or outflows do not have to coincide. In that case, only the foreign direct investment to set up the local presence is a direct consequence of financial services trade. Since commitments towards financial services trade can be made in principle independently from any commitment to capital account liberalization, it does make sense to study the effect of financial services trade separately.[4]

An analysis of the specific effect of opening up financial services markets to foreign competition can provide useful guidelines for the policy stance of emerging market economies towards the upcoming negotiations on a further liberalization of trade in financial services at the World Trade Organization (WTO). Despite the failure to launch a new comprehensive round of trade negotiations in December 1999, services are on the built-in agenda of the Uruguay-Round.

A useful starting point is the paper of Kono and Schuknecht (1998), hereafter KS, who have argued that financial services trade liberalization, which allows the use of a broad array of financial instruments and the presence of foreign banks, contributes to more stable capital flows to emerging markets. It is indeed remarkable that most of the Asian countries which were severely hit by the crisis had fairly restrictive and distortionary regimes with regard to trade in financial services. Alba, Bhattacharya, Claessens, Gosh, and Hernandez (1999, p. 49) point out that the limited role of foreign banks in Asia inhibited institutional development. Other countries, such as Argentina, have adopted more liberal regimes, and there is some evidence that foreign banks played a stabilizing role in these countries.[5]

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2 For a survey on theoretical and empirical work on capital account liberalization, see *Eichengreen* and *Mussa* (1998). For the impact of domestic deregulation in the financial services sector on financial stability, see *Demirguc-Kunt* and *Detragiache* (1998). For an empirical investigation of the impact of the introduction of new financial instruments, see *Jochum/Kodres* (1998).

3 "Cross-border" refers to a so-called mode of supply where the foreign supplier does not penetrate the home country. See Appendix A.1.1 for details.

4 Under the General Agreement on Trade in Services, capital flows have to be liberalized only for cross-border supply, otherwise these commitments would be useless. For commitments allowing commercial presence, only the foreign direct investment necessary to install the presence has to be liberalized.

5 *Goldberg, Dages,* and *Kinney* (2000) find that foreign banks in Argentina and Mexico contributed to a more rapid loan growth and a reduced volatility of overall banking sector loan growth.

In order to empirically test their hypothesis, KS developed various indices which measure the restrictiveness and the degree of distortion of the trade regime with regard to financial services. These are based on commitments within the General Agreement on Trade in Services (GATS).[6] In a sample of 26 emerging markets, including countries in Asia, Latin America, Eastern Europe and Africa, they find support for their hypothesis. In a cross-country regression of the standard deviation of annual net capital flows from 1991-1997 on financial services trade policy variables, macroeconomic and other regulatory variables, a liberal trade regime regarding financial services has a significant negative effect on the standard deviation of capital flows.

This paper argues that the theoretical case the argument brought forward is rather ambiguous and extends the existing evidence in various ways: it is asserted that the appropriate figure to consider is the volatility of *total* net capital flows, and not of different components. The time period for the data on capital flows is expanded to include the second crisis year of 1998 which adds considerably to the overall variability of capital flows in the 1990s. Moreover, the data set is expanded to a total of 54 emerging and developing countries. Finally, it is tested whether the results are robust to alternative measures of volatility and to alternative measures for trade in financial services: foreign bank penetration and the trade regime with regard to financial services as suggested by KS.

Contrary to the findings by KS, it is found that foreign bank penetration tends to rather increase the volatility of capital flows. The trade regime variables are not significant in explaining cross-country variations in the volatility of capital flows.

The remainder of the paper is organized as follows. Section 2 reviews the arguments made in favor and against financial services trade and foreign bank penetration. Section 3 discusses methodological issues and the selection of appropriate independent and dependent variables. In section 4 the results of benchmark regressions are presented. Section 5 tests whether the results are robust to alternative specifications of volatility. Section 6 concludes.

2 The debate in the literature

The case for and against financial services trade is discussed controversially among policy makers and in the academic literature.[7] The effects are likely to depend on how the foreign services are supplied, i.e. through a local presence or through cross-border supply.

On the one hand, it is often argued that the financial services trade leads to traditional gains from trade, i.e. more competition, and thus to more efficiency in the banking sector with more services at lower prices. Secondly, financial services trade brings about a transfer of know-how, technology and skills such as proper credit risk management practices. Thirdly, it can raise pressure on local authorities to provide a better institutional framework with regard to the supervision of banks and disclosure standards. Finally, the home

6 See Appendix A.1.1 for a brief description of financial services liberalization within the GATS.

7 For a survey of the arguments, see T*amirisa, Sorsa, Bannister, McDonald,* and *Wieczorek* (2000).

head offices of foreign banks can serve as a credible lender of last resort in a crisis situation. The positive effects on financial sector development are also likely to enhance growth.8 These effects are likely to take place if the services are provided through a local presence of foreign banks. A pro-competitive effect through cross-border supply will be more limited because proximity to the client is still relevant in financial services. The positive effects through know-how transfer and institutional pressures can hardly be expected for cross-border supply. With regard to the stability of capital flows, KS argue that financial services trade liberalization, which allows the use of a broad array of financial instruments and the presence of foreign banks, can contribute to more stable capital flows. One channel pointed out by KS (p. 10) works as follows. Foreign financial institutions in emerging markets can compile better information about the creditworthiness of borrowers if they have a local presence. This facilitates proper risk assessment by international investors who are, in turn, less likely to engage in herding behavior.9 The pressure on local authorities to provide a better institutional framework which, in turn, leads to more transparency, works in the same direction. Recently, however, Morris and Shin (1999) showed theoretically that more information does not necessarily reduce market volatility if a strategic coordination problem among investors is at work.

The theoretical case for a stability-enhancing effect of financial services trade gets even weaker if one considers that the entry of foreign banks can be harmful by itself if they start operating in a weak local banking system. Eichengreen and Mussa (1998, p. 21 and p. 27) stress that in such a situation foreign competition can provoke a banking crisis because lower margins for domestic banks can make them more vulnerable to loan losses. They call financial services trade liberalization in a weak domestic banking system a "delicate matter". Domestic banks might respond to increased competition by taking excessive risks. Moreover, there might be the danger that foreign banks promote capital flight, and that they rapidly withdraw from local markets during a financial crisis. Kaminsky and Reinhart (1999) have stressed that in such a situation, foreign banks may worsen financial distress by calling in loans and cancel credit lines to domestic financial institutions. This would have rather a destabilizing effect on the volatility of capital flows. Since financial services trade liberalization often coincidences with other policy measures of deregulation, it is also necessary to keep the findings by Demirguc-Kunt and Detragriache (1998) in mind. They find that financial liberalization, measured by the deregulation of bank interest rates, which takes place in a weak institutional environment, makes banking crises more likely. Finally, it is sometimes argued that foreign banks dominate the most the most profitable market segments leaving domestic banks

8 *Claessens, Demirguc-Kunt*, and *Huizinga* (1998) provide extensive empirical evidence that foreign bank entry tends to improve efficiency in domestic banking markets. For the argument related to institutional capacity building, see *Demirguc-Kunt* and *Detragiache* (1998), *KS*, and *Eichengreen* and *Mussa* (1998, p. 27). On the role of foreign banks as a lender of last resort, see *KS* (p. 12). For evidence on positive growth effects of financial sector development, see *King* and *Levine* (1993).

9 Herding in financial markets can be rational for various reasons. For a survey on theoretical foundations of herding behavior, see *Devenow* and *Welch* (1996). Recently, *Calvo* and *Mendoza* (1999) have shown that in a growing global securities market, there might be little incentives for all investors to gather costly country-specific information and herding, i.e. imitating an arbitrary market portfolio, can be the outcome of optimal portfolio decisions.

with the more risky project's, and thus making the domestic financial system more vulnerable to financial crises.

The controversial arguments in favor and against free financial services trade, in particular with regard to its effect on the stability of capital flows have lead many to conclude that this effect is ambiguous.[10]

3 Methodology and data

This paper expands one type of empirical analysis carried out by KS. In a cross-country regression of a volatility measure of net capital flows on financial services trade variables, macroeconomic and other regulatory variables, it is tested whether financial services trade variables tend to reduce the volatility of capital flows.[11]

KS also suggest a regression of the level of net capital flows on these variables. In their sample, "other investment" (mainly bank lending), measured by the standard deviation, is more volatile than portfolio investment, and portfolio investment is more volatile than foreign direct investment. Consequently, they argue, if financial services trade variables tend to raise the level of a specific type of capital flow relative to other flows, say portfolio investment relative to other investment, this can be called a stability-promoting property. This approach is not pursued here because it is not clear whether such an inference about stability is justified. While it is true that "other investment" has historically been the most volatile component of capital flows, there is no evidence that the composition of capital flows has a systematic effect on the volatility of total net capital flows. The International Monetary Fund (1999a, p. 65) stresses that even increases in foreign direct investment flows, by all measures the most stable component of capital flows, does not automatically lead to more stable net foreign financing.

3.1 The dependent variable

The question of how to measure the volatility of capital flows is not a trivial one. KS suggest to compute the standard deviation of various types of net capital flows as a share of GDP. Two problems arise with this approach.

Firstly, instead of examining the determinants of volatility for each type of capital flows separately, *total* net capital flows are considered here. Claessens, Dooley, and Warner (1995) have pointed out that the question about volatility is motivated by the concern of policy makers about sudden reversals in the total capital account and not just in some

10 See Tamirisa, Sorsa, Bannister, McDonald, and Wieczorek (2000, p. 12).

11 From a macroeconomic standpoint, it could be argued that it makes little sense to analyze capital flows in isolation from the current account. However, attempts to develop a full structural model of capital flows which identifies the shocks that lead to changes in the current account turned out to be difficult and there are reasons to assume that especially portfolio flows are rather exogenous from the standpoint of the emerging market economy. See *Claessens, Dooley* and *Warner* (1995, p. 155) for more details about this argument and the references given there.

particular flow. They show for numerous countries that there is a high degree of substitution between various capital flows. Moreover, they find that movements in the overall capital account are little influenced by movements of specific components. Movements of one type of flow can be offset by another type of flow. Hence, it can be misleading to look at movements of one particular flow. There is no variable in the regressions which explains shifts from one type of capital flow to another. The financial services trade variables are supposed to reflect rather a more general uncertainty about investment opportunities which should be reflected in an increased volatility of the aggregate of foreign direct investment, portfolio, and other investment flows.

Secondly, the coefficient of variation, computed for absolute net capital flows is used as the volatility measure in the benchmark regression of this paper. Although it is common to compare net capital flows across countries by looking at the share in GDP of these flows, such a measure might be misleading if we want to explain different volatility's across countries. If a country experiences a sharp recession during a financial crisis, the scale of outflows looks more dramatic than if the recession had been less severe. This effect will also be reflected in a higher volatility. The explanatory variables used here offer no explanation of GDP contraction during a crisis.

3.2 Independent variables

3.2.1 Financial services trade variables

The most straightforward variable to measure the openness of the financial sector is simply foreign bank penetration. Notice that this measure relates to a supply through a local presence, and hence more stability-enhancing effects should be expected from this variable. The following two variables are included in the regressions in order to test whether a direct link of foreign bank penetration and the volatility of capital flows exists:

Share of foreign banks (number) equals the number of foreign banks in total banks.

*Share of foreign banks (assets)*equals the share of foreign bank assets in total banking sector assets.

However, the role that foreign banks play for the stability of capital flows might be a more complex process which requires more subtle regulatory measures, especially if one wants to capture the claim that commercial presence tends to be more stability-enhancing than cross-border supply. The following three indices developed by KS assess specific distortions and biases in the trade regime which are likely to contribute to capital flow volatility. This paper uses the assessments by KS, but adds more countries to the sample which have been classified in a similar way.

Bias towards cross-border supply is an indicator (see Appendix A.1.2 for details) which measures to what extent the financial services trade regime favors cross-border supply relative to commercial presence. The desired effects on improved transparency and a diffusion of skills in risk management occur presumably only if foreign banks have a local presence. While cross-border supply generates pro-competitive effects as well, it

does not contribute to more stable capital flows. Since the stability-enhancing properties of financial services trade only occur if banks establish a local presence, we would expect that a bias towards cross-border supply increases the volatility of capital flows, i.e. a positive sign of coefficient is expected.

Bias towards bank lending indicates whether the trade regime favors classical bank lending/depositing services as opposed to securities-related services (see Appendix A.1.2 for details). If foreign banks are allowed to offer a broad spectrum of financial instruments, they are likely to contribute to the development of bond and stock markets. KS (p.13) claim that these, in turn, can increase transparency because they reduce information asymmetries. Stock prices and bond ratings should reflect all available information about a firm's soundness.[12] Moreover, securities markets usually require higher standards of disclosure. Absent capital market finance also leads to an exclusive reliance on bank lending which has historically been the most volatile component of capital flows. Thus, a bias towards bank lending would lead to an increase of volatility, i.e. a positive sign of coefficient is expected.

Restrictions on foreign banks measures the extent to which activities of foreign banks are limited by discriminatory regulation. KS focus on four restrictions which are likely to offset the stability-enhancing effects of commercial presence of foreign banks. These are

– limits on equity participation in domestic financial institutions,

– limits on raising domestic financing,

– limits on the establishment of a branch network, and

– limits on the issuance of new bank licenses.

Limited equity participation can undermine foreign banks' ability to exercise corporate control on domestic banks which would make them more transparent. When foreign banks cannot raise domestic funding, they have to rely on international capital markets. The induced capital flows might be volatile if this fund raising coincidences with a lack of transparency. If foreign banks are not allowed to set up a branch network, they are deprived from engaging in retail banking. Since wholesale business tends to be more volatile than retail business, this can contribute to an increased volatility. The lack of a domestic depositor base leads to capital inflows which can if there is a lack of transparency, exhibit high volatility. Limits on the issuance of new bank licenses lowers the scope of commercial presence in general. KS construct an index for these four restrictions (see Appendix A.1.2 for details). More restrictions on foreign banks of this type will increase the volatility of capital flows, i.e. a positive sign of coefficient is expected.

12 This is the case if capital markets are efficient. This hypothesis was subject to a long debate. If investor behavior is rather characterized by imitative strategies, bubbles can occur and market prices can substantially deviate from fundamentals. See e.g. *Shiller* (1992).

3.2.2 Macroeconomic and other regulatory Variables

The *average inflation rate* is included because high inflation rates are related to macroeconomic instability. It is correlated with large movements in interest rates and the exchange rate. In order to achieve a parsimonious parameterization, this is the only macroeconomic variable that enters the regressions. Logarithms are taken in order avoid a too big weight of the periods of hyperinflation in Latin America in the beginning of the 1990s.

Economic freedom is an index published regularly by Johnson, Holmes, and Kirkpatrick (1999). The greater the score, the greater the level of government interference in the economy. Government interference, such as explicit or implicit guarantees, should decrease market transparency and thus increase the volatility of capital flows, i.e. a positive sign of coefficient is expected.

Rule of law is an index which measures to which extent the law is respected in a country. Stronger institutions, in particular with regard to the enforcement of property rights are likely to reduce the volatility of capital flows.

Since the regulatory variables considered here do not vary much over time, indices which were compiled once are used as proxies for the whole time period of 1990-98.

3.3 The sample of countries and descriptive statistics

In order to ensure proper econometric regressions which do not suffer from a small sample bias, a large number of observations is clearly desirable. Therefore, no a priori selection of countries has been done. The sample size is determined only by data availability. All emerging markets for which data on foreign bank penetration, the financial services trade regime, and the indices of economic freedom and the rule of law are available have been included in the sample. For a total of 56 countries, data on foreign bank penetration and the macroeconomic and regulatory variables are available (see Table 1).

Since not all countries have signed the GATS agreement on financial services, the total number of countries which have data on the financial services trade regime is only 36.[13] A list of these two groups of countries can be found in Appendix A.3. Note that group 2 is almost a prefect subset of group 1.

13 For six more countries, GATS commitments are only available in Spanish. These countries are not included in the sample.

Table 1:
Data availability for two groups of variables

Variable	
Foreign banks (assets)	Bias towards cross-border supply
Foreign banks (number)	Bias towards bank lending
	Restrictions on foreign banks
Economic Freedom	Economic Freedom
Rule of Law	Rule of Law
Inflation	Inflation
Total net capital flows	Total net capital flows
56 countries (group 1)	36 countries (group 2)

Table 2 and 3 show some descriptive statistics for the two groups of countries. The variable names are assigned as follows:

Level: Time average (1990-98) of total net capital flows in millions of U.S. dollars;

Share: Time average (1990-98) of total net capital flows as a share in GDP in percent;

CV: Absolute value of the coefficient of variation of (absolute) total net capital flows;

Fora: Average share of foreign banks (assets) (1990-97), in percent;

Forn: Average share of foreign banks (number) (1990-97), in percent;

Bias1: Bias towards cross-border supply, index;

Bias2: Bias towards bank lending, index;

Restrict: Restrictions on foreign banks, index;

EF: Economic Freedom, index;

Rule: Rule of Law, index;

Infl: Log of average inflation (1990-98).

Table 2:
Descriptive Statistics Group 1, 56 observations

	Level	Share	CV	For a	Forn	EF	Rule	Infl
Mean	1791.6	1,61	2,31	0,28	0,32	2,96	3,31	2,88
S.d.	4886.7	5,15	3,78	0,21	0,13	0,54	1,06	1,54
Min	-14854.8	-21,83	0,32	0,01	0,08	1,30	1,25	0,06
Max	21096,7	18,22	20,56	0,85	0,67	4,05	5,25	7,31

Table 3:
Descriptive Statistics Group 2, 36 observations

	Level	Share	CV	Restrict	Bias1	Bias2	EF	Rule	Infl
Mean	3121,9	2,68	2,15	1,89	-0,67	1,17	2,83	3,63	2,82
S.d.	5113,3	3,64	3,47	1,38	0,83	1,54	0,55	1,14	1,44
Min	-3444,9	-8,32	0,33	0,00	-2,00	0,00	1,30	1,25	0,06
Max	21096,7	8,82	19,32	4,00	1,00	4,00	3,80	6,00	6,84

4 Results of the benchmark regressions

Table 4 shows the results of the benchmark regressions. The dependent variable is the coefficient of variation of total net capital flows. Five regressions are run in order to test separately which of the financial services trade variables tend to affect the coefficient of variation. In all five regressions, it is controlled for the same macroeconomic and regulatory variables.[14]

Five key observations can be drawn from these regressions:

1. The explanatory power of the regressions is very low. The adjusted R^2 is below 20% for all of the regressions. The explanatory power of the foreign bank penetration variables is higher than the one of the trade regime variables.

2. Foreign bank penetration tends to *increase* the volatility of capital flows. Here, the market share of foreign banks matters. While the share of foreign banks' assets in total assets is significant at the 5% level, the share in the total number of banks is not significant at the 10% level.

3. The trade regime variables are not significant in explaining cross-country differences in the volatility of capital flows. The *t*-Statistics for all three of these variables are far below common levels of significance.

4. Inflation is also not significant in explaining the differences in volatility's.

5. The degree to which the law is respected in a country does reduce the volatility of capital flows. The variable is significant at the 5% level or better in all five regressions. Economic Freedom, however, is not significant in any of the specifications.

The fact that foreign bank penetration increases the volatility of capital flows indicates that the concerns about foreign competition, in particular in a weak domestic banking

14 Two outliers with an extremely high coefficient of variation have been eliminated from group 1, one outlier from group 2.

system might be justified.[15] The finding that the trade regime variables are not significant raises doubts whether the stability-enhancing effects described above take place automatically and whether they offset the possibly negative impact on financial stability. They could also indicate that coordination problems which are not necessarily amended by better information are at the root of the volatility of capital flows.

Table 4:
Determinants of volatility measured by the Coefficient of Variation; Coefficients and (*t*-Statistics) of OLS estimates; *,**,*** : significant at the 10, 5, 1% level

Independent variables	Dependent Variable: Volatility of total net capital flows (Coefficient of Variation)				
Foreign banks (assets)	2.11 (2.2)**				
Foreign banks (number)		2.29 (1.54)			
Bias cross border supply			0.12 (0.33)		
Bias bank lending				0.13 (0.63)	
Restrictions on foreign banks					0.12 (0.57)
Inflation (log)	-0.04 (-0.30)	-0.09 (-0.59)	-0.12 (-0.46)	-0.1 (-0.41)	-0.11 (-0.45)
Economic Freedom	-0.05 (-0.23)	-0.06 (-0.23)	0.06 (0.18)	0.03 (0.09)	-0.02 (-0.06)
Rule of Law	0.42 (2.82)***	0.42 (2.65)**	0.52 (2.62)**	0.48 (2.32)**	0.5 (2.53)**
Observations	54	54	35	35	35
R^2	0.21	0.17	0.13	0.14	0.13
Adjusted R^2	0.16	0.12	0.04	0.05	0.05

However, it is important to keep in mind that GATS commitments are only a very crude measure of actual trade policies pursued. Moreover, only countries which made liberalization commitments are included in the sample. With only 36 observations, these results should be treated with a little caution.

15 It could also indicate that foreign presence in many countries is rather due to historical factors than to a liberal trade regime. *KS* (p. 30) have stressed that in these cases foreign presence in otherwise closed financial systems without the possibility of new entry is not very likely to generate any stability-enhancing effects. However, this argument is not compelling because no evidence of any stability-enhancing effects of the trade regime are found here.

The poor performance of the only macroeconomic variable that is included in the regressions, inflation, suggests that for long-run average figures, the regulatory environment matters more than macroeconomic factors.

Finally, it seems what matters most for differences in volatility is respect for the law. Surprisingly, however, government involvement in the economy does not increase the volatility of capital flows. Crony capitalism with explicit and implicit state guarantees that directed resources into non-profitable project's might have contributed to the financial crisis in some Asian countries, but there is no evidence of a broader relationship of economic freedom and the volatility of capital flows.

5 Robustness to alternative specifications

In order to make the results of this paper comparable to the findings by KS, the standard deviation of the respective shares in GDP are also used as dependent variable. Moreover, the number of sign changes is considered as an alternative measure of volatility. It counts every switch from a positive to negative value as one, i.e. it counts episodes of changes of directions of capital flows which usually coincidence with the beginning of a financial crisis or the start of (over-)optimism after a period of net outflows. Appendix A.4 contains the results of the regressions which have the same independent variables as the benchmark regressions.

If the standard deviation of shares in GDP is used as a dependent variable, only observation 2 of the benchmark regression has to be modified. All other observations are robust to this change in specification. Foreign bank penetration does not significantly influence the volatility of capital flows. This is true for both measures. The rule of law variable is even significant at the 1% level.

The same is true for regressions where the number of sign changes is the dependent variable. The *t*-Statistics of the coefficients of foreign bank penetration, however, are very close to the critical value of the 10% level of significance.

6 Conclusion

This paper has examined empirically the relation between the volatility of capital flows, foreign bank penetration and a liberal trade regime with regard to financial services. It was argued that such a relationship should be tested for total net capital flows, and not for specific components. It was found some evidence for foreign bank penetration to rather *increase* the volatility of capital flows. However, this result is not robust to alternative specifications of volatility. No evidence for any significant influence of the trade regime with regard to financial services was found. This could indicate that the volatility of capital flows to emerging markets was not primarily caused by a lack of transparency and information.

Nevertheless, regarding the policy stance of emerging markets towards a further liberalization of trade in financial services, it should be kept in mind that the efficiency losses

from a closed financial sector are possibly large.[16] In order minimize the risks, liberalization should only take place in an appropriate institutional environment such an efficient bank supervision and proper disclosure standards. A transparent licensing process should ensure that only sound foreign banks enter the domestic market. There might be the case for solving problems of non-performing loans prior to liberalization. However, foreign banks could also be helpful in this process if they participate in mergers and privatization. With regard to the liberalization of cross-border supply even more caution is needed since it necessarily involves capital flows. It should only take place as part of a coherent, well-sequenced liberalization strategy within a consistent macroeconomic framework and exchange rate regime. Free cross-border supply does not in general preclude the introduction of temporary capital controls. These policies have probably not been pursued in the past. Therefore, in some countries, financial liberalization did indeed coincidence with financial crises. This might be an additional reason why stability-enhancing effects are difficult to find empirically.

Further research should include in cross-country regressions additional variables which measure specifically more aspects of financial liberalization and other macroeconomic variables which are used in the prediction literature on currency crises. Moreover, a panel data analysis where observations of changes in capital flows are the dependent variable would be probably fruitful because dynamic interactions could be examined. Such an analysis would be especially interesting if data on financial liberalization in time were available.

16 Some of these recommendations draw on *Tamirisa, Sorsa, Bannister, McDonald*, and *Wieczorek* (2000).

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Appendix

A.1 Financial services trade regime variables

A.1.1 Financial services liberalization in the GATS

Financial services were integrated into the GATS framework in December 1997. After difficult negotiations, the financial services agreement (FSA) was signed by 102 WTO members. The commitments came into force in March 1999. However, most of the FSA is a formalization of the status quo.[17] Therefore, KS use the FSA commitments, as proxies for actual policies in the 1990s.

The GATS distinguishes four modes of supply (see Table 5). Differential commitments across different modes of supply are allowed.

Table 5:
Modes of supply in the GATS

Mode 1	Cross-border Supply
Mode 2	Consumption Abroad
Mode 3	Commercial Presence
Mode 4	Presence of Natural Persons

Cross-border supply and commercial presence are the two most relevant modes of supply of financial services. Whereas the first refers to a service which is provided without the foreign bank entering the country, e.g. by telephone or on-line, the second takes place if the service is provided by a the domestic subsidiary or branch of a foreign bank.

A.1.2 The KS Indicators of the financial services trade regime

Bias towards cross-border supply: The index reflects the relative level of commitments under mode 1 and mode 3 (see Table 6).

Table 6:
Assigned scores for the bias towards cross-border supply

	Mode 1	Mode 2
No commitment	0	0
Partial liberalization	1	-1
Full liberalization	2	-2

17 See *Dobson* and *Jacquet* (1998, p. 2) and *KS*.

The bias index is the sum of the two columns. It ranges from -2 to 2 where -2 means no commitments in mode 1, full liberalization in mode 3 while an index value of 2 means just the opposite: no commitments under mode 3, full liberalization of mode 1. The lower the index, the more stability-enhancing the trade regime.

Bias towards bank lending: This index assigns a higher score to the trade regime if the commitments are biased towards bank lending relative to capital market finance. The more severe the bias, the higher the score (see Table 7).

Table 7:
Assigned Scores for the lending bias

Equal commitments or bias towards securities	0
Weak bias for bank lending	2
Strong bias for bank lending	4

Restrictions on foreign banks: The index counts the number of the described four restrictions and ranges therefore from 0 to 4.

A.2 Data sources and computational remarks

Annual capital flow data for the sample countries are obtained in U.S. dollars for the time period of 1990-1998. The IFS distinguishes three types of capital flows: foreign direct investment (FDI), portfolio investment and other investment. Net flows are calculated by netting the respective assets and liabilities. The sum of all three types of net flows is called total net capital flows, the IFS refer to this figure as the financial account. As is explained above, this is the aggregated variable which will be considered here. The coefficient of variation is computed as the absolute value of the standard deviation divided by the mean.

Inflation is the average from 1990-98 of the year-on-year percentage change in the consumer price index.

Annual data on the share of foreign banks in the total number and total assets of the domestic financial sector are obtained from the Database on Financial Development and Structure, which was recently published by the World Bank.[18] A bank is defined as foreign if at least 50% of the equity is owned by foreigners.

See Table 8 for a complete list of data sources.

18 See *Beck, Demirguc-Kunt* and *Levine* (1999) for a description of the database.

Table 8:
Data sources

	Source	Published by
Total net capital flows	IFS, line 78bjd	IMF (1999b)
Inflation	IFS, line 64	IMF (1999b)
GDP in U.S. dollars	WEO database	IMF (1999c)
Foreign banks assets/number	World Bank database	Beck et al. (1999)
Index of Economic Freedom		Johnson et al. (1999)
GATS commitments	GATS schedules, KS	WTO (1998), KS

A.3 List of countries

Group 1

Argentina
Bahamas
Bahrain
Bangladesh
Bolivia
Botswana
Brazil
Bulgaria
Cameroon
Chile
China, P.R.
Colombia
Congo, Republic of
Costa Rica
Cyprus
Czech Republic
Dominican Republic
Ecuador
Egypt
El Salvador
Guatemala
Guyana
Honduras
Hungary
India
Indonesia
Kenya
Korea
Madagascar
Malaysia
Mali
Mexico
Morocco
Namibia
Nicaragua
Nigeria
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Romania
Russia
Senegal
Sierra Leone
Singapore
South Africa
Tanzania
Thailand
Tunisia
Turkey
Uganda
Uruguay
Venezuela

Group 2

Argentina	Honduras	Nigeria
Bahrain	Hungary	Pakistan
Bolivia	India	Philippines
Brazil	Indonesia	Poland
Bulgaria	Jamaica	Romania
Chile	Kenya	Senegal
China, P.R.	Korea	Singapore
Costa Rica	Malaysia	South Africa
Czech Republic	Malta	Sri Lanka
Ecuador	Mexico	Thailand
Egypt	Morocco	Turkey
Ghana	New Zealand	Venezuela

A.4 Further regression results

Table 9:
Determinants of volatility measured by the Standard Deviation of shares in GDP; Coefficients and (*t*-Statistics) of OLS estimates; *,**,*** : significant at the 10, 5, 1% level.

Independent variables	Dependent Variable: Volatility of total net capital flows (Standard Deviation of shares in GDP)				
Foreign banks (assets)	0.39 (0.28)				
Foreign banks (number)		1.33 (0.61)			
Bias cross border supply			0.28 (0.67)		
Bias bank lending				-0.09 (-0.34)	
Restrictions on foreign banks					-0.044 (-0.16)
Inflation (log)	0.12 (0.57)	0.11 (0.53)	0.07 (0.22)	0.03 (0.11)	0.04 (0.14)
Economic Freedom	0.10 (0.33)	0.05 (0.16)	0.09 (0.21)	0.09 (0.22)	0.10 (0.22)
Rule of Law	0.83 (3.9)***	0.8 (3.53)***	1.01 (3.98)***	0.99 (3.89)***	0.98 (3.88)***
Observations	49	49	32	32	32
R^2	0.11	0.12	0.19	0.18	0.18
Adjusted R^2	0.05	0.06	0.10	0.09	0.09

Table 10:
Determinants of volatility measured by the number of sign changes; Coefficients and (*t*-Statistics) of OLS estimates; *,**,*** : significant at the 10, 5, 1% level.

Independent variables	Dependent Variable: Volatility of total net capital flows (Standard Deviation of shares in GDP)				
Foreign banks (assets)	1.47 (1.63)				
Foreign banks (number)		1.65 (1.15)			
Bias cross border supply			0.36 (1.36)		
Bias bank lending				-0.15 (-0.93)	
Restrictions on foreign banks					0.03 (0.17)
Inflation (log)	0.08 (0.58)	0.05 (0.33)	0.06 (0.33)	0.01 (0.07)	0.04 (0.19)
Economic Freedom	0.04 (0.17)	0.05 (0.24)	0.15 (0.59)	0.17 (0.63)	0.11 (0.4)
Rule of Law	0.26 (1.85)*	0.24 (1.59)	0.3 (1.90)*	0.3 (1.88)*	0.27 (1.67)
Observations	49	49	32	32	32
R^2	0.15	0.13	0.18	0.15	0.12
Adjusted R^2	0.09	0.07	0.09	0.05	0.03

Alternative Exchange Rate Regimes for pre-EMU Integration: A Preliminary Estimation for Selected Accession Countries in Eastern Europe

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JEL Classifications: E52, E61, F02, P33.

Keywords: Euro, Enlargement, Exchange Rate Regimes, Monetary Policies, Mundell-Fleming Models.

Abstract

The main proposal behind this paper is to study the effects of different exchange rate regimes in individual transition economies in process of Accession towards the EU/EMU. The work is structured as follows: section I describe the set up of the current enlargement wave and the rationale for such a study, section II describes the proposed MF model, section III presents some preliminary estimation results for a specific set of transition economies. The paper ends with a conclusion.

1 Introduction: The Accession Process

The European Commission, according to the provision of the Article O of the Treaty of the European Union (TEU), launched, in March 31, 1998, official accession processes with Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia[2], through the mechanisms of the Accession Partnerships[3] (AP). According to the terms of a Luxembourg European Council decision, the pre-accession process and its related questions will be dealt via the APs and the respective National Programmes for the Adoption of the *Acquits* (NPAA), their counterparts at the accession-country level.

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2 Malta was only added to this list in October of 1998, when the Council accepted Malta's request to reactivate its candidature, which had been presented in 1990 but withdrawn following the change in government in the island after the general elections of 1996. A new government, elected in September of 1998, reverted this position.

3 See *European Commission*, 1998.

Substantive negotiations for Accession were opened on November 10, 1998, with Cyprus[4], the Czech Republic, Estonia, Hungary, Poland and Slovenia, the so-called "first wave" countries. This set of countries was selected on the basis of their level of fulfillment of the economic and political criteria set out by the European Council held in Copenhagen in July 1993[5] as benchmarks for future member countries. These 6 former "first wave" entrants would add over 63 million of inhabitants to the current Union's population (almost two thirds of them in Poland alone) and over 240 Billion Euro to its GDP (again, over half of this figure in Poland). That will mean, respectively, a 17% increase in the Union population, but a mere 3% increase in its GDP. The so-called "second wave" entrants (Bulgaria, Latvia, Lithuania, Malta, Romania and Slovakia) would add to these figures roughly other 57 million of people and 97 Billion of Euro (or a 15% increase in the population of the Union, but an even more marginal increase of 1.2% in its GDP). This, of course, reflects the lower level of development of the two biggest countries in this group, Bulgaria and Romania.

This division was, in practical terms, ended by a series of new EU Commission's recommendations, published in 13, October, 1999 (see European Commission, 1999(a)). In a wide-ranging modification of the EU accession procedures *and* foreign policy – approved by a European Council meeting, held in Finland, in December 1999, substantial negotiations for accession are now to be opened with *all* application countries in 2000. Turkey was also added to the Application Countries' list, but without any date for the opening of negotiations. The Balkans was also added to the list of countries for *eventual* future integration. A new framework of cooperation is also to be developed with all remaining EU-neighboring areas, from Eastern Europe to the Mediterranean Sea. The official opening of substantive negotiations for Accession with the new Accession Countries happened in 15 of February, 2000, in Brussels (actual talks are expected to start by mid-March of the same year), during the Portuguese presidency of the Union, for which Enlargement was chosen as one of the main priorities.

In number of countries, this will be the biggest wave of expansion of the Union since its birth in 1957, surpassing the North Sea Accession of 1973/74 (the Kingdom of Denmark, the Republic of Ireland and the United Kingdom), the Mediterranean Accession of 1982 (the Greek Republic), the Iberian Accession of 1986 (The Kingdom of Spain and the Portuguese Republic) and the Nordic-Central European Accession of 1995 (the Republic of Austria, the Republic of Finland and the Kingdom of Sweden). The complexity and duration of the related negotiation process could perhaps equal – and even surpass – the almost 10 year long negotiations of the Iberian accessions (see Vinhas de Souza, L., 1996),

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4 It must be noted that the specific political situation in Cyprus, namely, its division between a Greek Cypriot south and a Turkish-occupied north, casts doubts on the final outcome of the accession negotiations.

5 These criteria, know as "Copenhagen Criteria", are that the new entrants should present: "i) stable institutions, guarantees the rule of the law, human rights and the protection of minorities; ii) can be regarded as a functioning market economy able to cope with the competitive pressure and market forces within the Union in the medium term and iii) should be capable in the medium term of applying the *Acquits* provided it continues its efforts on its transposition and intensifies its works on its implementations". See *European Commission*, 1998.

at least for some of the countries. Such a prolonged pre-accession period is even more likely when one remembers that the comprehensiveness and extension of European legislation, and realms of integration which are included in the current negotiations, surpass by far the ones covered on all previous expansion waves.

In this negotiation process, there is one major institutional difference, among the many from the previous expansion waves, that shall concern us here: namely, that the new entrants cannot benefit from the use of "Opt-out" clauses, which were used by the United Kingdom and the Kingdom of Denmark for EMU (Economic and Monetary Union), and also by the UK for the Social Chapter. Therefore, the *Acquits Communautaire* is expected to be, in time, *taken in full* by all future new entrants, including, of course, EMU participation and all the requisite "Criteria". All future entrants are supposed to become, eventually but not immediately, members of the common currency area, which became a reality with the introduction of the Euro in 11 of the 15 European Union (EU) member states, in January 1999[6]. This is implicitly stated in the Amsterdam Treaty (AT), which declares that all future member countries "shall adhere to the goals of EMU", and explicitly indicated by the general commitments in the pre-accession agreements signed by the new entrants with the European Commission.

In its 1998 "Composite Paper", which presents an integrated analysis of the assessment performed in the applicant countries[7], the European Commission's phasing of EMU integration for future members envisage a three-phased process (see European Commission, 1998, ibid.). The first is a pre-accession phase, during which the accession states shall fulfill general EU membership criteria. The second is the accession stage *per se*, in which the states, already in the EU but outside the Euroarea, shall nevertheless (according the TEU) treat the "exchange policy as a matter of common interest" and eventually coordinate policy through a structure similar to the Exchange Rate Mechanism (ERM)[8]. The third and final phase is the actual Euro phase. This timing would implicitly exclude a simultaneous accession to the European Union[9] and to the common currency framework[10].

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6 The founding members of the Euro are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. The currently non-participating member-states are Denmark, Greece, Sweden and the United Kingdom.

7 The applicant states' overall progress towards accession is to be evaluated by periodic reports by the European Commission, according to a European Council decision in Luxembourg. The latest ones were also published in 13 of October 1999.

8 At this stage, the governors of the new member countries' Central Banks will also join, upon accession, their counterparts in General Council of the ECB, a non-voting body that encompasses all EU member-countries, regardless of their membership in the Euroarea. Actual ECB policy decisions are taken by its Governing Council, which encompasses the Governors of the CBs of the 11 member countries and the 6 members of the ECB board.

9 According to the EC (see *European Commission*, 1998), concerning the "first wave" countries future *EU accession*, "…the applicants' positions were based on the working hypothesis that *they would join the European Union on 1 January 2002 in the case of Hungary and on 1 January 2003 for the others*". No specific dates were set in the 1999 version (see *European Commission*, 1999(a), ibid.), but in a speech for the European Parliament, delivered on the same day that the new the reports were pub-

EU and EMU integration will undoubtedly have a strong effect on present and future macroeconomic policies of the Application Countries. In our proposed research, we will focus on the effects of two extreme types of exchange rate strategies: fixed and flexible exchange rates[11]. The two exchange rate regimes differ significantly in the transmission of monetary and fiscal policies and of macroeconomic disturbances[12]. Therefore, the choice of the exchange rate regime of will be of crucial importance for the effects of the integration process in these economies.

A fixed exchange rate inside the Euro framework is a substantial move from the current exchange rate policies of most of these countries (see Vinhas de Souza et al, 1999(b)). Nevertheless, a credible Euro peg could provide considerable long-term benefits (this is already happening, for some of the Application Countries). On the other hand, a peg, in the case of asymmetric shocks, is likely to imply considerable adjustment costs to the transition economy (see Vinhas de Souza et al, 1999(b), ibid.). Nevertheless, it must be realized that, as indicated above, either a fixed exchange rate regime or a flexible one must be seen as mere *transitional* systems (see Vinhas de Souza et al, 1999(b), Ibiden), since the Euro "fix" is the ultimate goal (or, using Lucjan Orlowski's happy expression, the final aim of the process is a "return-to-peg strategy": see Orlowski, 1998).

The proposal of this paper is to study the effects of some macro policies in individual transition economies in a process of accession towards the EU/EMU, namely the exchange rate strategy. To analyze the implications of a given policy choice a simple stylized model of a transition economy, described in the next section, is used. The model allows a simulation analysis, were the two different scenarios are tested and their outcomes then compared.

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lished, the current President of the European Commission, Romano Prodi, indicated his will to see some of the Application Countries inside the Union before the end of the term of the current Commission – i.e., before 2005 (see *European Commission*, 1999(b)).

10 This clarifies the statements in the "Agenda 2000" (see *EC*, 1997), which, in principle, do not seem to exclude a two-phased process, in which the entry in both the EU and the EMU could be simultaneous, and where no exchange rate coordination framework was actually specified. These statements were confirmed by the 1999 version of the "Composite Paper", which didn't introduced any substantial modifications concerning EMU (see *European Commission*, 1999(a), Ibiden).

11 As indicated by the Author in previous works (see *Vinhas de Souza*, 1999(a) and 1999(b), Ibiden), the current diverse pre-entry linkage strategies collapse to, in essence, a peg or a float. The inclusion of the peg as a "pre-entry" alternative in itself, i.e., separate from the ERM2, is also justified by the statements from some countries that use "hard pegs" in the CBA (currency board arrangement) fashion that they would contemplate the possibility of Euroarea entry without passing through the two year ERM "waiting period". This is not legally possible, given the current EU legal framework (see *Vinhas de Souza*, 1999(a) and 1999(b), Ibiden), but what will be feasible will be, of course – and in keeping with the time honored EU tradition, defined by the ongoing negotiation process.

12 For example, for a critic of the "creeping float" strategy of Poland (progressive widening of the band coupled with a reduction of the devaluation rate, culminating with the float of the Polish currency, the Zloty, in April 2000), see *Nuti*, 2000, and for a defense of the float, see *Dedek*, 1997.

2 A Stylized "MF" Model of a Transition Economy

To study effects of alternative economic policy regimes and the interaction with the EU on macroeconomic adjustment of a individual transition economy, we use a model that is an extension of the classic "Mundell-Fleming" (MF) model[13]. This type of model has been chosen because i) it is of small size, tractable and flexible; ii) it enables a study of some of the questions of main interest for our research, like direct economic linkages between the Application Countries and the EU; iii) to the relatively intuitive economic interpretation of its parameters and iv) the existence of a established body of literature on its use and also on applications to transition economies[14].

The initial model proposed here[15] assumes that there are two composite regions, a domestic country, whose domestic currency is indicated by *T* (for temporary) and a foreign economy, the EU, that has the Euro (€) as its single currency. Given our focus on the Application Countries, the usual "small country" assumption is adopted (as indicated in the previous section, the *joint* GDP of all Application Countries is less than 5% of the EU's GDP), i.e., it is assumed that the effects of the transition economy on the EU economy are negligible.

The equations that represent the structure of the proposed model are at the end of this section. The description of their meaning is given below. In our analysis all variables will be in logs, and, according to the case, the can be either contemporaneous or lagged.

In equation (1), we have the GDP Equation, for domestic goods in the transition economy, which is assumed to be a function of domestic income, the real interest rate, the level of government consumption, the competitiveness relative to the EU economy, and real output in the EU economy, where Y is the real domestic output, r, the real interest rate, g, the real government consumption, c, a competitiveness parameter, y^*, the real EU output, while ζ is the multiplier parameter, which works whit a one lag delay, to introduce dynamics into the model. The supply of goods is elastic and output is therefore demand-determined in the short-run.

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13 Other types of modelization strategies are possible, like the endogenous growth models (EGM), in the Romer (see *Romer*, 1986) and *Rebelo* (see *Rebelo*, 1991) tradition (for a comprehensive guide, see *Aghion* and *Howitt*, 1998, for an example applied to the EU, see *Gaspar & Pereira*, 1995), or, the so-called computable general equilibrium models (CGE), in the Baldwin et al. tradition (see *Baldwin at al,* 1997, and for a critic of it, see *Rodrik*, 1997; for other examples of CGE applied to transition economies or to the EU enlargement, see also *Breuss* and *Tesche*, 1993, *Hare et al.*, 1993, *Tabeau et al.,* 1994, *Braber et al.*, 1996, *Piazolo*, 1999 and 1998). The main reason for not using an EGM is because a Mundell-Fleming one implies far less restrictive data requirements, and the main reasons not to use a CGE modelization is that the "quilibrium" assumption leads to very counter-intuitive results when this class of models is applied to transition economies, and also because the introduction of "money" in their framework is rather controversial.

14 See, among others, the works by *Turnovsky* (1986), *Giavazzi* and *Giovannini* (1989), *Sheen* (1992), *Sutherland* (1995), *Wdowinski* and *van Aarle*, (1998), *Plasmans* (1999), *Bohn* (2000), and *Frowen* and *Karakitsos* (2000).

15 The model here presented is based mostly on the work by *Wdowinski* and *van Aarle*, (1998), *Plasmans* (1999) and *Frowen* and *Karakitsos* (2000), ibid.

In (2), we have the Money Market Equilibrium equation, which is given by an LM relationship, where *M* denotes nominal money supply, p the domestic price level and i the nominal interest rate.

In (3), The Money Supply Identity, *M* consists of two components: credit supplied by the Central Bank (CB) to the domestic banking sector, D, and the foreign reserves held at the CB, denoted by F.

Since the transition economy is assumed here to operate alternatively in the fixed or floating exchange rate regime, the analysis will be based in de facto two models16. Those two models differ with respect to the **Balance of Payments Equation (Equation 4)**: this equation enables to differentiate the two alternative exchange rate regimes. The two standard MF model conclusions apply to them:

1. in a fully flexible exchange rate system, the money supply is exogenous and can, in principle, enable an activist policy by the monetary authorities, while the fiscal policy is not effective;

2. in a fixed exchange rate system, the money supply is endogenous. Therefore, monetary policy is not effective, while fiscal policy is.

In (4), we have main relationship for a system of *fixed exchange rates*, where S is the nominal T/€ exchange rate, i^* is the common EU interest rate, and E is the expectation operator. Changes in the Euro-denominated reserves, $\dot{F}$, equal the sum of the capital and current account balances, resulting in *B* (for balance). ρ is the coefficient for the "imports leakage", since the *typical* transition economy is assumed to be highly import-dependent in the middle run. The capital account is here assumed to be a function of the differential in expected returns.

In (5), we have the Current Account Balance Equation, which is a function of competitiveness as well as foreign and domestic income, where π stands for the degree of capital mobility ($\pi \to \infty$ implies perfect capital mobility, $\pi = 0$ financial autarky). In case of the fixed exchange rate regime (5) simplifies, since $E(\dot{s}) = 0$. If we additionally assume that $s \equiv \bar{s} = 0$ 17, the equation further collapses, resulting in (5').

In case of the *flexible exchange rate regime*, change in reserves are here assumed to equal zero (i.e., $\dot{F}^* = 0$). Accordingly, any surplus or deficit in the capital account must be matched by a corresponding movement in the current account. Therefore, in (4*), we have the *Balance of Payments Equation* – somewhat of a misnomer, in this case – for this type of arrangement. The free floating is assumed to keep the balance of payments in equilibrium (the monetary authorities do not intervene and official reserves do not

16 It is implicitly assumed here that the current exchange rate linkages of the application countries can be summarized by either of these two types, which represent the two essential pre-entry strategies.

17 Empirically speaking, very few of the pegs observed in the region are actually that binding.

change). Adding a perfect foresight assumption to the equation (4*) and simplifying the notation of the coefficients, we get equation (4**)[18].

In (6), we have a Phillips Curve(-like) Equation, linking inflation and output, where the parameter ν represents specific factors that determine the degree of short-run price stickiness in the transition economy. As such, it is a major determinant of the speed of adjustment of the economy. A low value of ν would imply a long, costly adjustment path.

The competitiveness of the domestic economy, represented by the Identity (7), is defined as the real exchange rate (using consumer prices, were p^* is the EU inflation, and p is the domestic consumer price level).

In (8) we have the (Real) Interest Rate Identity, which is defined as the difference between the nominal interest rate and inflation. In case of the *flexible exchange rate regime* we assume backward-looking, adaptive expectations[19]. This is expressed in the Identity (9).

Since the model aims to reflect some of the main features of a transition economy, we will make the following assumptions concerning the structural parameters of a prototype transition economy:

1. The depreciation of the domestic exchange rate (T) has a relatively small positive impact on exports (i.e., the parameter α has a small value); Nevertheless, it is expected to be positive, satisfying the Marshall-Lerner (ML) condition[20];

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18 It should be pointed out that in case of perfect capital mobility ($\pi \to \infty$) under a flexible exchange rate, regime current account changes become insignificant in the determination of the exchange rate. In that case, the Interest Rate Parity condition, $E(\dot{s}) = \underset{ti}{i} - \underset{ti}{\overset{*}{i}}$, holds approximately. Perfect capital mobility, implying uncovered interest rate parity, is a special case in this model.

19 The use of adaptive expectation is defended by Orlowski (see *Orlowski*, 2000, ibid.) and, on a different context, by *De Grauwe et al.* 2000 and 1998. The critics of the theoretical correctness of the use of rational expectations, and of the "Lucas Critique" implication are, of course, recognized. Nevertheless, we make our the defense used by DeGrauwe et al., according to which i) both the national governments and their central banks, in real terms, use models that incorporate an adaptive expectations formation process; ii) the construction of models of rational, forward looking expectations necessarily implies the use of past expectations in the information set of the agents, while future expectations are difficult to get (and even more so in the case of transition economies) and iii) in empirical terms, rational expectations models just do not usually perform better that adaptive ones (more than that, they can actually perform *worst*: see *Fuhrer*, 1997). Nevertheless, the case for forward expectations in monetary models has been made as recently as in the excellent series of paper co-authored by Wieland et al. (see *Wieland et al.*, 2000 and 1999), produced during his stint as a consultant at the ECB. As a small anecdote, I have had the opportunity (and the pleasure, of course) of seeing the De Grauwe et al's. paper (better, *versions* of it…) presented by all three co-authors, in a period that goes from November 1998 to February 2000. I must congratulate all of them on their inter-temporal and interpersonal consistency.

20 The ML condition is formally expressed *by* $\varepsilon_f + \varepsilon_d < -1$, where ε_f is the foreign price elasticity of the demand for imports and ε_d is the domestic price elasticity of demand for imports. It is derived under

2. The prototype transition economy is a highly import-consuming one (i.e., parameter ρ is relatively high);

3. There is short-run price stickiness (i.e., the parameter ν is relatively small).

Additionally, it is also expected that the still existing capital controls will be progressively liberalized (nevertheless, it is assumed that external and domestic financial assets *will not* become perfect substitutes, i.e., π can became substantially large, but will never reach infinity).

An easy and straightforward way to evaluate the comparative optimality of the two possible regimes for any specific country can be derived from a simple objective function, that would enable the policy maker at the monetary authority to compare the "utility" derived from the alternative regimes, as proposed by Frowen and Karakitsos (see Frowen & Karakitsos, 2000, Ibiden). Modifying their objective function to use only variables endogenously generated by our model, we will estimate

$$U = sum\left[Y - (P)^2 \right]$$

where is Y the GDP series generated by the Equation (1) and P is the dependent variable of the equation (6), the Phillips Curve relationship, representing the "inflation bias" of each regime.

The Model

Fixed Exchange Rate Regime Specification – Flexible Exchange Rate Regime Specification

$$Y = \zeta \underset{ti}{y} - \sigma \underset{ti}{r} + \delta \underset{ti}{g} + \alpha \underset{ti}{c} + \beta \overset{*}{\underset{ti}{y}} \tag{1}$$

$$M = \kappa \underset{ti}{y} - \lambda \underset{ti}{i} + \chi \underset{ti}{p} \tag{2}$$

$$M \equiv D + F \tag{3}$$

$$B = \pi(\underset{ti}{i} - \overset{*}{\underset{ti}{i}} - E(\dot{s})) + \alpha \underset{ti}{c} + \beta \overset{*}{\underset{ti}{y}} - \rho \underset{ti}{y} \tag{4}$$

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the assumption of constant domestic price level – i.e., a fully elastic supply of goods – and current account equilibrium at the starting point. A generalization of it for situations of finite supply elasticity's and a current account disequilibria (the typical transition economy situation) as a starting point is the so-called Metzler-Robinson (MR) or Bickerdike condition, expressed by

$$\varepsilon_{Tb} = (Ex^f/Im^f)*\{(\varepsilon_t + 1)/[(\varepsilon_f/S_{ex}) - 1]\} - (S_{im} + 1)/[(S_{im}/\varepsilon_d) - 1]$$

were ε_{tb} is the elasticity of the trade balance with respect to the exchange rate, Ex^f is exports revenue in foreign currency, Im^f is the imports expenditure in foreign currency, s_{ex} is the price elasticity of export supply and s_{im} is the supply elasticity of imports (see *Viser* and *Smits*, 1995). Therefore, in practical terms, we should speak of a *MR* condition in our model.

$$\pi(i - i^* - E(\dot{s})) = -(\alpha c + \beta y^* - \rho y) \tag{4*}$$

$$\dot{S} = \delta(i_{ti} - i^*_{ti}) + \phi c + \chi y^*_{ti} - \varphi y_{ti} \tag{4**}$$

$$\dot{F} = \pi(i_{ti} - i^*_{ti} - E(\dot{s})) + \alpha c_{ti} + \beta y^*_{ti} - \rho y_{ti} \tag{5}$$

$$\dot{F} = \pi(i_{ti} - i^*_{ti}) - \alpha(p_{ti} - p^*_{ti}) + \beta y^*_{ti} - \rho y_{ti} \tag{5'}$$

$$\dot{P} = C + \nu y_{ti} \tag{6}$$

$$c \equiv s - p + p^* \tag{7}$$

$$r \equiv i - \dot{p} \tag{8}$$

$$E(\dot{s}) \equiv \dot{s}_{t-(t-1)} \tag{9}$$

3 The Data and Some Preliminary Results

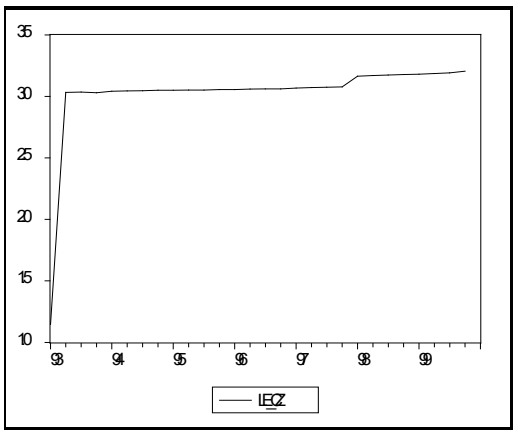
We used for our first estimations quarterly data, both for the Euroarea aggregate and for the Czech and Slovak Republics, from the second quarter of 1993 until the first quarter of 2000.

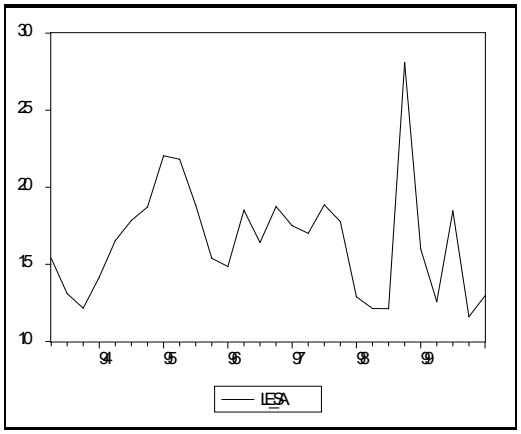
For the Euroarea, the data used was taken from the IMF/IFS series, for the period 1993-1997, and from the Eurostat and the ECB for 1998-2000. For the first period, GDP-weighted average lending rates were built (excluding Belgium, Ireland and Luxembourg, who do not produce quarterly GDP series: this implies an average loss of, roughly speaking, 5.25% of the Euroarea GDP)[21]. Different inflation rates were used for the construction of the -also GDP-weighted- Euroarea inflation (a somewhat representative EU-wide index was only achieved with the implementation of the HIPC): for most of the countries, the index used was "Consumer Prices", once again taken from the IMF/IFS data series.

This first selection of transition countries was due to the fact that both the Czech and Slovak Republics have available, roughly speaking, the necessary series for our estimation, for similar time periods – not surprisingly, since that, up to the so-called "Velvet Divorce" of 1993, they were one single nation (for some macro data on both countries, see the Statistical Annex).

21 This approach is similar to the one used by *DeGrauwe et al.* (2000, 1998, ibid.). *Wieland et al.* (2000, ibid.) just uses a German benchmark rate.

Also, the Czech Republic has clearly defined periods of a peg and a float, during the time considered (see Dedek, 1997, ibid.). The forced float of the Czech Koruna (CZK) in May 1997, after one of the longest stable pegs[22] among Central and Eastern European countries (see Vinhas de Souza, 1999(a), Ibiden; the amazing stability of the Czech currency can be also verified by looking at the graph below, at the left-hand side of the page, which shows the log first differences of the CZK exchange rate), plus the "dirty floating" implemented afterwards make it an interesting test case for both scenarios in the proposed modelization.





The Slovak Republic, in general terms, mimics those developments in the exchange rate regime, but with a one-year lag, in the case of the forced change to a float regime (more precisely, on 1st. October, 1998)[23]. It also must be noted that its "peg" strategy was always much less credible than the Czech one (see the graph above, at the right-hand side of the page, which shows the log CZK and SKK exchange rates). The standard deviation of the SKK peg series is 1.17, and the one for the CZK peg period is a mere 0.42.

22 A "peg" of some sort, aiming to provide a stable external "anchor" to the currency and to the economy as a whole, was a standard feature of the immediate post-transition macro stabilization programs in Eastern Europe (for more on the rationale of such strategies, see, among others, *Vinhas de Souza at al*, 1999(a), (b) and (c), Ibiden)

23 A lower degree of openness to capital inflows and what was, for all practical porpoises, an "entry devaluation", when the Slovak Koruna (SKK) was created in 1993, allowed it to "hold" the peg a little longer then the Czech Republic.

In our modelization attempts, the exchange rates used were the ECU/CZK and ECU/SKK, to represent the T/€ exchange rate[24]. Expectations are assumed the equal the one-lagged difference of the actual nominal exchange rate[25], and CB credit's were proxies by the "claims to banking institutions by the monetary authority" (IMF/IFS data). Estimated parameters were used, instead of imposing ones by a calibration procedure, since it is assumed that the estimated ones – by definition – represent better the "true relationships" prevalent in the transition economy.

Czech Republic:

First, we estimate the "peg" model (sample period 1993:2 to 1997:2). The results of the estimated equations are given below (the t-statistics probabilities are given between brackets after the coefficients):

$$Y = +0.35\, y(0.00) + 0.37\, r(0.00) + 0.08\, g(0.01) + 0.04\, c(0.15) + 0.22\, y^{*}(0.00)$$

R^2: 0.92 F: 33.59 DW: 1.46

$$M = 0.33\, y(0.00) + 0.05\, i(0.64) + 0.53\, p(0.00)$$

R^2: 0.84 F: 35.40 DW: 2.50

$$B = 1.51(i - i^{*} - E(\dot{s}))(0.08) - 0.60\, c(0.24) + 2.78\, y^{*}(0.22) - 0.20\, y(0.88)$$

R^2: 0.62 F: 7.08 DW: 2.78

$$\dot{F} = 0.54(i - i^{*})(0.00) + 0.82(p - p^{*})(0.00) + 0.94\, y^{*}(0.04) - 0.96\, y(0.06)$$

R^2: 0.83 F: 21.84 DW: 2.26

$$\dot{P} = 2.95C(0.00) - 0.26\, y(0.01)$$

R^2: 0.43 F: 10.51 DW: 0.62

– in the "GDP Equation", lagged domestic output and government expenses are significant and have the expected sign, the domestic interest rate is not-significant and has a

24 This "indirect" derivation of a proxy "Euro" exchange rate may also entails some problems.

25 As indicated above, it is assumed here that the use of backward-looking, adaptive expectations is a better representation of the way that the agents formed their expectations during the first stages of transition. The recent attempts of some Accession Countries to abandon their currency anchors and switch to a Direct Inflation Targeting (DIT), or, more precisely, *inflation forecasting targeting* framework is part of a process in which the policy makers try to lead private agents towards a "regime change", in which their expectations will be formed by a forward-looking, rational process, as pointed out by Orlowski, (see *Orlowski*, 2000, Ibiden).

positive sign (at one lag), the EU output is significant in the determination of domestic output and has the expected positive sign, as is the lagged competitiveness coefficient;

– in the "Money Market Equation", domestic GDP is significant and has the expected positive sign, while the interest rate is not significant and has the wrong sign (higher interest rates affect positively the money supply, perhaps due to the "re-monetization" process that follows transition), while prices are significant and have the right sign (i.e., a positive one);

– in the "Balance of Payments Equation", the differential of expected returns is significant (at 10%) and has the expected positive sign, while the competitiveness coefficient has a wrong negative sign but is non-significant, while the EU output is non-significant but has the expected positive sign, as the domestic output.

– in the "Current Account Balance Equation", the one-lagged differential on interest rates is significant and has the expected positive sign, as the lagged price differential, which is significant but with a wrong positive sign, while the EU output is significant and has the right positive sign, and the lagged domestic output is significant and has the expected negative sign;

– finally, in the "Philips Curve Equation", the constant is significant and has a positive sign, but the domestic output lagged one period, inspire of being significant, has the wrong negative sign.

Among our assumptions, two are violated outright for this model: first, the estimated parameter α is small but negative (the transition economy, in its first transformation phase, seems to have difficulties in generating exports), so the ML condition is violated; second, the lagged estimated parameter ν is relatively small, indicating the existence of specific factors that prevent adjustment. ρ, on the other hand, is relatively small, as was expected[26].

The results of the estimation of the "float" model (sample period 1997:2 to 2000:1) are given below:

– in the "GDP Equation", again, the domestic interest rate is significant, but now it has the right sign, also with a two-period lag, while EU output is also significant and this variable has the expected sign, government expenses and lagged domestic output are also significant and have the expected positive sign, while the "odd man out" is still the competitiveness, which has the wrong sign and is non-significant;

– in the "Money Market Equation", the domestic output behaves as expected (significant and positive), while the interest rate is also significant, but has again the wrong sign, while prices are still non-significant and have the right sign;
– in the "Balance of Payments Equation", the differential of expected returns is highly significant (with five lags) but has a wrong negative sign, while the two-lagged com-

26 The attempted use of a dummy to try to capture the effects of the widening of the variation band of the CZK from 1% to 15% in February of 1996 – which can be interpreted as a pre-float action – does not improve the overall results of the model for the Czech Republic.

petitiveness coefficient has the expected positive sign and is significant, and the equally two-lagged EU output is significant but has the wrong negative sign, while the (equally two period lagged) domestic output is, once again, significant but with a wrong positive sign.

– finally, in the "Philips Curve Equation", as before, the relationship only becomes significant and with the expected sign with the introduction of a constant and with the domestic output lagged one period.

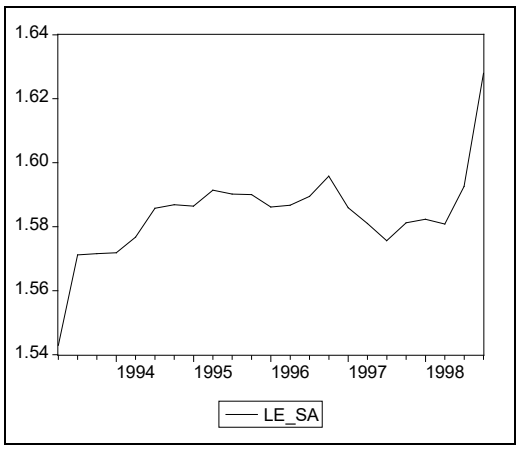
Now, all our assumptions are respected: the parameter α is small and positive, after two lags (the transition economy, in a more advanced stage of reform, is better at generating export surpluses); second, the parameter ν is, again if used with one lag, becomes substantially smaller.

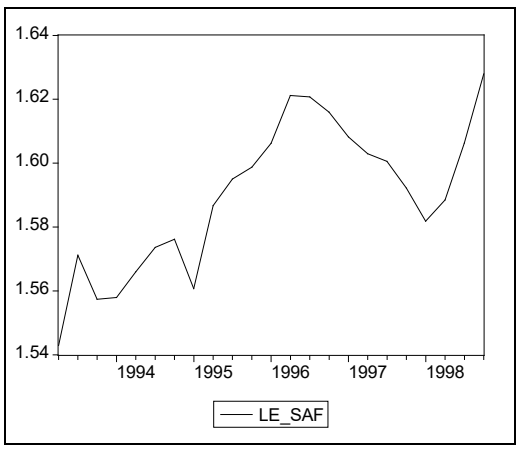
Estimating the objective function for both models, for their respective samples and correcting for the number of years in each sample, the results indicate that the float regime would outperform a peg one (2.507907>2.470743).

As a conclusion, we could say that, *for the specific case of the Czech Republic*, under the float regime (where we have a transition economy that is in a more advanced stage of the transformation process), the country behaves more accordingly to the expected theoretical predictions *and* generates a higher degree of welfare, as measured by our objective function.

Slovak Republic:

For the Slovak Republic, the sample peg period goes from 1993:2 to 1998:3. Below, we have the log exchange rate for the peg model, the only model whose estimations are presented for this country. As before, estimated variables are indicated by an "F" at the end of the series' name, and are located at the right- hand side of the page.





From the figures above, we could expect the peg model to yield a relatively good representation of the actual relationships, in the case of the Slovak Republic. The estimations' results of this specification are given below:

– in the "GDP Equation", lagged domestic output and government expenses are significant and have the expected signs, the domestic interest rate is non-significant but has the expected sign, the EU output is also non-significant in the determination of domestic output but has the expected positive sign, while competitiveness coefficient is both significant and has the right sign;

– in the "Money Market Equation", the domestic output and the interest rate are significant and have the expected positive sign and negative sign (higher interest rates affect negatively the money supply), while prices are significant and have the right sign (i.e., a positive one);

– in the "Balance of Payments Equation", the differential of expected returns is non-significant but has the correct positive sign (the differential of expected returns would actually be marginally significant, just below the 10% level), while the competitiveness coefficient is also non-significant and has a wrong negative sign, while both the EU output and the domestic output are significant (at the 10% level) and have the opposite expected signs (they are, respectively, negative and positive);

– in the "Current Account Balance Equation", the differential on interest rates is significant at a three-lag horizon, with the expected positive sign, while the price differential is non-significant but has the expected negative sign, and the EU output is significant but has a wrong negative sign, while the domestic output is significant, but has a positive sign instead of a negative one;

– finally, in the "Philips Curve Equation", the relationship again only becomes significant and with the expected sign with the introduction of a constant, and with the domestic output lagged one period.

Concerning our assumptions, the results are: first, the parameter α is small and positive, in the "GDP Equation"; second, the parameter ν is small, indicating the existence of relatively substantial specific factors that prevent adjustment (especially when compared with the previous country, the Czech Republic). ρ, in the "Balance of Payments Equation", is also relatively small.

Comparing the peg model with a *counterfactual* float model estimation for the same sample, corrected for the number of observations, the results of the objective function indicates that the float *slightly surpasses* the peg (5.241258>5.21887).

In spite of the reduced difference, this result might indicate that smaller (the Slovak GDP is about a third of the size of the Czech one), less diversified (the Slovak Republic has a smaller industrial sector than the Czech one, and it is concentrated in older industrial sectors, and also its tertiary sector is mostly in lower-value added activities, like construction), more open economies (foreign trade – imports plus exports – represents 138% of the Slovak GDP, as opposed to 95% in the Czech case, and its exports are clus-

tered in lower-value added, older sectors) could, comparatively speaking, benefit a little less from a float regime.

Finally, we could say that the peg model performs better in representing the Slovak Republic than it does with the Czech Republic.

4 Conclusions

Planned extensions of the previous work will include more countries and time periods, forecasting, a pooled estimation for a set of transition countries, and the construction of a more desegregated production/employment block in the model (following Blanchard & Muet, 1993, and Plasmans, 1999)[27].

A specific question that clearly needs to be addressed in the framework used above is the modelization of expectations' formation, especially under the peg regime, which is probably linked to the question of the credibility of the peg strategy.

A corollary of the results and statements above is that a "one-size-fits-all" model faces serious problems, since this mechanism is extremely different from one country to the other: the lags in its formation, and the very formation mechanism (rational or adaptive) seems to differ. Of course, one of the implications is that the modelization of the fundamentals that define if a foreign exchange regime is sustainable or not are necessary for the adequate modelization of the expectations mechanism.

There is also a question of the dynamics of the mechanism(s). Since this process is seems to be also related to the stage of the transition in which each specific countries finds itself, several different regimes are possible for each country, in different moments in time, with periods of instability and indeterminacy in the "regime-change" interval.

27 The construction of a functional "composite" economy for the Application Countries implies several problems, including data availability, that still need to be resolved and thought through. One possible way would be the use of a GLS joint estimation, as in Vinhas de Souza, 1996 (see *Vinhas de Souza*, 1996, ibid.).

Statistical Annex

Czech Republic	GDP (USD bn.)
	58.07
by sector (%):	
Primary	4.5
Secondary	34.3
Tertiary	61.2
	GDP Growth (98, %)
	-2.3
	Population (Mil.)
	10.3
	Exports (USD bn.)
	26.393
Machinery and Transport Equipment (%)	41.3
Intermediary Manufac-tured Goods (%)	26.4
	Imports (USD bn.)
	29.017
Machinery and Transport Equipment (%)	39.4
Intermediary Manufac-tured Goods (%)	20.9
	Budget Balance (98, GDP %)
	-1.6
	External Debt (98, USD bn.)
	24.6
	Inflation (99, CPI)
	3.4
	Discount Rate (99)
	5.5

Slovak Republic	GDP (USD. bn.)
	20.36
by sector (%):	
Primary	4.8
Secondary	28.2
Tertiary	67
	GDP Growth (98, %)
	4.4
	Population (Mil.)
	5.36
	Exports (USD bn.)
	12.97
Machinery and Transport Equipment (%)	27.5
Intermediary Manufac-tured Goods (%)	34.7
	Imports (USD bn.)
	15.24
Machinery and Transport Equipment (%)	33.6
Intermediary Manufac-tured Goods (%)	15.1
	Budget Balance (98, GDP %)
	-5.7
	External Debt (98, USD bn.)
	9.9
	Inflation (99, CPI)
	10.6
	Discount Rate (99)
	8.8

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The Credibility of the Hungarian Exchange Rate Regime 1997-98[1]

Ádám Szeidl[2]

Abstract

This study intends to analyze the credibility of the Hungarian exchange rate regime preceding and during the Russian stock market crisis and devaluation (in 1998). Throughout the paper the comparison with the similar regime in Poland is stressed.

The basic tool applied is a measure of market imperfections, more precisely deviations from covered interest rate parity. The size, sign and dynamics of these deviations provide insight into the expectations of market participants. These in turn yield conclusions concerning the credibility and vulnerability of the regimes. Policy implications also follow.

1 Introduction

The present paper is intended to analyze the credibility of the crawling band exchange rate regime in Hungary for the period April 1997-October 1998. Special attention shall be paid to the effects of the Russian stock market crisis and devaluation on the expectations of investors concerning the Forint. Throughout the text a comparison with the similar regime in Poland is stressed, providing valuable insights.

The paper is organized as follows: Section 2 reviews basic facts about the regimes in Hungary and Poland. In Section 3 we look at part of the literature on testing target zone (or crawling band) credibility. In particular, we investigate the notion of the interest rate differential, one of the popular tools applied to construct an empirical measure of credibility. It turns out that the applicability of this method in the present context is questionable due to market imperfections. Section 4 turns to measure these market imperfections by testing covered interest rate parity for the Forint and the Zloty. The results are somewhat surprising; they are interpreted in terms of market expectations and credibility in Section 5. Finally Section 6 concludes.

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2 The Regimes

In the present section we briefly review some of the basic facts concerning the crawling band exchange rate regimes in Hungary and Poland during 1997-98. More thorough expositions may be found in Szapáry-Jakab (1998) in the case of the former, and Darvas (1998) pp. 157-181. for the latter. See also Backé (1999) for a comparative analysis of several exchange rate regimes in the region. It is worth noting that the exchange rate regimes in both countries have changed since the period under investigation.

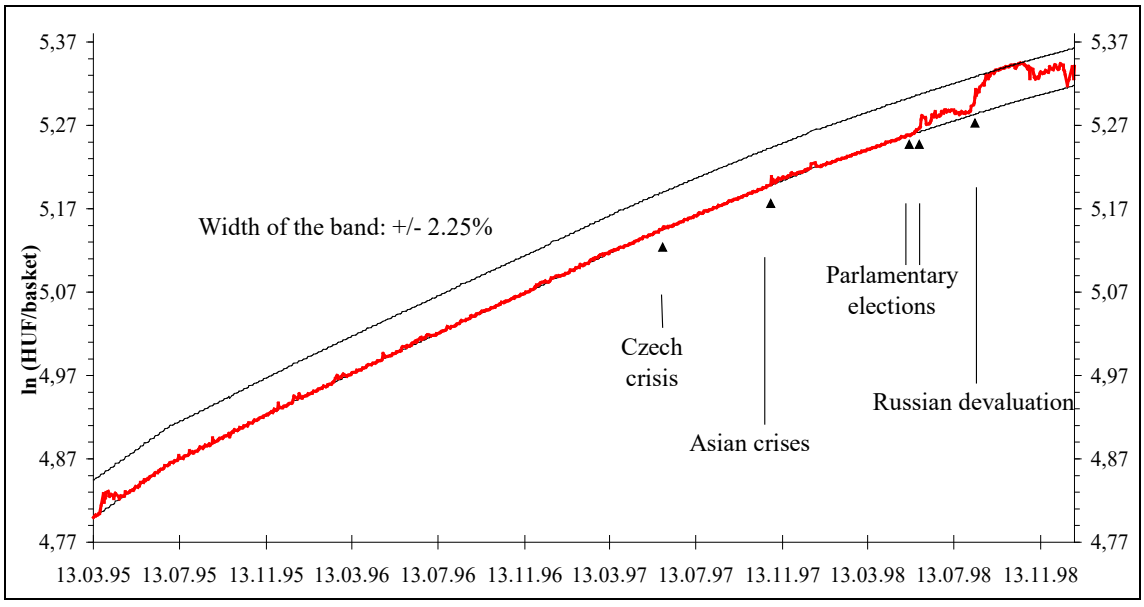
2.1 Forint

The Forint crawling band regime was introduced in March 1995 as part of a general stabilization package. During 1997-98, the central parity was determined by a (geometric) basket of currencies: 70% DM - 30% USD. The bandwidth was plus-minus 2.25%. The rate of the crawl had been adjusted several times, basically in order to fit the path of disinflation. Each such adjustment was announced by the National Bank of Hungary (NBH) and the government several weeks, often months earlier. In practice, the NBH depreciates the central parity each trading day so that these changes add up to the rate of the crawl on a one-month basis. More formally, the (HUF/USD) central (NBH-quoted) exchange rate valid for the next trading day is calculated in the following manner:

$$\left(\frac{HUF}{USD}\right)_{t+1,central} = \left(\frac{HUF}{USD}\right)^{0.3}_{t,central} \left(\frac{HUF}{DEM}\right)^{0.7}_{t,central} \left(\frac{DEM}{USD}\right)^{0.7}_{t+t,market} (1+craw) \quad (1)$$

where t is measured in (trading-) days, *(HUF/currency) t central* means the Forint-currency central exchange rate prevailing on day t (similarly for $t+1$), *(DM/USD) {t+1, market}* stands for the market DM-USD exchange rate on day $t+1$, finally (1+crawl) re-

Figure 1:



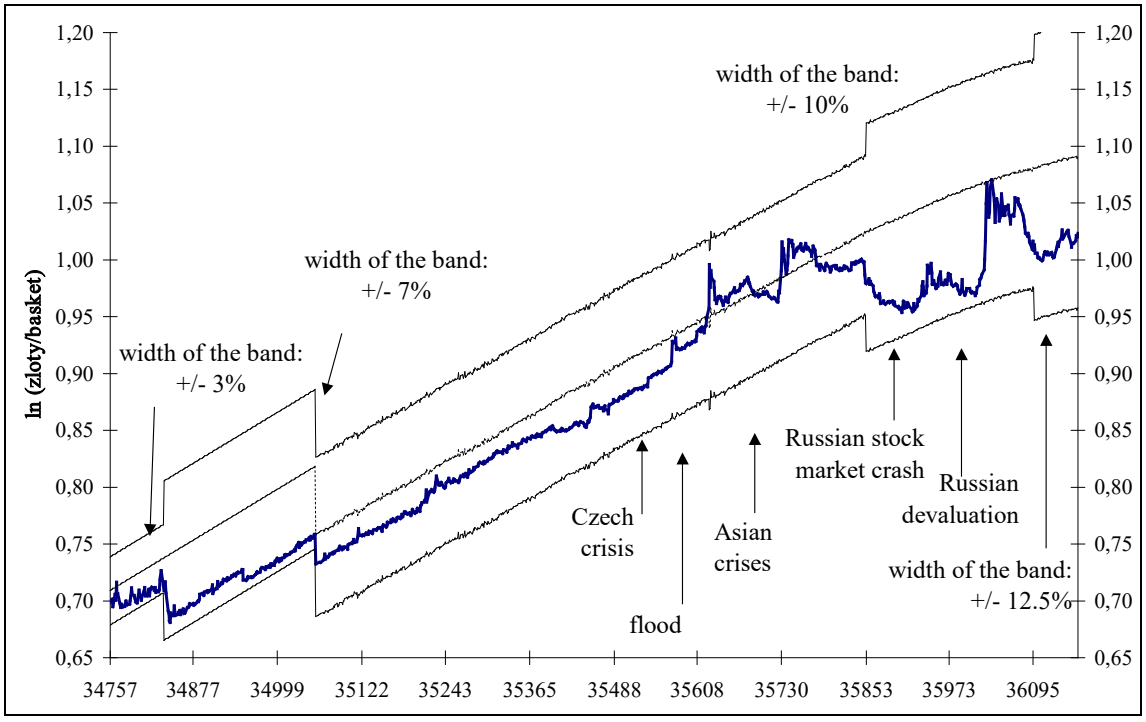
fers to the daily rate of crawl. A similar formula is valid for the *(HUF/DM)* central exchange rate:

The NBH is obliged to intervene at the sides of the band and has the right to deliver within-band intervention. The NBH intervenes in US dollars. Figure 1 plots the logarithm of the market exchange rate of the Forint against the geometric basket $((HUF/USD)^{0.3}(HUF/DM)^{0.7})$ as well as the central parity and the band. It is apparent that for most of the existence of the regime the exchange rate was 'stuck' to the strong side of the band. Substantial weakenings were corresponding to major political and/or economic events, as indicated in the Figure.

2.2 Zloty

The Zloty crawling exchange rate regime was introduced in October 1991. During 1997-98, the central parity was determined by a basket of five currencies: 45% USD, 35% DM, 10% GBP, 5% FFR, 5% CHF. The exact method of determining the central parity was not public. The bandwidth as well as the rate of the crawl have been changed several times during the existence of the regime. There have also been central parity realignments. These are all visible from Figure 2 which plots the logarithm of the market exchange rate of the Zloty against the (geometric) basket as well as the central parity and the band for the period March 1995 - October 1998. Since the exact method of calculating the central parity is not available, estimations are necessary. This Figure is taken from Darvas (1998), pp. 167. The calculations leading to the graph are explicitly explained there. We shall not rely on the exact value of the central parity in the sequel, so the Figure may be considered more as an illustration. It is well observable that for most

Figure 2:



of the time period the Zloty stayed within the stronger region of the band. Similarly to the case of the Forint pronounced weaknesses were associated with political/eco-nomic events.

3 Interest Rate Differential

A significant part of the literature focusing on empirical measures of target zone credibility approaches the problem by means of the interest rate differential (see Garber-Svensson (1995) for an overview). The present section aims at studying this notion on a more-or-less theoretical basis and examining its connections to market expectations. A (somewhat critical) view of the so-called 'drift-adjustment' method is presented. Further, the applicability of this measurement technique for Hungary and Poland is discussed. In later sections we shall propose a different and somewhat less formal methodology which seems to be more suitable for our purposes. Nevertheless the following brief and incomplete survey of the existing literature on our topic is going to help us in the sequel.

Before proceeding, let us fix what is meant by credibility throughout this paper. Intuitively, credibility is a property of an exchange rate regime for a given time period. Credibility intends to capture the amount of 'faith' that agents have at the beginning of the period as to whether the regime prevails throughout the period. Although conceptually clear, this is not a formal definition, hence there can be different approaches to construct a measure of credibility. Not surprisingly, all of these aim at measuring the expectations of market agents. We now turn to one of the most popular methods, the drift-adjustment approach.

We shall always assume that the foreign interest rate is exogenous to the model and that the domestic exchange rate regime is a crawling band (with possibly zero crawl). Indeed, it is useful to keep in mind that all what follows is developed in order to analyze the case of Hungary and Poland. For technical simplicity, all variables in this section are to be understood in the logarithmic sense.

Suppose firstly that the interest rate differential and in turn the domestic interest rate are solely determined by market forces, and market actors are rational. In such a situation, if the instantaneous domestic and foreign risk-free interest rates at time t are denoted by $i(t)$ and $i^*(t$Í respectively, then the interest rate differential may be written as

$$i(t) - i^*(t) = Eds(t)/dt + P(t) \qquad (2)$$

where $s(t)$ is the (log of the) exchange rate (measured in domestic currency), thus $Eds.(t)/dt$ is the expected instantaneous rate of depreciation, and $P(t)$ is a possibly time-varying premium (see e.g. Garber-Svensson (1995) and the references therein). The existence of the premium term ($P(t)$) may stem from several sources. One is default risk. In line with our assumption of risk-free interest rates (such as T-bill yields) being applied, default risk has to mean country risk: the inability of the government to repay debt, or to exchange domestic into foreign currency. Beyond default risk, the standard consumption-based asset-pricing risk premium may also imply a premium. As to the

other reasons explaining the premium term, a very good reference is Lewis (1995). The peso problem, learning process of the market, risk aversion and other factors may all play a role. In the case of a constant zero *P(t)* term the above formula may also be understood as the uncovered interest parity condition.

Denoting by *c(t)* the central parity of the band, *x(t)=s(t)-c(t)* may be interpreted as the exchange rate deviation from central parity. It follows that expected depreciation takes the form

$$Eds(t)/dt = Edx(t)/dt + Edc(t)/dt \tag{3}$$

the sum of expected within band depreciation and expected changes in central parity. In the case of a non-zero crawl this latter term is the sum of projected (instantaneous) crawl and expected changes in the regime, such as realignment expectations. Therefore our final form of the interest rate differential is the following

$$i(t) - i^*(t) = Edx(t)/dt + dw(t)/dt + Edz(t)/dt + P(t) \tag{4}$$

where the second and third terms on the right-hand side stand for the projected crawl and expected realignment respectively. It is assumed that the instantaneous crawl is deterministic, so all uncertainty about the future behavior of the central parity is incorporated in *z(t)*. It is this third term (*Edz(t)/dt*) of the above formula which is interpreted as a measure of credibility in the present approach.

On applying the above formalism to empirical data, several difficulties arise. First of all, supposing that the interest rate differential minus the projected crawl is available, and even that the risk premium is somehow taken care of (e.g. is considered negligible), it is unclear how to distinguish between expected within-band depreciation and band-realignment, only the sum of which is known. One method proposed is the so-called 'drift-adjustment' method (Bertola-Svensson (1993), see also Garber-Svensson (1995)), which estimates the future within-the-band rate using a simple linear regression on the current (and possibly lagged) exchange rate (*s*) and domestic and foreign interest rates. The estimate then serves as a proxy for within-band depreciation expectation, and an estimate of realignment expectations follows readily. However, it is not apparent that market participants should form their expectations using some regression technique. Moreover, the exchange rate behavior in Hungary has been a rather uneventful one in the sense that during tranquil times, which are most of the relevant time interval, it was stuck to the strong side of the band (see Figure 1). In other words, within-band volatility has been insignificant. Therefore a regression based on this data is likely to be misleading when applied to more recent crisis-like situations, most notably that during the Russian stock market crash.

A second difficulty stems from the presence of maturities. No instantaneous risk-free interest rates are available, so what should be used instead? One solution is to incorporate maturities in the model, that is to calculate for example 3-month interest rate differentials. The terms on the right-hand side of our formula then accordingly transform into expected within-band depreciation, projected crawl, realignment expectation and risk

premium on a 3-month time horizon. Yet, in such a situation the drift-adjustment method is even more likely to fail in predicting within-band depreciation expectations for such time intervals. Furthermore, for longer maturities the projected crawl may not be correctly considered deterministic.

Thirdly, what to do with the risk premium? In Svensson (1992) Svensson argues that in a theoretical target zone model the foreign exchange risk premium is likely to be small. However, in the countries under consideration a more or less significant country-risk may have been present, especially during the aftermath of the Russian crisis. Russia explicitly defaulted on repaying its debt, which could have led investors to fears of similar events in the whole of the region.

Finally, and most importantly from our point of view, the assumption that expectations determine the interest rate differential could be false. Should this be so, the validity of the formulas developed so far is at least questionable, and we may not deduce conclusions upon market expectations using the above methodology. Consider the following example to illustrate the case: The domestic country has a fixed exchange rate regime (zero bandwidth, zero crawl), and the central bank completely controls the interest rate, say by borrowing or lending any amount of money at the chosen level. In such a situation expectations (which are necessarily realignment expectations), have nothing to do with the interest rate differential. Suppose further that the domestic central bank commands a tight monetary policy, keeping domestic interest rates higher then foreign. Theory would imply then that an infinite amount of capital inflow appears, forcing the currency to appreciate. However in practice the amount of available funds in the known universe is finite. Information is not costliest, so not all investors will learn about this profit opportunity. The domestic country may also impose capital controls on inflows. Finally, the domestic central bank may well be able to finance the arbitrage profits of investors for some time, and even control the money supply by sterilizing.

In short, such a situation could be preserved for some time due to market imperfections. If market participants foresee this, they will correctly expect the regime to remain in effect for some time, so instantaneous realignment expectation is zero, even though the interest rate differential is not. One may incorporate this difference in the premium term. But in practice $P(t)$ is almost impossible to explicitly determine, so we are equally lost.

Of course contradictory monetary and exchange rate policy in a relatively open economy can not be sustained for ever. Yet, market imperfections can provide some room for monetary policy, which in turn has significant influence on the interest rate differential. Indeed, monetary policy may, and usually does seriously affect market expectations as well, so it is quite possible that it is the interest rate differential that to some extent determines expectations rather then vice versa. Anyhow, the relationship between them is probably a much more complex issue than our formulas would indicate.

We feel that in this respect both Hungary and Poland fall between the two limiting cases. There are two simple reasons for this. The first is that both countries engaged in active monetary, more explicitly interest rate policy during the nineties, mainly for disinflation purposes. They probably would not have done so, had these policies had no ef-

fect. Secondly, at least in Hungary there are some existing capital controls. The most important of these are: Non-residents are not allowed to buy Treasury-bills of maturity less then one year; neither are they allowed to engage in futures transactions on the domestic exchanges; and there is no legal possibility for short-selling.

So what now? It seems that the above outlined drift-adjustment approach suffers from serious drawbacks in our situation due to market imperfections. To cope with this problem, we examine more closely these imperfections to see whether one can extract information from their *presence!* It turns out that a numerical analysis of market imperfections, more specifically deviations from no-arbitrage conditions, reveals much information concerning expectations and related issues. Such an approach is necessarily less formal, and the conclusions therefore are often not so clear-cut. However the present study seems to be lucky in this respect. (At least to the author.)

We wish to stress that in spite of its drawbacks, the model proposed in the first part of this section is important. It provides a benchmark formal framework to which we can compare our experiences with empirical data. Should it be felt that for some period market expectations played a major role in determining the interest rate differential, this framework is to be applied. Indeed, we shall make use of it in a later section. But first we turn to a more down-to-earth issue, hoping that it will be of some use.

4 Covered Interest Rate Parity

In the present section we make a short account on covered interest parity and produce some empirical results for the case of Hungary and Poland. Here we wish to concentrate mainly on general issues, data and measurement techniques. Interpretation of the results as well as some conclusions, mostly concerning the expectations of market participants, follow in the subsequent section.

Covered interest rate parity (CIP) is captured by the formula

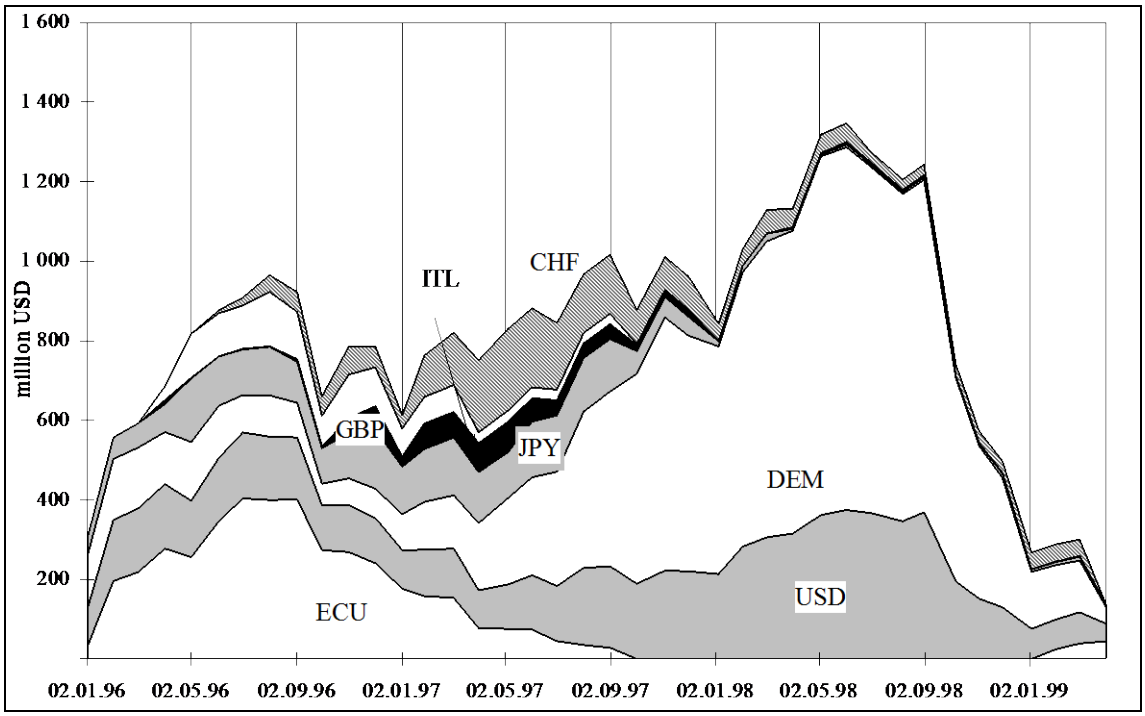
$$\left(1 + r^*_{t,+k}\right)\frac{f_{t,t+k}}{e_t} = 1 + r_{t,t+k} \tag{5}$$

where e_t stands for the spot, $f_{t,t+k}$ for the futures exchange rate at time t maturing at $t+k$ (each measured in domestic currency), and $r_{t,t+k}$, $r^*_{t,t+k}$ for the domestic and foreign risk-free interest rates respectively (for the same maturity). In the following we shall examine to what extent CIP prevails in Forint futures exchange markets. The straightforward method for testing CIP is to calculate the yields in domestic currency implied by investing in foreign risk-free securities and hedging exchange rate risk through futures operations, and then to compare these yields with domestic risk-free rates. In other words, to compute the left-hand side of the above formula and compare it with the right-hand side. This computation has been done for the Forint using futures prices quoted on the Budapest Commodity Exchange (BCE), and for both the Forint and the Zloty using data from the London Non-Deliverable Forward (NDF) market. Since these exchanges differ in several aspects, most importantly the maturity structure and the requirement of

marking to the market, it shall be convenient to handle them separately. We start by a more precise description of the differences.

The exchanges. There are two possible organized trading places to open futures positions in Forint: the Budapest Stock Exchange (BSE), and the Budapest Commodity Exchange. The London NDF is an institutional forward market, also trading Zloty. There exist domestic Zloty futures markets in Poland, however no date has been available on their trading. One might also engage in domestic OTC forward transactions in either country, but again no statistical data is available on the volume or prices of this trading. As to the two domestic institutions in Hungary, the vast majority of currency futures transactions have taken place in the Budapest Commodity Exchange, which has consequently been chosen to be the subject of our study. On the BCE futures prices are quoted for selected expiration dates. The most liquid expiration dates are the quarterly ones; the corresponding futures prices are often referred to as the March, June, September and December futures exchange rates respectively (naturally the specification of the year is also necessary). For example on 11th July, 1997, one could have opened a futures position in Forint expiring on 17th September, 1997, a different one expiring on 17th December, 1997, or yet another one expiring on 17th March, 1998. Daily marking to the market is required, that is, margin accounts have to be refilled daily according to closing prices. Although several currencies are traded, most of the attention has focused on basket currencies (USD and DM), as it is plainly visible from Figure 3.

Figure 3:

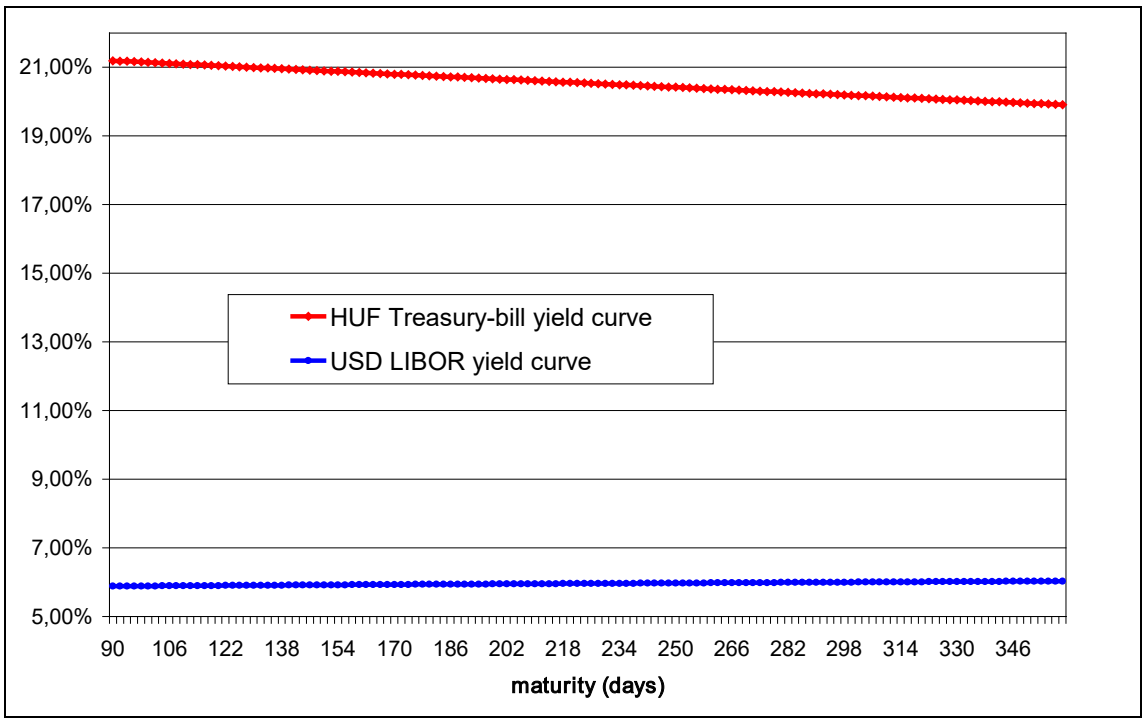


On the London NDF Forint (and Zloty) market there are forward prices quoted for (beyond others) a 3-month maturity each trading day. Thus, for example on the 11th July

1997 one could have opened a forward position in Forint (or Zloty) expiring 3-months from that day, that is, on the 11th October 1997. Daily marking to the market is not required. It is obvious that forward Forint prices of the NDF and the BCE on a typical trading day are not directly comparable. However, in the following we shall introduce more comparable measures, and indeed this comparison is going to be fruitful. We now turn to the issue of testing for CIP on the BCE. Before delivering the computations, two points are noteworthy.

The data. CIP has been tested for the USD-Forint market. Accordingly, as to the exchange rates, daily closing spot and futures USD prices of the Budapest Commodity Exchange have been used. The question of interest rates is, however, a bit trickier. Returning to our previous example, suppose we wish to test CIP on 11th July, 1997, for the December 1997 futures exchange rate. This means that we need domestic and foreign 157 day risk-free interest rates. Since such interest rates are not readily available, some estimations are necessary. For the domestic interest rates, daily (e.g. one on the 11th July 1997) zero-coupon yield curve estimations of the NBH constructed from Hungarian Treasury-bill yields have been applied (see Csajbók (1999)). Although these curves seem to be very reliable for longer time horizons, such as three months or more, they lose their efficiency for short maturities[3].

Figure 4:

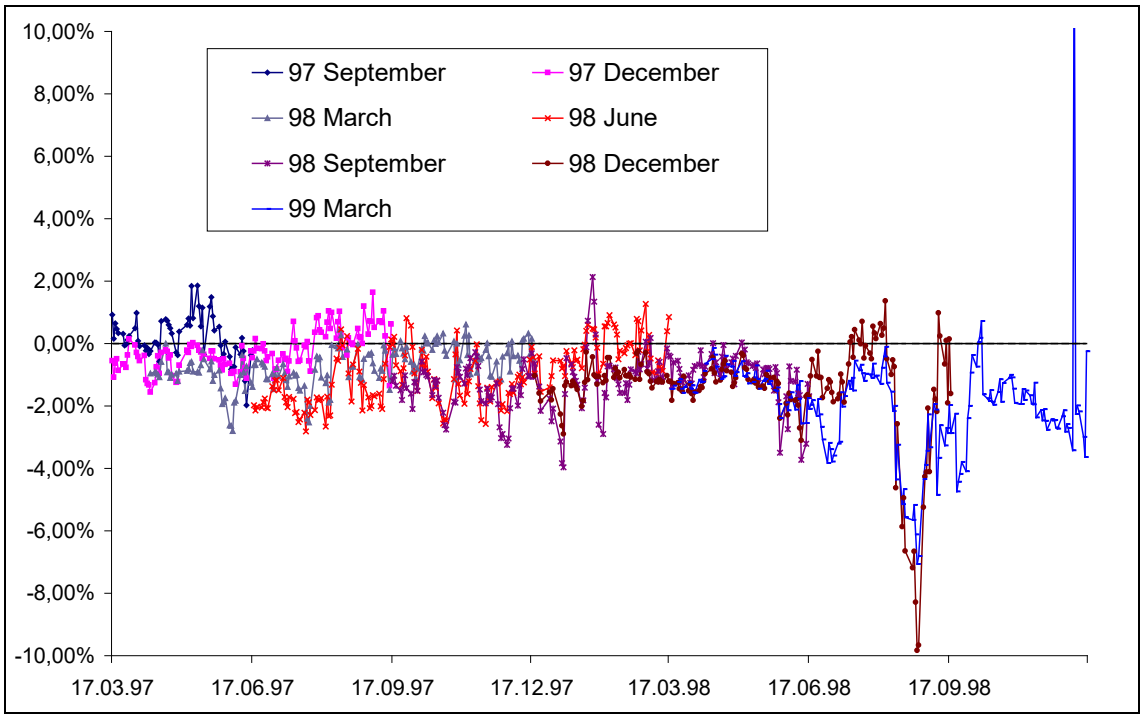


3 Since there are no official quotes for T-bill yields with (remaining) maturity less than 90 days, it is difficult to 'pin down' the short end of the yield curve estimation. Overnight inter-bank rates are too volatile; longer (e.g. one-month) inter-bank rates are not very reliable due to lack of liquidity in the market. See the reference for details.

Therefore we have chosen to test CIP each day for only those futures prices maturing at least 90 days later. As to the foreign interest rates, lack of similar estimates forced us to linearly interpolate the yield curve each day. This has been done using the 3-month, 6 month and 1 year LIBOR interest rates valid on that day. Since in contrast to the situation in Hungary these latter yield curves are almost flat, it is not likely that we lost much information. Figure 4 illustrates the case by plotting both the domestic and foreign yield curves prevailing on 11th July 1997.

Annualizing. It follows from what has been said that upon calculating an ('implied') domestic interest rate from the foreign interest rate and the spot and futures exchange rates (the left-hand side of the CIP formula), this value has to be compared to the domestic interest rate valid that day and for the same maturity. Moreover, during the calculations the foreign interest rate needs to be transformed (geometrically) to the relevant time horizon (157 days in the previous example) so that it is measured consistently with the futures-spot exchange rate spread. The implied yield that follows should then be transformed back to a one-year basis. This is exactly what has been done. Figure 5 plots the daily difference (in the form of implied minus domestic) of the logarithm of annualized implied and domestic interest rates valid on that day for several maturities. Since it may be somewhat difficult to interpret so many graphs in one diagram we also plotted the average of daily deviations as well as the spot Forint within the band in Figure 6.

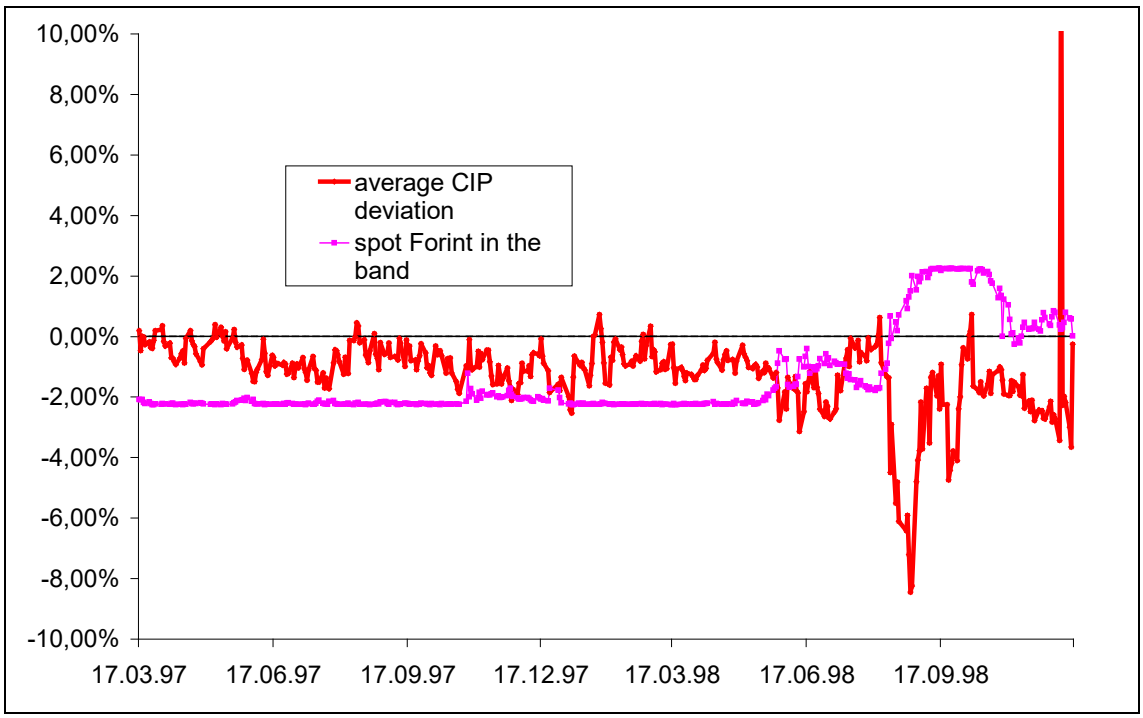
Figure 5:



Discussion. It is apparent that the deviations for all maturities stayed between +3% and -3% except for one occasion during January 1998, and the periods 29th May-10th July 1998 and 13th August-29th September 1998. In the case of the latter period the deviation

is exceptionally pronounced. These results strongly suggest that at least during certain time intervals CIP did not prevail on the BCE futures Forint market. Thus, before further investigating the data it seems reasonable to divide the time-frame into two parts, one ending on the 26th May 1998 (to be referred later as Interval I) the other starting the next trading day, 27th May 1998 (Interval II). We shall be arguing that CIP did prevail for the most part of Interval I (a 'tranquil period'), whereas it definitely and significantly failed during much of Interval II (a 'crisis period'). However, in order to be more explicit about this we need to survey possible explanations of the difference between domestic and implied interest rates.

Figure 6:



The following Table shows the averages and standard deviations of the plotted data for both time intervals as well as for the whole time-frame.

time frame	Interval I (17.03.97-26.05.98)	Interval II (27.05.98-16.12.98)	all (17.03.97-16.12.98)
average	-0.80%	-2.03%	-1.06%
standard deviation	0.82%	2.01%	1.28%

The averages shown capture a fact which is pretty obvious from simply looking at the graphs: namely that the deviations are typically of a negative sign. Indeed, only 13.39% of all deviations is greater then zero. Concentrating firstly on Interval I, what may cause an average deviation of -0.80%? We wish to set aside this question for a while, and further investigate it in the next section. Our reasons are twofold: firstly, the analysis of the

London NDF market will provide valuable insights. Secondly, some of the explanations given will be related to market behavior, expectations and the credibility of the regime, and these issues are to be tackled in Section 5. So imagine for now that the average deviation is somehow taken care of, and turn to the problem of explaining the volatility of the plotted deviations, still focusing on Interval I.

One obvious reason is the role of transactions costs. It is well known that transactions costs provide a neutral band around the domestic interest rate within which no arbitrage is possible. These transactions costs arise when engaging in spot and futures currency transactions as well as when entering the domestic or foreign money market, i.e. buying or selling risk-free securities. During our procedure of annualizing all relevant data the noise stemming from transactions costs was transformed accordingly. It is at least unclear whether this transformation of costs may be justified on economic grounds. One might overcome the difficulty by transforming back the data to the original time horizon. However, other factors explaining the average deviation from CIP (see below) are more properly measured on a fixed time-horizon, e.g. one year. Upon transforming back the data these factors would lose their exact meaning and would be equally difficult to handle. Thus we decided to keep all data measured on one fixed time-horizon (1 year), so that at least inter-day comparability is preserved.

It is still worth noting that Frenkel-Levich (1975) estimated transactions costs between USD, GBP and DM 3-month interest arbitrage to be around 0.15%. On a one year basis this accounts for a spread around the domestic interest rate of plus-minus 0.6%. During Interval I such a band around the average deviation (=-0.80%) explains only 59.02% of the calculated data. However transactions costs in Hungary may well be higher. For example a (plus-minus) 1% transactions cost on a one-year basis explains 79.22% of the data during Interval I.

Furthermore, and this refers to the average deviation as well, data and measurement errors can have significant effects. We used yield curve estimations. All exchange rates applied were closing prices which may differ from daytime trading prices. As to the size and sign of these effects we have no information. However, the data for Interval I seem to be consistent, suggesting that CIP prevailed during most of Interval I, or even if it did not, the extent of failure was small. It is indeed unlikely that large unexploded profit opportunities existed for such a long time. Therefore it seems reasonable to use Interval I for comparison when analyzing Interval II, where significantly more turbulent behavior is observed.

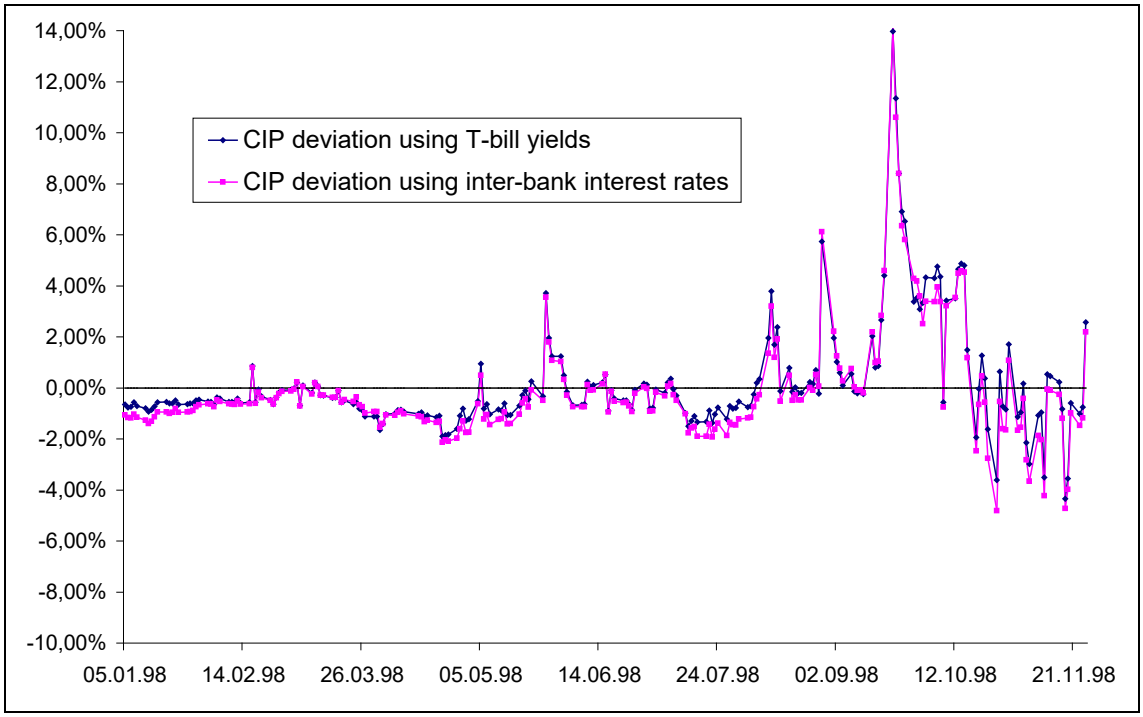
We now turn to examine the data of Interval II. It seems apparent from Figure 6 that CIP deviations were correlated with the movements of the spot exchange rate within the band. Not much more is left to be said; the comparison with Interval I implies in a straightforward manner that CIP did fail during our second period, most notably during June and from mid-August until the end of September, with deviations sometimes as large as 10%. There is one day (8th December 1998) when CIP again definitely failed, but on this occasion the deviation has a positive sign. As to the June (parliamentary elections) and August-September (Russian crisis) periods there exists an explanation: during these periods of weak Forint daily closing futures prices (which determine mar-

gin accounts) were manipulated by brokers to avoid losses and possible default of their customers. This issue will be more thoroughly investigated in Section 5.2; the conclusion that CIP failed for much of Interval II suffices for now.

The London market. Next we shall be testing CIP on the London NDF Forint and Zloty market. This is a considerably easier issue since, as it has been pointed out, 3-month forward currency contracts are quoted each trading day. Therefore it is most easy to calculate the implied rates, no maturity-transformation is necessary. The time period to be considered is 5th January - 25th November 1998.

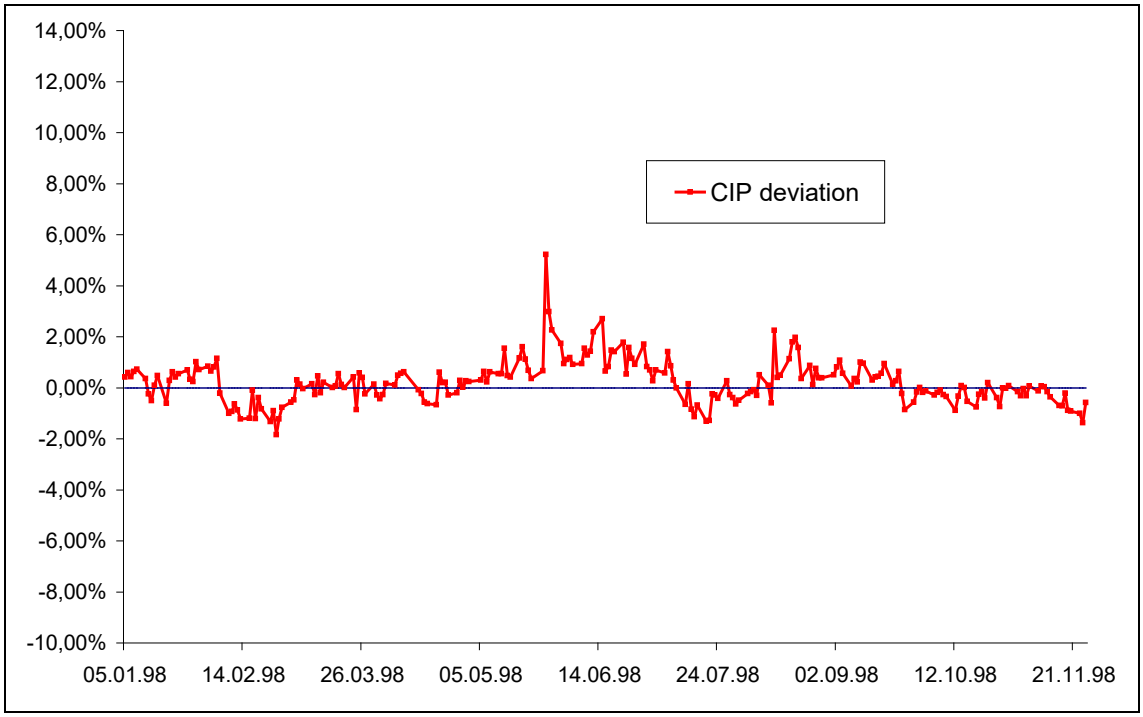
As to the data: the USD interest rates applied were daily closing quotes of 3-month LIBOR rates. The domestic interest rates used were 3-month inter-bank rates. The reason for choosing these latter rates is simple: for Poland, no daily data on Treasury bill yields was available. One might have applied inter-bank rates throughout the previous test (of the BCE) in order to be consistent, however there was no corresponding yield curve estimate based on these rates. Thus there was a trade-off as to whether apply the available estimates at the price of some inconsistency, or stick to inter-bank-rates and (e.g.) linearly interpolate. We have chosen the former approach. Nevertheless all calculations to follow have also been delivered using T-bill yields (for the Forint) and all corresponding results are reported. It shall be apparent that the difference is indeed minor, suggesting that we have not lost much information, if any. In the case of the Zloty an average of the (log of) daily ask and bid interest rates, for the Forint daily closing BUBOR rates have been made use of. The spot and futures exchange rates were those quoted at the London NDF.

Figure 7:



After computing the left and right side of our formula, that is the implied and domestic rates, we (geometrically) annualized the results from their 3-month time horizon, and calculated the difference between their logarithms. This difference (in the form of implied minus domestic) for the Forint and the Zloty is plotted on Figures 7 and 8 respectively. As to the Forint, it again seems plausible to divide the time-frame into two intervals separated by the 26th May 1998. Indeed, the deviation exhibits rather conservative behavior before, and some wild fluctuations appear after that day, the latter being most pronounced during August and September. It is also visible from the graphs that the difference upon applying Treasury-bill yields or BUBOR interest rates is not very significant relative to the size of the deviation, although results of the former approach are typically somewhat higher.

Figure 8:



The following Table reports the average and standard deviation of the plotted values (in the case of the Forint the results calculated using T-bill yields appear in parenthesis) for the sub-intervals as well as for the whole time frame for both currencies.

time frame	Interval I'		Interval II'		all	
currency	Forint	Zloty	Forint	Zloty	Forint	Zloty
average	-0.82% (-0.64%)	0.08%	0.39% (0.70%)	0.32%	-0.73% (-0.53%)	0.22%
standard deviation	0.75% (0.68%)	0.65%	2.70% (2.61%)	0.96%	0.75% (0.68%)	0.85%

Note that the notation Interval I' (similarly Interval II') refers to a sub-period of Interval I (Interval II) studied earlier, since the examined time horizon is shorter now. However the day separating these intervals (26th May 1998) is the same in both cases.

As to the Forint the results for Interval I', a more tranquil period, are broadly consistent with those obtained for Interval I when concentrating on the BCE market. In contrast, during Interval II' the sign of the large deviations in August and September visible from the graphs is positive, whereas our earlier analysis of CIP on the BCE resulted in deviations of similar size but of opposite sign for Interval II. This fact is indeed striking, and later we shall be examining it more thoroughly. Here it suffices to conclude that CIP prevailed for most of Interval I' with only relatively small deviations, and definitely failed for much of Interval II', especially during the Russian crisis.

Turning to the case of the Zloty, two interesting issues arise. Firstly, the average deviation for Interval I' is almost nil, and for the whole period slightly positive, in sharp contrast with our results for the Forint in each exchange. This fact deserves further attention. Secondly, the data for Interval II' are only slightly more volatile than those for Interval I'. One might deduce that apart from a few occasions CIP prevailed for the whole time frame.

We are now left at explaining the observed differences between the behavior of the Forint and Zloty futures rates, as well as the disparity in the sign of the deviations for the Forint NDF and BCE markets. This is the subject of the next section.

5 Puzzles and Credibility

We start this section by more closely examining some of the puzzles revealed in the previous one. Conclusions about market expectations are to emerge from the study. The puzzles under consideration are:

(a) The difference between the averages of CIP deviations for the Forint and the Zloty during the tranquil period.

(b) The difference between the behavior of these deviations for the second time interval, with much more turbulent behavior exhibited by the Forint.

(c) The different sign of deviations for the Forint on the two markets during August-September 1998.

We shall proceed in this order.

Market Behavior During Tranquil Times

As to the first issue. Remember that for now we are concentrating on the tranquil period. The result that Forint produced typically negative deviations during that time seems to be robust in the sense that it does not depend on the market studied. However, such consistency may stem from a consistent misspecification of interest rates. Observe that the

foreign rates applied were numerically the same in each case, and as to the domestic rate inter-bank quotes have been used for the London NDF market for both countries. (With T-bill rates for Hungary producing qualitatively the same result). So, assuming perfect capital markets, any such misspecification must be caused by some difference between the structure or risking of inter-bank rates in the two countries. This explanation seems to be unlikely. It is also possible that there is a country specific default risk attached to the pricing of forward contracts. We do not believe that there was such a difference between the countries under consideration in terms of default risk.

If the assumption of perfect capital markets is relaxed, then market imperfections such as liquidity effects may also lead to consistent mispricing. Indeed, suppose that the demand and supply elasticity's on the market are less than infinite; in other words, that price is not independent of the trading volume. In such a situation, significant one-sided market pressure may result in systematic deviations from equilibrium. Assume that typical actors on the exchange take long positions in futures Forint against basket currencies, and that their demand is high. This assumption has some relevance as to the BCE futures market. The finiteness of elasticity's implies that the price of futures Forint measured in USD increases ($f_{t,t+k}$ decreases). Therefore the implied interest rate, captured by the left hand side of our formula for CIP decreases, so the plotted deviation (implied minus domestic) decreases. If this hypothesis is responsible for a proportion of the average negative deviation, one conclusion is apparent: such market behavior was less typical for the Zloty futures exchange.

In this situation the interest rates applied may also be incorrect in another way. Suppose again that a typical actor in the futures market is small, and takes a long position in Forint against basket currencies (with banks taking the corresponding short position). Had the futures market not existed, the composite transaction required for her to duplicate this position would have two additional costs: One is that being small, she would only be able to borrow basket currencies at higher than LIBOR interest rates, the other is that investing in treasury bills also has a lump-sum transaction cost which may be relevant on that scale. Moreover, a proportion of the average deviation may simply be bankers' profit: they take the short position in Forint and hedge it through CIP, arbitraging the spread between implied and T-bill yields.

The time is right now to more thoroughly examine typical market behavior in the BCE Forint futures exchange. First of all, the assumption of small actors going long in Forint is consistent with our results. In the following we shall see that this assumption is also supported by sounder reasons. It has been observed that until May 1998 the Forint stayed at the strong side of the band for most of the existence of the regime. Construct now a basket of futures exchange rates (for the same maturity) according to the basket of the Forint, and call the resulting price process measured in Forint the futures basket exchange rate. It turns out (see Figures 9-10), that the BCE futures basket exchange rate was almost always weaker then the strong side of the projected band. This latter term here means the band expected to be valid on the date of maturity if the crawling regime prevails and the crawl is determined by NBH announcements up to now. More formally (in the logarithmic sense):

$$\left(c(t) + w(t, t+k)\right) \pm b \qquad (6)$$

Figure 9:

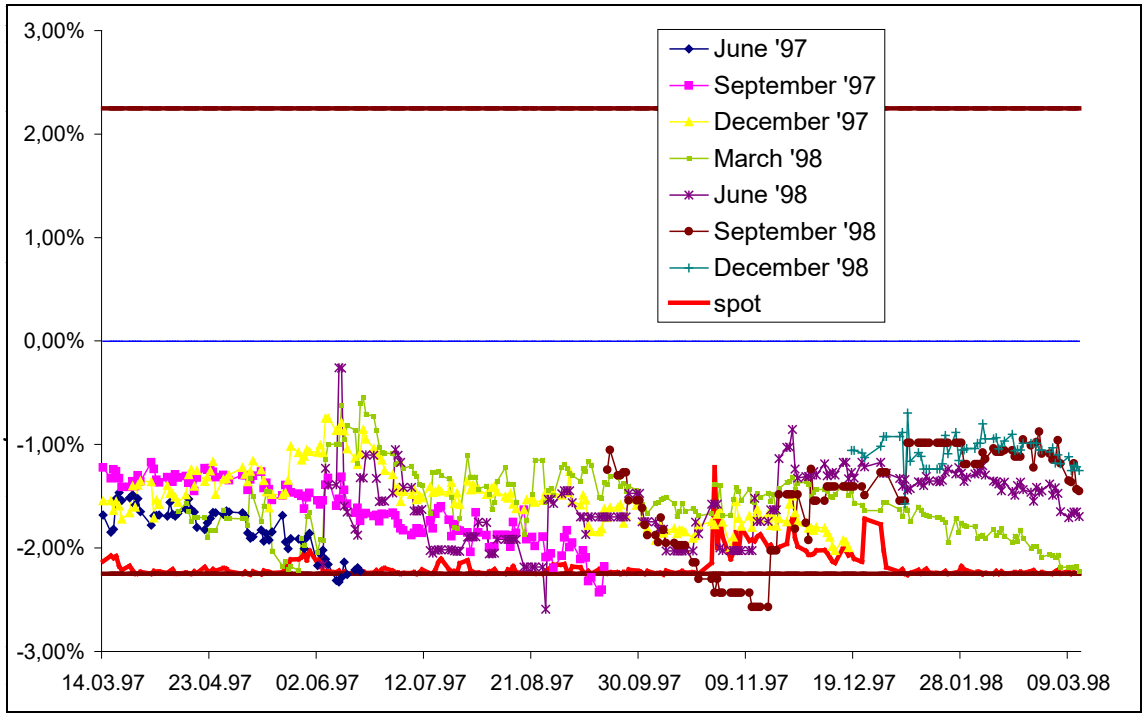
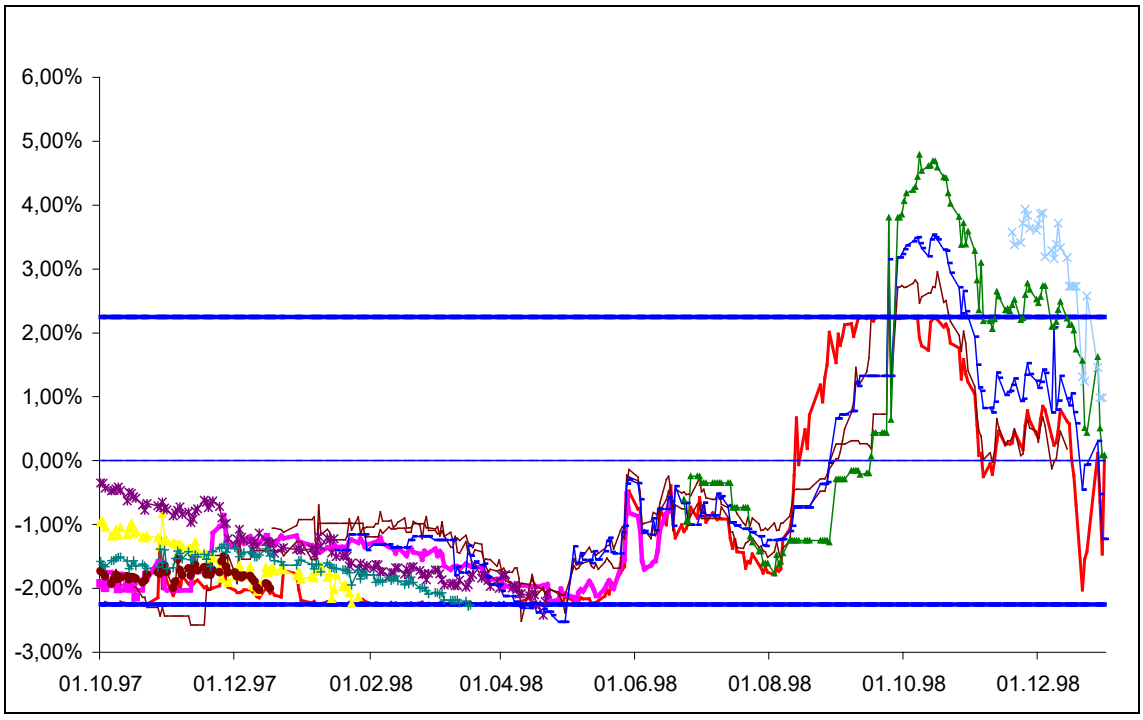


Figure 10:



In this situation, banks going short in futures Forint must have been aware that should the exchange rate remain on the strong side of the band, their marginal positions are to gradually worsen. So a continuous refillment is necessary, and to the extent this refillment is to be delivered in cash they have additional costs. If these costs are taken into consideration upon pricing then somewhat stronger futures Forint prices result in, pushing the implied interest rates as well as the (plotted) deviations downward. In the literature of arbitrage-based derivative pricing this phenomenon is referred to as the 'futures-forward spread'. It stems from the different structure of futures and forward contracts, i.e. the required marking to the market in the case of the former. For details see Karatzas-Shreve (1998), pp. 43-47. or Campbell-Lo-MacKinley (1997), pp. 458-461.

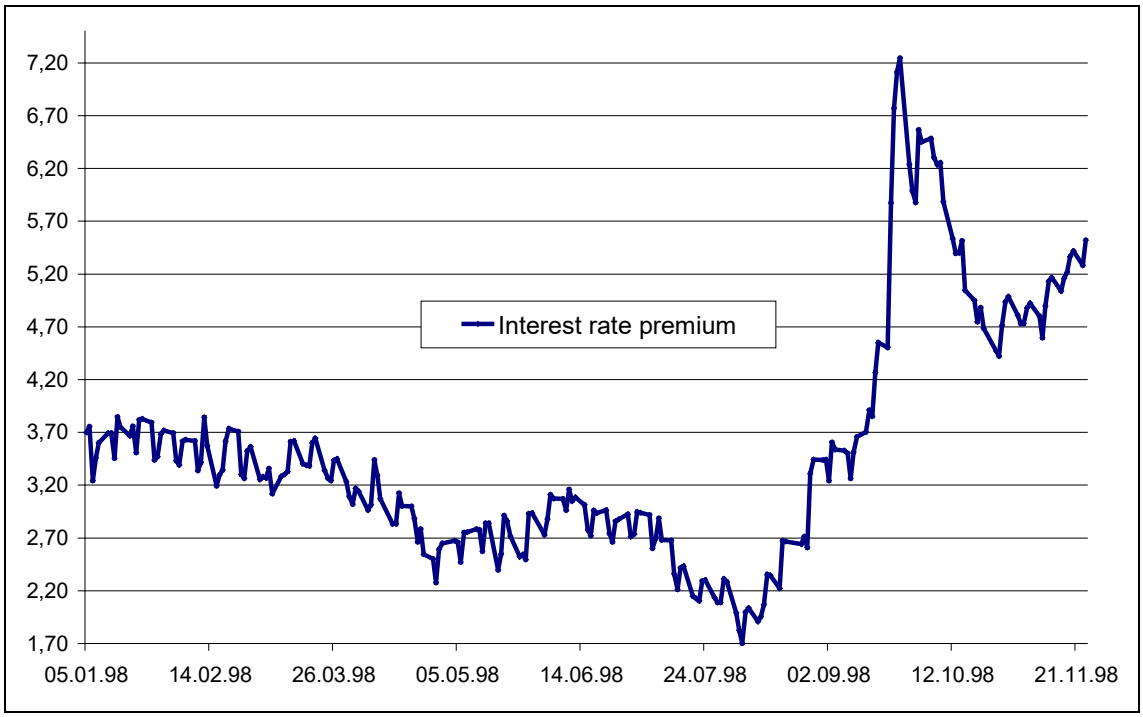
In our view at least on the BCE futures market the average deviations are to a large extent explained by the consequences of market behavior. However, we do not know whether this behavior was also typical on the London NDF Forint market. Even so, the two Forint exchanges may well be interlinked, and systematic deviations on one market may spread to the other one. The basic channel is arbitrage: there are trading days when certain prices on the two exchanges are directly comparable. It is also possible that some larger actors (e.g. Citibank, Deutsche Bank, Creditanstalt etc.) are present on both markets and they use the same valuation method on either exchange. The fact that this behavior is atypical of the Zloty futures market may be explained in the following way: Firstly, the exchange rate of the Zloty was more volatile within its band than that of the Forint, therefore profit opportunities were somewhat riskier. Secondly, the basket for the Zloty consists of five currencies, so it is technically more difficult and also more costly to construct a basket futures rate.

Now, the behavior of market participants on the BCE outlined so far leads us in a straightforward manner to the conclusion that the regime was credible. Indeed, it has been seen that the exchange rate was expected to remain on the strong side of the band. Even more, this expectation was the source of extensive speculation in favor of the Forint, thereby reinforcing the strength of the currency. We are dealing with a typical example of self-fulfilling expectations. Note that we are not questioning whether these expectations were fundamentally unjustified; however their self-strengthening nature is apparent.

Still focusing on the tranquil period, we wish to push our point on the credibility of the regime somewhat further. To do so, we need a convenient measure of the profit opportunities incorporated in basket speculation. Modulo the observed deviations from CIP, the interest rate differential minus projected crawl is a perfect nominee. Furthermore it also measures the profits international investors realize on LIBOR rates when they invest in Hungarian T-bills instead. Therefore, for each trading day we calculated (the log of) a geometrically weighted basket interest rate from 3-month USD and DM LIBOR interest rates, and subtracted from it the accordingly transformed 3-month domestic T-bill yield (i) as well as the projected crawl valid for the 90 days under consideration ($dw\{t\}/dt$). This latter term is based on NBH announcements on the crawl. The results have then been annualized and are shown in Figure 11. In the sequel we shall address such a value as the '3-month interest rate premium' valid for that day. Although the

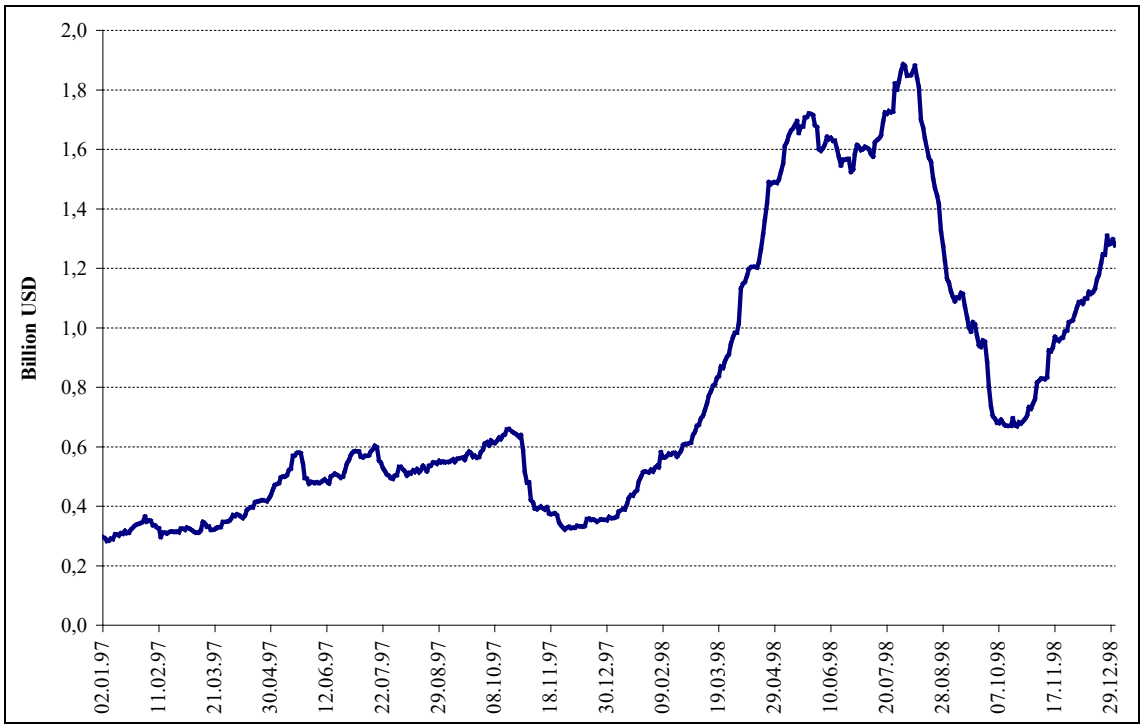
curve in the figure is rather volatile, it is obvious that during the period January-late April 1998 the plotted interest rate premium was gradually decreasing, from 3.75% in early January to 2.5% in late April. So we might conclude that the profit opportunities significantly decreased.

Figure 11:



However, observe from Figure 3 that the amount of open futures contracts in basket currencies on the BCE was almost constantly increasing from early 1997 until August 1998 (there is a slight decline associated with the Asian crisis). This tendency was exceptionally pronounced in January-April 1998. As Figure 12 shows, during that latter period there was an equally rapid increase in the volume of government securities owned by non-resident investors. Either phenomenon may be explained by (re)gaining investor trust after the Asian crisis, both on behalf of domestic and foreign investors. They can not be explained, as we have seen, by increased profit opportunities. Quite the contrary, it is possible that growing interest in Hungarian Treasury-bills pushed their prices upward, thereby reducing their yields. And there is one more degree of freedom which we have not taken care of so far: the width of the band. Indeed, it has been implicitly assumed that the bandwidth was expected to remain constant. However, if the market expected a widening, and Forint to strengthen accordingly to the strong side of the new band, then increased speculation in favor of the currency is justified, even though it is not visible from our diagram. Such an expectation may be based upon the experience in Poland: the band of the Zloty was widened from plus-minus 7% to plus-minus 10% on 25th February 1998.

Figure 12:



Also, having another look at Figures 1, 11 and 12 demonstrates a similar synchronous movement during mid-July. Following the above reasoning one might deduce that after the parliamentary elections band-widening expectations again played a role in market decisions. Indeed, the hypothesis that these expectations were the driving force behind part of the increased speculation during the second quarter of 1998 is not contradictory to some article's appearing in daily economic newspapers that time (e.g. Napi Gazdaság, 21. July 1998).

Band-widening expectations can also affect the decisions of export-import companies. Fears of an appreciating Forint might have led such companies to hedge currency-risk through the futures or forward market even if they had not done so earlier, having predicted Forint to remain at the strong side of the (unchanged) band. In this case increased demand for long Forint positions again pushes the CIP deviations in the desired direction. We feel that this explanation may have some relevance as to the London NDF market.

Summing up, our analysis of the average deviations from CIP in the Forint and Zloty futures markets led to two conclusions: the Hungarian crawling band was extremely credible during the tranquil period in the sense that there were no fears of depreciation. On the other hand, there were some appreciation expectations. We now turn to the other puzzles.

Contagion in Hungary

As to {b}, there is a straightforward answer. During the Russian crisis the credibility of the Forint exchange rate regime was questioned; that of the Zloty was not, or only to a much lesser extent. The latter statement is easier to justify: the Zloty exchange rate never even reached the weak side of its (wide compared to the Forint) band, even though within-band depreciation was more then 10% during the crisis days. In contrast, in Hungary the Forint did reach the weak side of its much narrower band and did stay there for quite a while. However we wish to produce some sounder reasons indicating that the credibility of the regime was less pronounced then during the tranquil period. To do so, some measurement of credibility is necessary. Moreover, a closer look at the economic events associated with exchange rate behavior during that period in Hungary will also prove to be helpful. It will turn out, not very surprisingly, that puzzle {c}, i.e. the failure of CIP is also closely related to this issue. We begin with a short summary of the events.

During the period of parliamentary elections (June 1998), the Forint slightly depreciated within the band. This was followed by an appreciation, but the exchange rate did not return to the strong side of the band (see Figure 1).

The main reason behind the continued weakness of the Forint after the elections must have been the behavior of international capital markets. It was the period of the Russian stock market crisis and devaluation (on 17th August). There was extreme financial pressure on the Russian exchange rate regime, with interest rates peaking at astronomical heights. All stock markets in the region were bearish, indicating investor distrust, indeed, panic. (For the Warsaw and Budapest exchanges see Figures 13-14.) BUX, the Budapest Stock Exchange Index lost about 40% of its late July value (in less then a month!). Strains also spread to exchange rates, eventually leading to the devaluation of the Ukrainian hrivnya on 4th September, and the abandonment of the band for the Slovakian Koruna on 1st October.

However, central bank policy could have significantly contributed to the observed currency weakness. The NBH reduced interest rates significantly in late July and early August, and it was followed by a corresponding decrease in T-bill yields (see Figure 15). According to daily economic newspapers (e.g. Napi Gazdaság, 4. August 1998) markets interpreted this policy as {a}, a recognition of slowing inflation, and {b}, a tool to decrease the interest rate differential, thereby keeping exchange rates more volatile and preventing the country from excessive inflows of 'hot money'.

Figure 13:

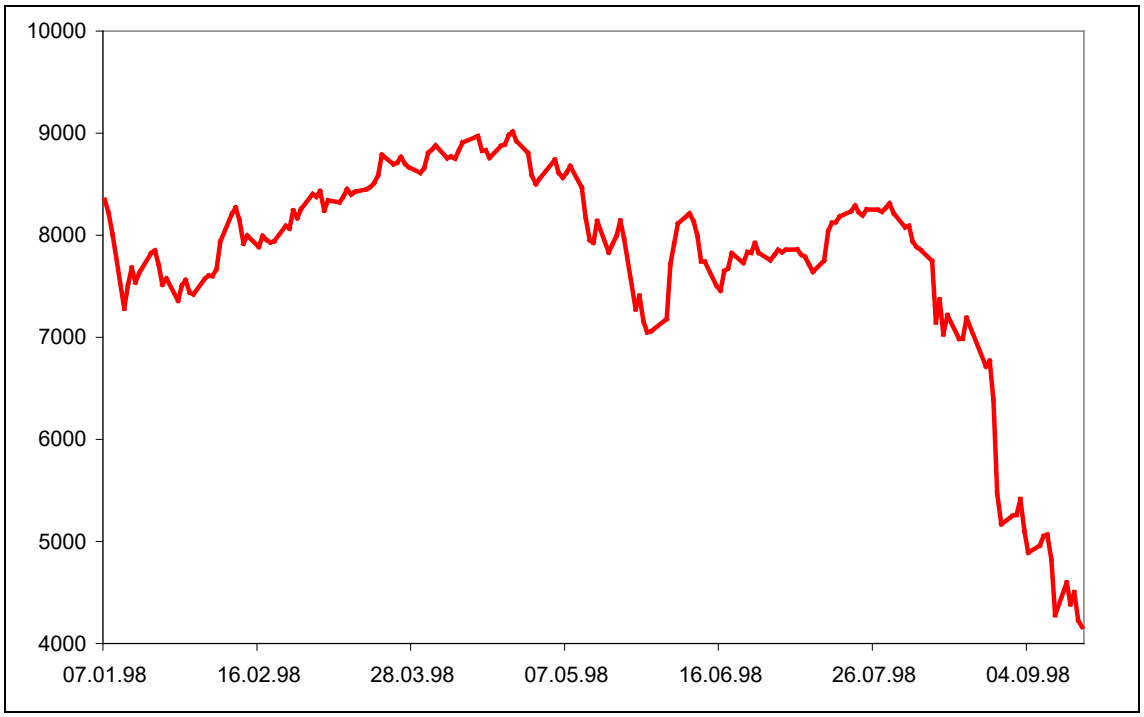
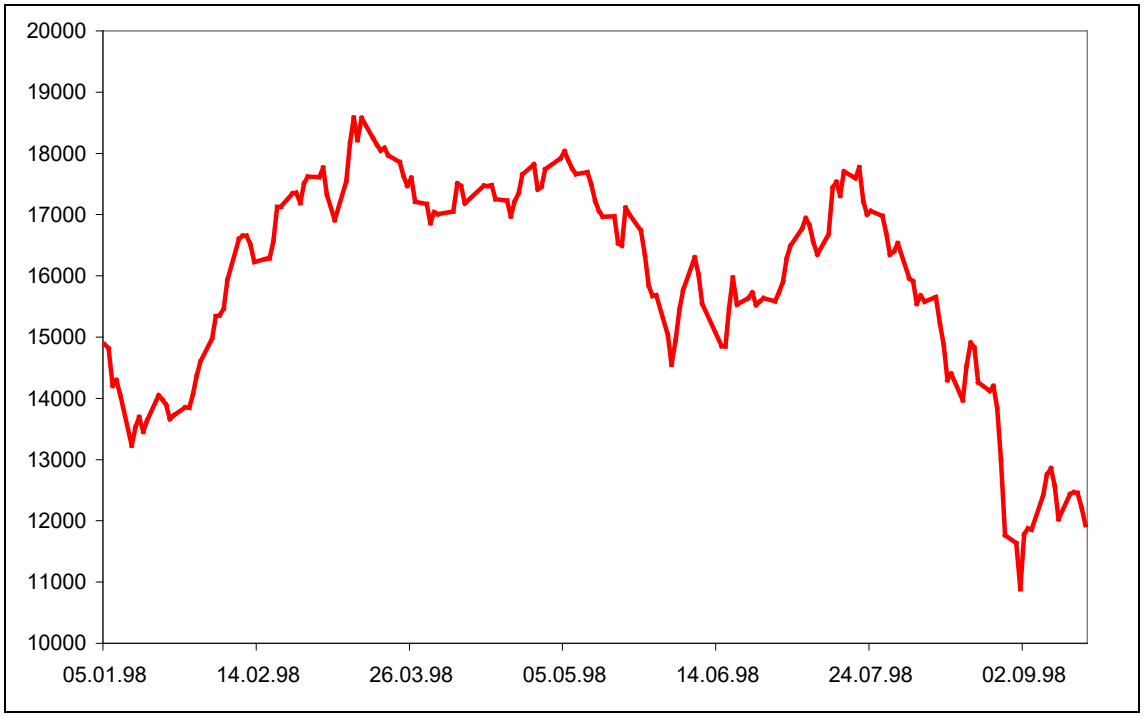


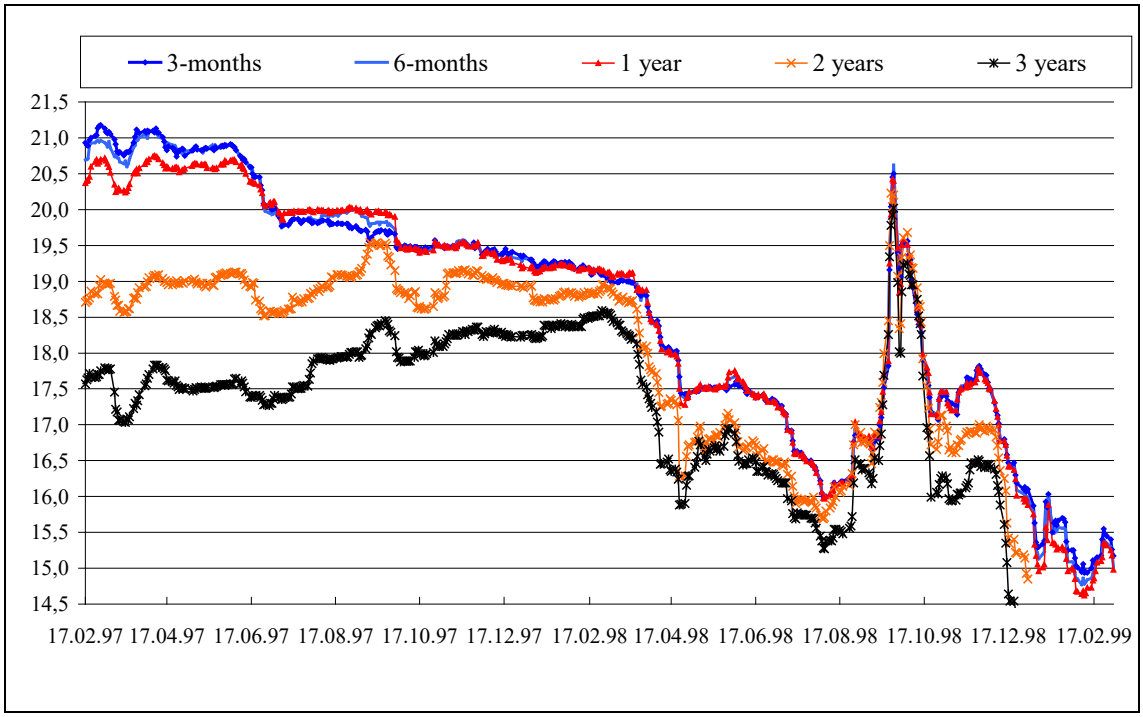
Figure 14:



All in all, the Forint continued to depreciate, but has not reached the weak side of the band until early September. The NBH intervened several times inter-band to support the currency. During September practically the central bank was the only agent to buy For-

int on the market. Figure 16 shows the volume of monthly NBH conversion for the relevant period. The futures exchange rates expiring 16th September were followed by decreasing forint liquidity in the inter-bank market, since banks closing their hedge for short Forint positions (against basket speculators) were buying basket currencies from the central bank. This lack of liquidity was one reason for increasing inter-bank interest rates. However, there was a parallel increase in T-bill yields, starting in mid-August for longer maturities and reaching its peak in a rapid run-up during the third week of September. Again, the central bank might have been responsible for part of this happening, since there were announcements on possible monetary tightening to defend the currency if necessary (see Figure 15). And indeed, in mid-September the NBH was forced to raise interest rates with 1 percentage point.

Figure 15:



During October the pressure on forint eased, T-bill yields decreased, and the exchange rate left the weak side of the band, albeit did not immediately return to the strong side, and has been quite volatile ever since.

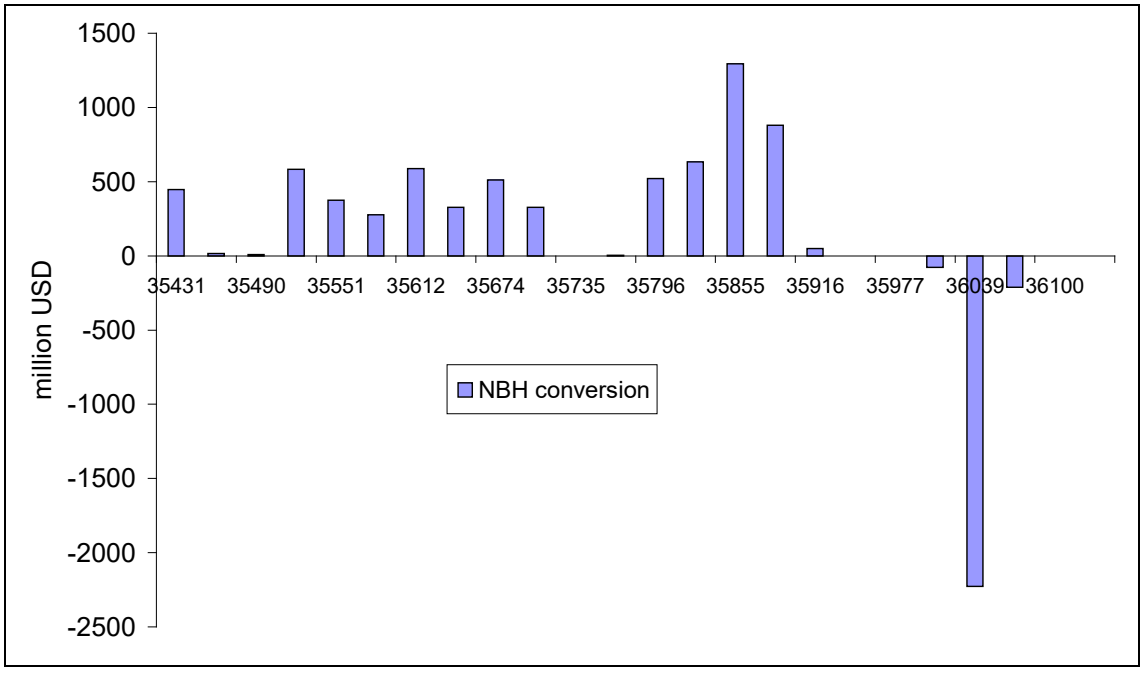
This is the story in short. From now on, we intend to understand on a deeper level what was actually happening, whether these events should be interpreted as a fall in the credibility of the Hungarian exchange rate regime, and if so, how serious.

At a quick glance, it seems that several components of a speculative attack were present. After all, the NBH had to defend the currency, treasury-bill yields significantly increased, and there was a parallel stock-market crash. It could have been a typical contagion crisis. However, a closer examination of the expectations of market participants

will reveal a more subtle picture. Puzzle {c} will turn out to be an efficient tool to deduce conclusions about these expectations, in a manner not entirely dissimilar to that seen in Section 5.1. It seems reasonable to start with some measure of credibility.

A classical method is the 'simple test' first proposed by Svensson in Svensson (1991). According to this method, one should plot for each trading day the futures exchange rate and the projected band expected to be valid upon maturity. Assuming full credibility a simple arbitrage argument convinces us that the former should lie within the area determined by the latter. Such graphs for the BCE basket futures prices have already been considered in the previous section from a different point of view (Figures 9-10). Taking yet another look at them indicates that according to Svensson's simple test the Hungarian regime failed to be perfectly credible for a period starting in mid-September, 1998.

Figure 16:



The application of Svensson's test raises two interesting issues. Firstly, failure in credibility according to this test means imperfect credibility in the sense that market actors attach positive probability to a possible realignment. The test per se does not measure quantitatively this probability. Moreover, the no-arbitrage argument which forms the basis of the test may be questioned when market imperfections are present. Nevertheless, as it is pointed out in Garber-Svensson (1995): 'the assumption of perfect credibility is clearly rejected for most exchange rate target zones and most sample periods'. Using this comparison one may deduce that during the tranquil period the Hungarian regime was exceptionally credible, a conclusion which does not contradict our earlier analysis.

Secondly, the applied futures prices may be misleading since they do not behave in accordance with the CIP condition. Upon applying CIP-determined forward prices, weaker

then BCE contracts in Forint terms during the crisis period, one might, using the simple test, deduce the presence of imperfect credibility starting somewhat earlier. In order to form a clear view as to which method captures reality better, we now try to explain why CIP failed for the BCE futures market during the period.

It turns out that as late as August the basket speculation in favor of the Forint was continuing. According to NBH estimates (see Report on Inflation), long Forint positions of the size of tens of billions of Forint were opened during that month[4]. The speculators, using their recipe that has been consistently fruitful in earlier times, opened futures short positions in basket currencies expecting the exchange rate to return to the strong side. Banks comfortably took the corresponding long positions hedging their risks by selling foreign currency and investing in the Hungarian T-bill market (note that this is in fact the basis for CIP), probably arbitraging a small interest premium between implied and T-bill yields. The exchange rate did not return to the strong side, quite the contrary, and in the process of marking to the market basket speculators were forced to refill their margin accounts. Since there was high default risk on speculators, brokers acting on the futures market began to manipulate daily closing prices (which determine margin accounts). This is the reason for the observed large negative deviations from CIP in the period: Intra-day trading was, correctly, determined by covered interest rate parity, whereas the closing rates were considerably stronger in Forint terms than they should have been.

The rationale behind brokers' actions is explained by the structure of organized trading on the exchange. Consider the following example: A basket speculator wishes to open a long Forint position. She contacts her brokerage firm, and that in turn opens a contract with the exchange. Now imagine that the spot, and accordingly the futures Forint exchange rate substantially weakens. Then the client has to refill her margin account, otherwise the brokerage firm is forced to close the position. Imagine further that the client is unable to refill her account. She is then equally unable to pay the losses which result from closing the position at a weaker rate: in other words she defaults. Nevertheless, the brokerage firm has to stand for its contract with the exchange, and thus the debt burden of the client is transferred to the firm.

If closing rates are manipulated to be stronger than they should be according to CIP (say by some small contracts at the end of each day), in fact strong enough in order not to melt margin accounts, then default on the part of the basket speculator is not immediate. However, upon maturity the futures rate is determined by the spot rate, so manipulation can not go on forever. Suppose that there are two possible outcomes: *{a}* The spot exchange rate strengthens back to the strong side of the band before maturity. Should this be so, the futures rate also strengthens, manipulation is no longer necessary, and the speculator is able to close the position without default. Thus the manipulation of the traders is justified in the sense that at a small cost (the contracts at the end of the day)

4 The estimates are obtained from comparing the change in the Forint value of Hungarian Treasury-bills owned by non-residents during August and exchange-rate sensitive currency outflow valid for that month. See the reference, pp. 26-27 for details.

they avoided losses which would have otherwise been inevitable. *{b}* The spot exchange rate remains weak up to and including the date of maturity. In that case the client (in practice some of the clients) defaults, causing losses to the brokerage firm. However, without manipulation these losses would have equally hit the firm. So in any case manipulation causes no further harm, and it may have some advantages.

Since basket speculation was very typical of the BCE market, the above example captures well the truth. Similar behavior is sometimes referred to in the economic literature as 'asset substitution effect'. In our situation it may well be considered unethical, and the BCE set up a board to investigate the issue and if possible prevent further manipulation in the future.

Supposing that all what has been said is correct, what conclusions can be drawn upon the expectations of market participants? On the part of basket speculators the answer is easy: at least during August, and probably even later on they expected the band to prevail and the Forint to return to the strong side sooner or later. Indeed, there were rumors a few days before the expiration of the September 1998 futures about possible central bank intervention to strengthen the Forint for one day in order to help speculators avoid their losses.

The expectations of the brokers manipulating futures rates is a more ambiguous issue. It seems reasonable that they were hoping for an appreciating Forint so that their clients would not default. But even if they gave only a slight chance to that as opposed to a large chance of the abandonment of the band (for example), their actions were perfectly rational.

Summing up, we see that using the BCE futures rates when applying the simple test was indeed misleading in some sense, however the fact that it was misleading made it possible to draw conclusions about the expectations of some actors. Indeed, it seems to be a good idea to partition the agents present in the market and to study their behavior separately. We propose that there were two groups with basically different objectives and behavior acting in Hungarian exchange markets during that time. This may be a serious simplification, degrading the analysis that follows to a purely speculative level, but as the previous example shows it may also turn out to be helpful. The first group shall be called international portfolio-investors, the second basket speculators, the case of whom has already been examined.

Thus we now turn to the first group. During and following the Russian crisis there was extreme investor distrust in the region on the part of international investors. Raising fears of yet another emerging market crisis forced them to try to realize their profits and flee. This phenomenon accounts for rapidly falling stock prices. Foreign presence in the Budapest Stock Exchange during that period was estimated to be around 60%. It should be noted, that with such extensive foreign participation international investors could not simultaneously exit, the domestic demand for their equity being insufficient. This fact might explain the extremely large price decreases in the Budapest Stock Exchange compared to other markets in the region.

In the T-bill market yields started to increase in mid-August. Figure 12, plotting the volume of Hungarian government securities owned by non-residents indicates extensive selling. Although no comparative estimates are available, it seems probable that exit from the T-bill market was significantly more pronounced then that from the stock exchange. Indeed, unless portfolio investors expected a very unfavorable economic scenario to follow, or were forced by clients, there was no reason for selling their stocks at such immensely depressed prices. One may also wish to distinguish between those non-residents investing in the T-bill and in the stock market, the former being probably more risk-averse institutions such as pension funds, fleeing at the first sight of danger.

In short, there was investor distrust towards the whole of the region, including Hungary. Such a distrust is naturally associated with a fall in the credibility of the regime. From this point of view the observed positive deviations from CIP on the London NDF Forint market may be interpreted easily. Positive deviations mean higher-then-domestic implied interest rates. It is quite possible that during that crisis period the implied interest rates of the London market mirrored well the expectations of international investors, better then T-bill yields, and consequently the methodology developed in the first part of Section 3 may have some relevance here. Accepting for a while that implied interest rates are more appropriate to use as domestic rates in this situation, recall our formula for the interest rate differential:

Increased implied rates mean an increase in the left-hand side of the formula. Since the currency is on the weak side of the band, the value of expected within-band depreciation (*Edx(t)/dt*) has to be negative. Therefore an increased left-hand side has to be interpreted either as a rise in the premium term or as increased realignment (depreciation) expectations, possibly both. We are prevented from delivering the exact calculations since to do so it would be necessary to have basket implied rates; unfortunately we do not have data on DM-Forint forward prices of the London NDF market. However the tendencies are obvious. To the extent that this substitution of implied rates into the formula is correct we observe a fall in the credibility of the regime (an increased premium term has to mean higher default risk which is obviously related to credibility).

$$i(t) - i^*(t) = Edx(t)/dt + dw(t)/dt + Edz(t)/dt + P(t) \qquad (7)$$

In line with our reasoning in Section 3, before settling on the conclusion it is worth having a closer look at possible market imperfections. Even more so, as the argument above was based on one such imperfection. First of all it should be noted, that the investor exit outlined before accounts for increased demand for foreign currency and supply of Forint. If the corresponding demand and supply elasticity's are less then infinite, then this fact may seriously contribute to the weakening of the exchange rate. Such a weakening might properly be described as the effect of transactional, rather then speculative money demand. A good proxy as to the size of this effect on the exchange rate may be the percentage depreciation of the Polish Zloty during the period. We have already noted that the credibility of the Zloty band was probably questioned only to a lesser extent; nevertheless there was a depreciation of more then 10% against the basket, likely due to similar transactional money demand.

In this situation it is difficult to tell which explanation captures reality. A safe solution would be that probably both. It is not questionable that international investors had some doubts about the sustainability of the crawling band. However it is quite possible that they were more concerned about realizing possible profits and avoiding further losses, and did not speculate directly against the Forint. So even if the credibility of the band was questioned, there was no speculative attack or the like.

A very good reason supporting this latter statement is the fact that the regime still prevails. It is not unrealistic to assume that international capital could have forced a successful speculative attack against the Forint, or for that matter any other similar regime in a small open economy. However there are costs of such an attack, and these may raise the question whether the success is worth the price. The existing capital controls in the country impose one such cost, by producing some difficulties as to the technical accomplishment of the attack. Moreover the relatively high ratio of reserves and the sound financial system compared to other countries in the region (see Árvai-Vincze (1999)) also indicate that Hungary is less vulnerable to a crisis then some of its neighbors. As to the fundamentals one may draw a similar conclusion based on the above reference, which actually very thoroughly investigates the issue we are now at. Without further justification we wish to express here our view that the crisis Slovakia suffered was a fundamentally justified one, and the fact that Hungary and Poland were harmed only to a lesser extent by the contagion effect is similarly a consequence of healthier fundamentals and financial system.

Summing up, we feel that puzzles {b} and {c} have been more-or-less explained by expectations and market imperfections. It may also be deduced that Hungary experienced a fall in the credibility of the exchange rate regime during the aftermath of the Russian crisis, however the situation was not as dangerous as it might seem. It was not a speculative crisis; transactional money demand and again market imperfections account for much of the observed behavior.

6 Conclusions

In the present paper we analyzed the credibility of the Hungarian crawling band exchange rate regime for the time period April 1997-October 1998. Our basic tool was a careful study of market imperfections. The comparison with the similar regime in Poland often proved to be fruitful. We briefly list here our main conclusions.

1. In a world where markets are less than perfect, information involves costs, capital controls and transactions costs prevail, it can be misleading to directly deduce conclusions concerning the expectations of market participants due to the noise these factors introduce. In particular, for the case of Hungary and Poland, the behavior of the interest rate differential is guided more by monetary policy and less by expectations.

2. However, the analysis of market imperfections may serve as an additional source of information. More precisely, measures of no-arbitrage conditions and their evolution

in time, as well as cross-country comparisons provide a different approach and help overcome some of the difficulties.

3. The observed one-sided deviations from CIP for the Forint during January-early May 1998 can be explained by basket-speculation in favor of the currency, and band-widening expectations (allowing more room for appreciation). Svensson's simple test also shows the regime to be highly credible.

4. During the aftermath of the Russian crisis there was a fall in the credibility of the Hungarian regime, but not, or only to a much lesser extent in that of Poland. Svensson's test and the deviations from CIP on the London NDF market prove this.

5. Nevertheless there was no speculative crisis in Hungary. To see the different expectations of different groups more clearly it is worth partitioning market actors into basket speculators and international investors. During August there was still (basket-) speculation in favor of the Forint. The weakness of the currency as well as the rise in interest rates during August-September are largely explained by transactional money demand on the part of international investors, not direct speculation.

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Moldavia in 1995-1999: Macroeconomic and monetary consequences of fiscal imbalances

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Abstract

After stabilization in 1993 Moldavia maintained an unsustainable macroeconomic policy mix. The key problem was a lack of a fiscal adjustment, which resulted in large budget deficits. At the same time, the National Bank of Moldavia (NBM) was trying to conduct a tight monetary policy. As a result, the exchange rate was appreciating, domestic absorption increasingly exceeded income and the country has been running large Current Account deficits. Moldavia had an access to international financial markets and its indebtedness vs. the rest of the world was growing year by year at an alarming rate. Finally, in late 1998 Moldavia suffered a balance of payments crisis, directly triggered by developments in Russia. Moldavian leu was devalued by about 70% and the current account improved.

The paper concentrates on the empirical dimension of the Moldavian financial crisis. It provides a case study of 1) detecting and interpreting macroeconomic anomalies and 2) identification of early warning signals of policy unsustainability and imminent change of financial market sentiment.

The first part of the paper discusses domestic macroeconomic developments, which corresponded with the current account evolution. It examines determinants of a steady growth of the share of consumption in GDP, and of developments in government and non-government disposable incomes. The turnaround of foreign balance had its counterpart in a significant reduction of the share of consumption and investments in GDP, although, given the economic outlook of Moldavia, investments still remained surprisingly high. Macroeconomic anomalies in Moldavia have their roots in both the fiscal disequilibrium and a too slow progress in enterprise restructuring.

The second part of the paper identifies monetary phenomena generated by macroeconomic imbalances. Initially, the tight monetary policy of the NBM, the resulting stable exchange rate and low inflation contributed to a gradual growth of demand for money and remonetization. However, growing imbalances in the Moldavian economy put sustainability of the exchange rate and price level under question. As a result, demand for lei started to shrink and remonetization reversed itself. Interest rates increased and the NBM foreign reserves started to fall. Because of the uncertainty about the future stability of the leu, people converted much of their deposits into dollars and the Dollarization of deposits reached more than 50%.

The case of Moldavia illustrates dangers faced by a country, which conducts a loose fiscal policy and relies on foreign capital inflows. Prior to the crisis, many macroeconomic indicators, especially in the monetary sphere, had been judged as appropriate. However, a hard monetary stance only postponed manifestation of problems caused by the fiscal imbalance and lack of structural reforms.

Introduction

After stabilization in 1993 Moldavia maintained an unsustainable macroeconomic policy mix. The key problem was a lack of any fiscal adjustment, which resulted in large budget deficits. At the same time, the National Bank of Moldavia (NBM) attempted to conduct a tight monetary policy. For much of the period it refused to extend direct credit's to the government and large deficits were covered by foreign and domestic borrowing. Inflation was curbed and the exchange rate was stable, but the lack of fiscal adjustment and slow structural reforms gave rise to a serious macroeconomic disequilibrium. Domestic absorption increasingly exceeded income and the country has been running large Current Account deficits. Moldavia's indebtedness vs. the rest of the world was growing year by year at an alarming rate. Thus, in the longer term the hard monetary stance only postponed the manifestation of problems caused by the fiscal imbalance and lack of structural reforms.

A current account deficit would be a normal phenomenon in any transition country, which, like Moldavia, needs large capital inflows to finance investments (which are necessarily associated with imports of capital goods). Such deficits are sustainable as long as the long term foreign capital flows in, optimally in the form of Foreign Direct Investments (FDI). However, in Moldavia FDI inflows have been small in relation to the Current Account, and external deficits were financed by contracting a growing and increasingly short term foreign debt. While in the beginning Moldavia borrowed money only from the IMF and other multilateral and bilateral creditors, in 1996 debt on commercial terms started exploding, including issuance of Eurobonds and a 40% foreign participation in the T-bills market in 1997 (see Radziwiłł et al., 1999, for a discussion). Lack of restructurization of the energy sector contributed to increasing arrears in payments for energy related imports.

Finally, in late 1998 Moldavia suffered a balance of payments crisis, directly triggered by developments in Russia. As a result of the crisis, Moldavian leu was devalued by about 70%. Exports proved to be inelastic with respect to the exchange rate, at least in the short term, and in fact they even decreased. However, imports decreased more and the current account improved significantly. This turnaround had its counterpart in a significant reduction of the share of consumption and investments in GDP and other changes of macroeconomic outlook, which will be discussed here.

Devaluation's additionally increased foreign debt in relation to GDP. Growth of the domestic debt (consisting mainly of short term T-bills) provided another instability factor. It is obvious that by 1999 Moldavia was unable to service its obligations without a significant help and cooperation from creditors. However, the increasing unsustainability

of the situation must have been visible already by 1997. Further in this paper, manifestation of this fact in monetary statistics will be discussed.

Table 1:
Fiscal and monetary policy indicators (in lei mn., unless otherwise indicated)

	1993	1994	1995	1996	1997	1998	1999
Fiscal policy							
- Budget Deficit* (cash)	-137	-280	-374	-753	-667	-307	-368
- in % of GDP	-7.5%	-5.9%	-5.8%	-9.7%	-7.5%	-3.4%	-3.0%
- ch.in expenditure arrears (+ increase)	26	110	145	364	-290	510	7
- Budget Deficit (commitment)	-163	-390	-519	-1117	-377	-817	-375
- in % of GDP	-8.9%	-8.2%	-8.0%	-14.3%	-4.2%	-9.0%	-3.1%
Monetary policy							
- change in Monetary Base	191	307	232	67	276	-62	438
- change in MB / GDP	10.5%	6.5%	3.6%	0.9%	3.1%	-0.7%	3.6%
- MB (% growth)	389%	128%	42%	9%	33%	-6%	41%

*Budget deficit excluding grants.

Source: MET, expenditure arrears – IMF.

Table 2:
Exports, Imports, Current Account (USD mn., % of GDP), MDL/USD exchange rate (period average)

	1993	1994	1995	1996	1997	1998	1999
Exports	395	565	746	795	874	632	471
	33%	49%	52%	47%	45%	37%	41%
Imports	530	669	841	1072	1171	1033	568
	44%	58%	58%	63%	60%	61%	50%
CA	-155	-97	-95	-198	-284	-347	-21
	-13%	-8%	-7%	-12%	-15%	-21%	-2%
MDL/USD pa	1.5	4.1	4.5	4.6	4.6	5.4	10.5

Source: MET, CA in 1999 – estimate.

Table 3:
Foreign and domestic debt 1993-1999

	1993	1994	1995	1996	1997	1998	1999
Foreign debt*							
USD mn.	255	633	840	1070	1286	1390	1462
% GDP	21%	55%	58%	63%	66%	82%	129%
Internal debt							
MDL mn.	105	270	477	737	971	1572	1910
% GDP	6%	6%	7%	9%	11%	17%	16%

*Including energy debt.

Source: Ministry of Finance.

The background, course and aftermath of the Moldavian balance of payments crisis has been described in the IMF Country Report (1999) and in CISR Economic Surveys, No. 2-4. Radziwiłł et al. (1999) also provide a broad discussion of the subject, especially comprehensively covering problems of fiscal policy conducted in Moldavia. This paper complements their discussion by developing further two specific issues: evolution of macroeconomic imbalances in Moldavia and a reversal of the initial remonetization process.

The remainder of this paper is organized as follows. The first part discusses domestic macroeconomic developments, which correspond with the current account deficit. Analysis of Saving-Investment balances of the whole economy, government and non-government sector provides a framework for this discussion.

The second part revolves around the issue of monetization of Moldavian economy. Initially, the tight monetary policy of the NBM, and the resulting stable exchange rate and low inflation, contributed to a gradual growth of demand for money and remonetization. Unfortunately, growing imbalances in the Moldavian economy put sustainability of the exchange rate and inflation under question. As a result, demand for lei started shrinking and remonetization reversed itself.

1 Analysis of Savings-Investment Balances in Moldavia

Changes in external statistics have their counterparts in internal developments. The tool to follow the links between the Balance of Payments and domestic macroeconomic developments is the analysis of savings-investment balance. This analysis is conducted for the whole economy and, separately, for the Government and the Non-government sector.

The analysis of savings-investment balances is based on National Accounting data and concepts. The general logic of this approach is based on three rules, which are a matter of definition and necessarily hold ex post:

1. Disposable Income is spent on Consumption and what remains is defined as Savings.

2. Savings finance Investment.

3. When Investment of a sector exceeds the Savings, the difference is covered with Savings of another sector, or with foreign Savings.

Resource balances in Moldavian economy

The following Table presents the summary of aggregates for the whole economy in percent of GDP:

Table 4:
Gross National Disposable Income, Consumption, Savings, Investment and Current Account, Moldavia 1998-1999, in % of GDP

Period	GNDI	C(adj)	S	I (adj)	S-I=CAB
1995	102.6%	84.0%	18.6%	25.2%	-6.6%
1996	107.5%	94.8%	12.7%	24.4%	-11.7%
1997	108.0%	98.8%	9.2%	24.0%	-14.8%
1998	106.8%	100.5%	6.2%	25.8%	-19.6%
1999	112.6%	91.3%	21.3%	23.0%	-1.6%

Source: own calculations.

In the years 1995-1998 current account deteriorated gradually from -6.6% to the startling -19.6% of GDP. The deep deterioration of savings resulted primarily from a steady growth in the share of consumption in GDP by 16.6 percentage points – from 84% in 1995 to 100.5% of GDP in 1998. In the meantime, investments remained relatively stable and high as a share of GDP.

In the last quarter of 1998 the exchange rate crisis exploded and, after a 70% devaluation, the current account deficit shrank rapidly to -1.6% of GDP in 1999 (estimate). In the domestic macroeconomic structure the adjustment came from all main aggregates. Firstly, the share of consumption in GDP was reduced by 9.3% of GDP. Secondly, the disposable income increased in relation to GDP by 6 percentage points. These two developments resulted in an improvement in aggregate savings in relation to GDP by 15 percentage points. Thirdly, the share of investments decreased by 2.8 percentage points. As a result, the savings-investment balance improved by almost 18 percentage points, from -19.6% to -1.6% of GDP.

Evolution of the Consumption Share in GDP

The consumption share was the one, which underwent most dramatic changes: first it grew rapidly and, subsequently, the crisis forced its shrinking. The growth was probably related to real appreciation of the currency and additionally to soft budget constraints in some sectors of the economy, especially in the energy sector. Thus, the underlying cause of the unsustainable path of consumption was the lack of fiscal adjustment and structural reforms.

Table 5:
Total Consumption, Non-Government Consumption and Government Consumption, in % of GDP

Period	C	C_{ng}	C_g
1995	84.0%	56.9%	27.1%
1996	94.8%	67.7%	27.1%
1997	98.8%	71.4%	27.4%
1998	100.5%	75.0%	25.5%
1999	91.3%	72.2%	19.0%

Source: National Account Statistics, after MET, adjusted.

Non-government consumption share was growing steadily from 56.9% of GDP in 1995 until reaching a peak of 75.0% of GDP in 1998. Real consumption growth, probably reinforced by a shift of relative prices in favor of consumption, significantly overcompensated the simultaneous real GDP contraction. The crisis of 1998 forced the reduction of the non-government consumption share by 2.8 percentage points, to 72.2% of GDP. The real reduction amounted to almost 8%.

Table 6:
Real GDP (index), Consumption deflated with the CPI (index)

Period	GDP	Cp
1995	100.0	100.0
1996	92.2	116.0
1997	93.7	125.1
1998	87.6	124.9
1999	83.7	115.5

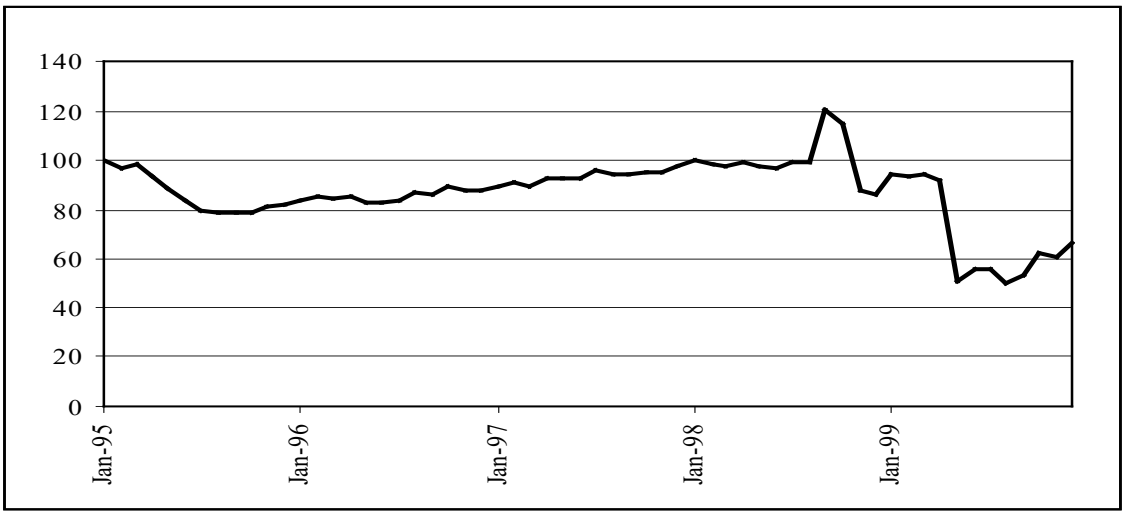
Source: Department of Statistics, MET, own calculations.

Government consumption was much more affected, it fell from 25.5% in 1998 to 19.0% in 1999. Partly, this reflected some attempts of a new government to realign budget expenditures with the revenues. On the other hand, government suddenly faced a hard budget constraint, because borrowing from abroad and on the domestic market became very difficult. The central bank already extended large credit's to save Moldavia from default and further borrowing for budget needs would be too destabilizing and, luckily, was avoided.

Consumption developments were related to the exchange rate evolution. Inflow of increasingly short term capital, used for covering reckless government spending, provided Moldavian market with foreign currency, which prevented depreciation of the leu. Real effective exchange rate (REER) appreciated by 25% between a low in 1995 and early 1998, which gave Moldavia increasing purchasing power over foreign goods.

Appreciation of the Moldavian leu has been modest and not every appreciation leads to a balance of payments crisis anyway. An economy, which attracts FDI and enhances its productivity, could survive a stronger real appreciation without balance of payments pressures. However, appreciation must be accompanied by a compensating improvement of export competitiveness (both in terms of quality and prices). Moldavia, however, attracted little FDI and underwent little restructurization.

Figure 1:
REER



Source: MET.

Lack of restructurization of the energy sector resulted in tolerating non-payment from customers. Mainly energy-related mineral resources come mostly from imports (they constituted 46% to 35% of imports in 1995-1997 – MET data). Gazprom and other partners tolerated payment arrears for political and strategic reasons. Ultimately, overdue payments were turning into government liabilities and some negotiated price was paid. However, tolerance for customer non-payment in Moldavia (and, additionally, lack of

counters of water or heating) was equivalent to a situation of a partially soft budget constraint, which created wrong incentives and lead to inefficient consumption[1].
Reduction of consumption after the 1998 crisis can be associated with the exchange rate devaluation. As a result of the devaluation, foreign goods became relatively more expensive. This switched the demand towards domestic products. However, domestic supply was not efficient and elastic enough to substitute for the reduced imports. The result was a growth of prices and a suppression of the overall level of consumption.

Disposable incomes

In 1996-1998 the GNDI exceeded the GDP by 7.6% on average. Moldavia was paying interest on its foreign debts, so its net capital income was negative. However, it is estimated that at least one hundred thousands of Moldavian citizens work abroad and send large part of their salaries back to their families. As a result, the net factor income from abroad is positive every year. Moldavia is also a recipient of current transfers related to technical assistance and humanitarian aid.

Table 7:
Net Factor Income from abroad (Y_f) and Net Current Transfers (TR_f), Moldavia (USD mn.)

Period	Y_f	TR_f
1995	-18	56
1996	55	73
1997	47	76
1998	33	82
1999	32	114

Source: Balance of Payments, National Bank of Moldavia.

The increase of the national disposable income from 107.6% of GDP on average in 1996-1998 to 112.6% of GDP in 1999 means that incomes and transfers from abroad increased relative to GDP. In USD terms, Net Factor income from abroad in fact shrank, especially in 1998. Interest payments abroad did not grow much (partly due to the increase of arrears), but compensation of Moldavian employees working abroad decreased due to the regional crisis[2]. Current Transfers increased noticeably. But more importantly, large devaluation of the exchange rate increased the value of foreign receipts in lei terms.

The growth of disposable incomes was reflected in the non-government income. Government disposable income fell significantly. The reduction of the government disposable income resulted from two factors. First, there was a significant reduction of total

1 For example, while most flats in Chisinau are hardly heated during winter, occasionally they 'enjoy' temperatures of over 26 degrees, so that it becomes necessary to open windows.

2 See: *National Bank of Moldavia*, a comment on Current Account, internet site http://www.bnm.org.

public revenues in relation to GDP (from the peak of 41.1% in 1997 down to 31.1% in 1999). Second, debt service costs increased in % of GDP. Social transfers and other payments, which are excluded from government disposable income, shrank, but their reduction did not compensate for the loss of revenues and growth of interest burden.

Table 8:
Gross National Disposable Income, Disposable Income of the Government and Non-government Disposable Income (% of GDP)

Period	GNDI	DIng	DIg
1995	102.6%	81.5%	21.1%
1996	107.5%	92.9%	14.7%
1997	108.0%	82.2%	25.8%
1998	106.8%	87.9%	18.8%
1999	112.6%	95.8%	16.9%

Source: MET, own calculations.

Table 9:
Public revenues, transfers, interest payments, Moldavia 1998-1999, in % of GDP

Period	Public revenues	Social Transfers	other	Interest Payments	DI_g
1995	40.4%	9.5%	8.0%	1.8%	21.1%
1996	36.1%	9.0%	9.3%	3.1%	14.7%
1997	41.1%	8.3%	2.8%	4.2%	25.8%
1998	38.4%	8.8%	6.2%	4.6%	18.8%
1999	31.4%	6.4%	1.0%	7.1%	16.9%

Source: MET, Ministry of Finance, own calculations.

Developments in Savings

Year by year reduction of aggregate savings prior to the 1998 crisis was caused both by decreasing government and non-government savings. The main factor was the growth of consumption share, discussed earlier.

After the crisis, improvement in aggregate savings was attained by a steep reduction of both the non-government and public consumption. Non-government savings increased as a result of the increase of the non-government disposable income (related to growth of the relative size of incomes and transfers from abroad) and the contraction in consumption. Government savings improved thanks to a reduction in consumption, in spite of the further decline in the share of government disposable income.

Table 10:
Total Savings, Non-government Savings and Government Savings, in % of GDP

Period	S	S_{ng}	S_g
1995	18.6%	24.6%	-6.0%
1996	12.7%	25.1%	-12.4%
1997	9.2%	10.8%	-1.6%
1998	6.2%	12.9%	-6.7%
1999	21.3%	23.5%	-2.2%

Source: MET, own calculations.

Developments in Investments

Developments in investments are important, because they determine future production capacity of the economy and its growth potential. On the other hand, high investments can contribute to macroeconomic imbalance. In Moldavia, regardless of the dismal economic performance, the share of investments has been surprisingly high and stable in relation to GDP.

Table 11:
Total Investments (I), Investment in fixed capital (I fix.), Non-government Inventory investments (I_{ng} fix.), Non-government Investments in fixed capital (I_{ng} fix.) and Government Investments (I_g), in % of GDP

Period	I	I fix.	I_{ng} inv.	I_{ng} fix.	I_g
1995	25.2%	16.2%	9.0%	14.1%	2.1%
1996	24.4%	19.9%	4.5%	17.9%	1.9%
1997	24.0%	20.2%	3.8%	17.5%	2.6%
1998	25.8%	22.0%	3.8%	19.7%	2.3%
1999	23.0%	19.6%	3.4%	18.7%	0.9%

Source: MET, own calculations.

According to the International Financial Statistics, in 1997 the world non-weighted average share of Gross Fixed Capital Formation (GFCF) in GDP was about 22%. Moldavia is not quite there, but in comparison with many other transition economies she is doing quite well. In countries like Armenia, Bulgaria or Kyrgyzstan the share of investment hovered around 15% since the mid-90's.

Reported investments tend to be higher in countries like Russia, Ukraine and, especially, Belarus, where restructurization of enterprises has been delayed and many of them are managed in the old, soviet style, without entirely hard budget constraints (thanks to preferential treatment by tax agencies, various offset and Barter schemes and in-kind payments to workers). These investments result from decisions made by soviet-mentality managers and they poorly enhance productivity. Guriev and Ickes (1999) de-

scribe how, as a result of Barter schemes, enterprises end up with an excess of construction materials, which belong to most popular barterable goods. To make use of them, enterprises engage in unnecessary construction project's. Through theft or in-kind wage payments those materials also end up in households' construction project's.

Table 12:
Gross Fixed Capital Formation (GFCF) / GDP, Transition Economies, in 1997

Country	GFCF/GDP
Bulgaria	0.113
Kyrgyz Republic	0.140
Armenia	0.163
Ukraine	0.184
Russia	0.188
Moldavia	**0.198**
Poland	0.212
Romania	0.221
Slovenia	0.235
Belarus	0.250
Czech Republic	0.307
China	0.338
Slovak Republic	0.386

Source: International Financial Statistics.

Obviously, the reported high and stable level of investment in Moldavia has very little impact on the economic performance. Inefficient, soviet-style management can be an explanation also in the case of Moldavia. This conjecture is reinforced by a very high level of inventory investments (around 4% of GDP), which are another sign of an inefficient management.

Another part of the explanation of the apparent high level of investment may lie in a different dynamics of prices of capital goods and the overall level of prices. Although in the period 1995-1998 the share of investment in GDP was growing, capital investments in constant prices were falling much faster than GDP in constant prices. Thus, the growing share of investments resulted from a rise of the relative price of investment goods. The available data on the dynamics of the price index for capital goods and the GDP deflator are not quite consistent with the figures in constant prices, but they also suggest a growth of the relative price of investments in the examined period.

On the other hand, the phenomenon of relatively high and stable level of investment, given the bad overall economic outlook in Moldavia, can simply raise suspicions about the quality of the national accounts statistics.

The dynamics of investments is another puzzle. Investments in Moldavia have been remarkably stable in spite of the 1998 crisis. Usually, households smooth their consumption and the level of investments is much more volatile, absorbing most of the shocks to

income. In Moldavia consumption took much of the impact of the shocks: in 1999 non-government consumption shrank by 2.8% while investment by 1.4% of GDP (as follows from preliminary data adjusted to consistency with the most recent estimates of the current account).

Table 13:
Capital investments in constant prices (% of the previous year), GDP in constant prices (% of the previous year), Price index in capital construction (without imported equipment) (avg. per year, in % to the previous year), GDP deflator (in % to the previous year)

Period	Capital investment	GDP	Price index of capital	GDP deflator
1995	84	98.6	141	139
1996	92	94.1	126	128
1997	92	101.6	133	113
1998	110	93.5	109	109

Source: Statistics Department, Republic of Moldavia in Figures – Statistical Pocketbook, Chisinau 1999, deflator – own calculation.

Stability of investments could be related to their non-market, inefficient nature. Alternatively, it could be a purely statistical artifact. Another explanation of the fact, that investment fell so little after the 1998 crisis and deep real GDP contraction, could lie in the depth of social inequalities in Moldavia. According to this version, there would be a deep separation between the group of agents who do have excess resources and invest them and the ones who do not. The devaluation was largely expected[3] and the group of the households that invest could insulate themselves from the effect of devaluation (by holding foreign currency or fixed assets). Most of the burden of the devaluation and the economic decline fell on the remaining poorer households, which do not invest anyway and do not have any stake in investing enterprises, so the only way they could accommodate was to reduce their consumption.

Saving-investment gaps

The dramatic improvement in the Moldavian current account from -19.6% of GDP in 1998 to -1.6% of GDP in 1999 resulted from the improvement of both the government and the non-government saving-investment balance. Non-government balance improved by 12.1% of GDP, while the government deficit improved by 5.9% of GDP.

3 For a more detailed discussion of devaluation expectations in Moldavia see part 2.

Table 14:
Saving-Investment Gap (Current Account Balance), Non-government and Government Savings-Investment Gaps, in % of GDP

Period	S-I	S_{ng}-I_{ng}	S_g-I_g
1995	-6.6%	1.4%	-8.0%
1996	-11.7%	2.7%	-14.3%
1997	-14.8%	-10.6%	-4.2%
1998	-19.6%	-10.6%	-9.0%
1999	-1.6%	1.4%	-3.1%

Source: MET, own calculations.

Summary of Macroeconomic Developments in Moldavia in 1995-1999

The pre-crisis situation in Moldavia, until late 1998, was characterized by a large macroeconomic disequilibrium. Government sector resource deficit was huge, it fluctuated between -4.2% and -14.3% of GDP. Non-government sector also ran deficits – in 1997-1998 non-government consumption and investment exceeded non-government disposable income by 10.6% of GDP. Both these deficits were financed by a current account deficit – excess savings of foreign economic partners of Moldavia. The later improvement in the current account was associated with a turnaround in the Non-government sector savings-investment balance and a reduction of the public sector deficit. As a result, in 1999 public sector deficit of -3.1% of GDP was financed by 1.4% of GDP of the non-government sector surplus and 1.6% of GDP of the surplus of the rest of the world.

Gradual currency appreciation and distorted incentives in the energy sector resulted in the swelling share of consumption in GDP. After the crisis the share of consumption was strongly reduced (by 9.3% of GDP). Reduction of consumption can be associated with the exchange rate devaluation. Before the crisis, an overvalued exchange rate gave Moldavian economic agents an excessive purchasing power over foreign goods. After the devaluation foreign goods became relatively more expensive. This switched the demand towards domestic products. However, domestic supply was not elastic enough to substitute for the reduced imports. The result was a growth of the price level and a suppression of the overall level of consumption.

In spite of the crisis, the share of investment in GDP suffered little reduction. This is unusual, taking into account a sharp reduction of the real GDP (by 6.5% in 1998) and over 70% devaluation of the currency, which happened in the last quarter of 1998. It could have been expected that households, facing such large reduction in their welfare, would try to prevent their consumption from falling at the cost of decreased investments. The opposite happened, investments were slightly reduced but the bulk of the adjustment was attained by a drop in consumption. The data suggest that, in real terms, investments were falling faster than GDP, but their relative price was increasing.

Apart from the reduction in both non-government and public consumption, the improved savings outlook was connected with the developments in disposable income. Taking into

account the price level increase and the devaluation, *real* disposable income fell, forcing the *real* reduction in consumption. However, in relation to GDP, Gross National Disposable Income increased by 5.9 percentage points, partly softening the effect of the economic downturn and making improvement in savings a bit easier. But the result was, that the dependence of Moldavia on net factor incomes and transfers from abroad increased significantly. According to the preliminary estimates, in 1999 they amounted to 12.6% of GDP.

The exchange rate devaluation in the late 1998 resulted in the needed adjustment of Moldavian macroeconomic aggregates. Mainly, the share of domestic absorption (consumption + investment) in GDP was reduced to a more sustainable level. A strongly improved current account balance and a stabilization of the exchange rate indicated regaining of equilibrium.

2 Remonetization and Its Reversal

The next chapter concentrates on the issue of monetization – its changes since the stabilization and their interpretation. It is argued here that the driving force behind remonetization or demonetization in Moldavia was a growth or decline of confidence in the stability of the domestic currency. In a country, which, as Moldavia, conducts an unsustainable fiscal policy, tight monetary policy cannot be credible in the longer run. When the critical level of external disequilibrium and debt burden had been reached, devaluation expectations emerged and the remonetization trend reversed itself.

Evolution of Monetization in Moldavia in the 90's

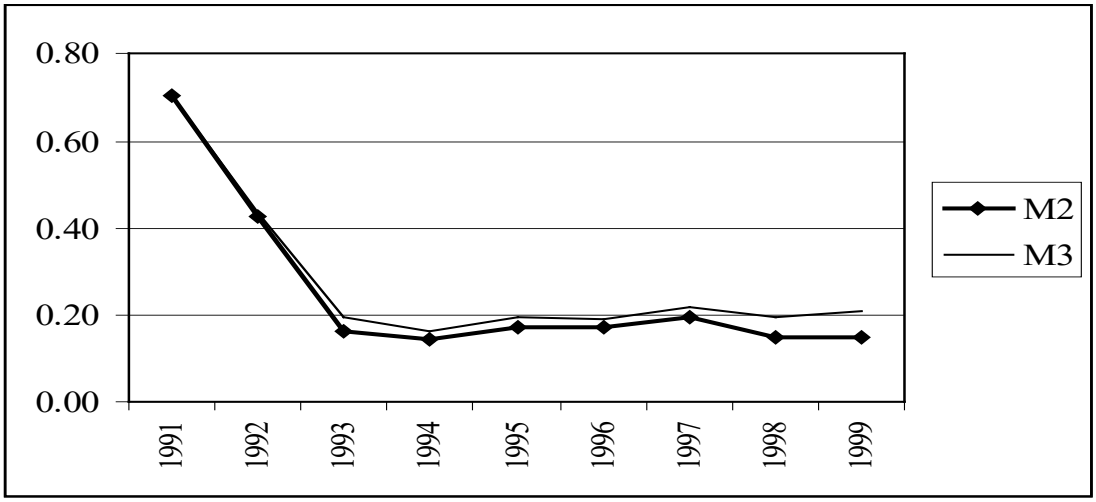
Monetization of Moldavian economy has followed a typical pattern: unsustainably high in the period of a fast money supply growth, reduced sharply in the moment of stabilization and gradually growing afterwards. In 1997 Moldavia reached the level of monetization of about 20% of GDP, which did not differ significantly from many other low-income countries (see Appendix I). Unfortunately, stabilization proved to be fragile and after a peak in the late 1997 monetization started to decrease again. By mid-1999, when the effect of the regional crisis could already be felt strongly, Moldavia was again close to countries with the lowest monetization by world standards.

In the period of fast monetary expansion prior to first stabilization attempts Moldavia had a high but artificial and unsustainable level of monetization. This phenomenon has been observed in all transition economies. Money supply was growing so fast that growth of prices (and, as a result, of nominal GDP) did not fully catch up with it. Additionally, price adjustment to money supply was distorted by administrative regulations. The increasing rate of inflation (151% in 1991, 1670% in 1992 and 2706% in 1993) was a clear signal of the unsustainability of the situation.

In 1993 monetary expansion slowed down for the first time (from 348% M2 growth in 1992 to 263% growth in 1993). This enabled prices to finally reflect all the past excessive money supply growth. As a result, inflation exceeded significantly the current money growth and thus real money balances were reduced (and so was money share in

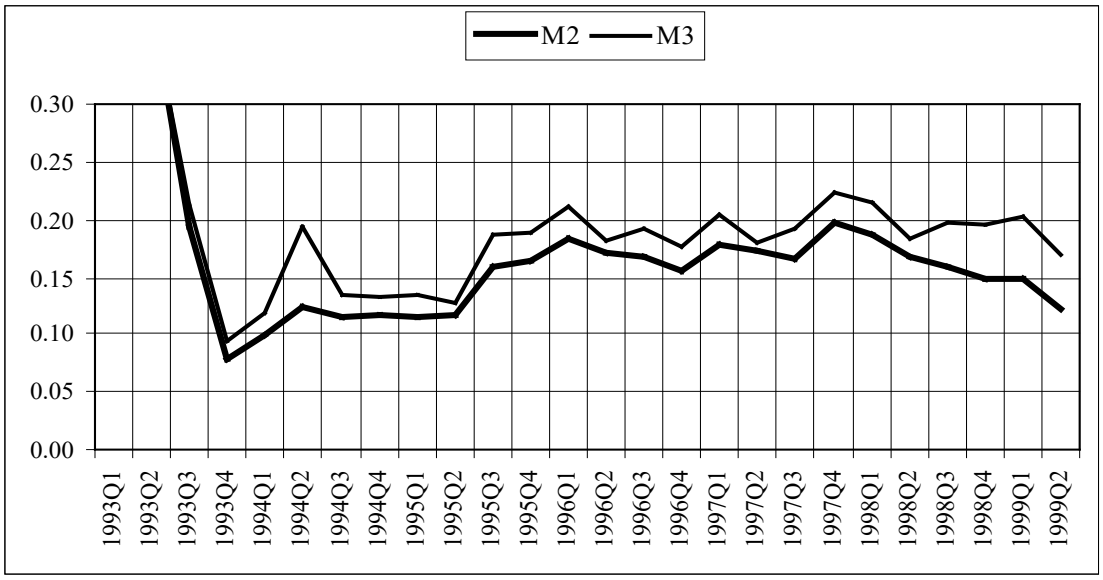
GDP). In 1994 inflation was already broadly in line with the monetary growth (105% inflation vs. 128% M2 growth), which means that the equilibrium between money supply and demand was more or less restored. The sustainable level of money supply, which corresponded to the demand, proved to be very low, less than 10% of GDP.

Figure 2:
Monetization: share of end year M2 and M3 in GDP, 1991-1999



Source: MET, own calculations.

Figure 3:
Monetization: share of M2 and M3 in GDP, annualized, seasonally adjusted



Source: MET, own calculations.

Between 1994-1997 a gradual growth of monetization has been observed. Abstracting from changes in the real GDP, this means that the rate of inflation was slower than the rate of money supply growth. Part of the monetary expansion was accepted by the econ-

omy without inducing price increases. This process is usually referred to as a growth of the real demand for money. Seasonally adjusted data show the fastest remonetization in the second half of 1995 and the beginning of 1996. Then the trend became less clear, with minor decreases and increases. In the end of 1997 the peak was reached.

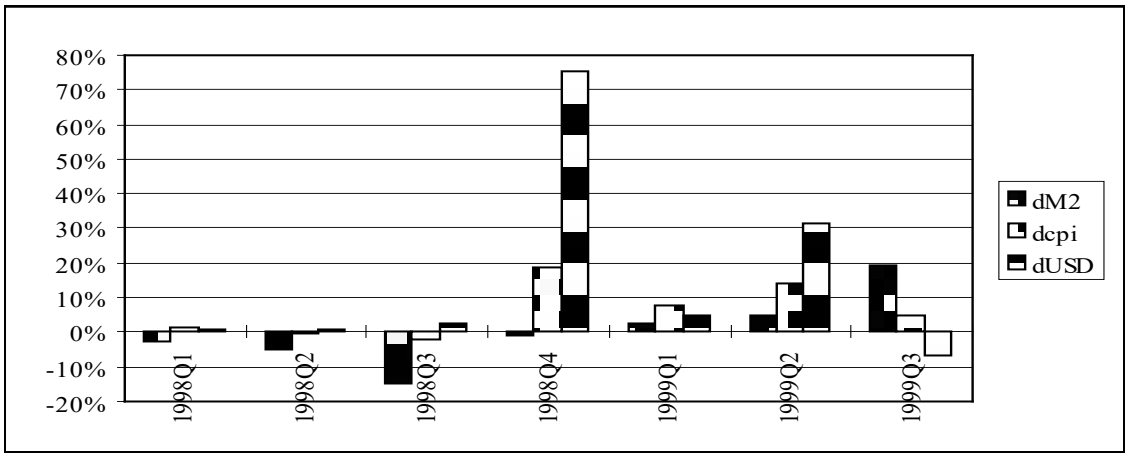
The Russian crisis triggered a crisis in Moldavian economy in the second half of 1998. However, **the reversal of the remonetization trend happened much earlier,** already in the end of 1997 / beginning of 1998. It was a clear signal of some unfavorable structural change taking place and it provided an early warning. This structural change can be labeled as an outflow of demand for the Moldavian leu. Further analysis shows 1) through what mechanisms the demonetization was realized and 2) what were the possible reasons of this process.

The Mechanism of Demonetization

The reversal of the remonetization trend happened at the end of 1997. Figure 4 allows to distinguish two distinct phases of demonetization that followed:

1. First, since the beginning of 1998 until the third quarter of the year, demonetization came about mainly through monetary contraction.
2. Subsequently, beginning with the fourth quarter of 1998, the main factor in this process was the increased inflation, which reduced real money balances and increased the nominal GDP, thus decreasing the share of M2. The devaluation of the leu was the cause of inflation and money supply growth lagged behind.

Figure 4:
Quarterly changes of M2, CPI and MDL/USD exchange rate (%)



dM2 – change of M2; dcpi – change of CPI; dUSD – change of the exchange rate (MDL per 1 USD).

Source: MET.

The Table below presents the contributions of each separate component of money supply to changes in Broad Money. Contraction of currency in circulation was initially the most important factor of money supply reduction. In the second half of 1998, shrinking

of currency in circulation slowed down, but then an outflow of deposits from banks accelerated. 250 mn. lei of deposits were withdrawn and 145 mn. were converted into foreign currency deposits.

Table 15:
Categories of Banking System Liabilities - Contributions to Broad Money growth (in %)

	Dec 97 - Jun 98	Jun 98 - Dec 98	Dec 98 - Jun 99
Currency in circulation	-5.64%	-0.44%	3.13%
Lei deposits	-1.44%	-12.73%	2.78%
Foreign deposits	4.51%	6.90%	19.38%
in US dollar terms	*4.34%*	*-3.19%*	*8.33%*
exchange rate adjustment	*0.17%*	*10.09%*	*11.06%*
sum: Broad Money (M3)	-2.57%	-6.27%	25.30%

Source: own calculations, data from IMF, Moldavia Recent Economic Developments, CR. 99/110.

In the second phase of demonetization, in the first half of 1999, lei deposits recovered slightly and the growth of USD deposits even significantly overcompensated the previous decrease. However, if inflation is taken into account, real broad money barely increased and real domestic money shrank further.

Apparently, in the eyes of depositors, the banking sector asset portfolio was invulnerable to more than 70% devaluation of the leu. There was no large scale bank run and no banking crisis. The main problem was not a fall of confidence in the banking system, but rather a fall of confidence in the Moldavian leu. Lei deposits were temporarily withdrawn and later converted into foreign currency deposits. The possibility to freely convert deposits into dollars played a positive role, softening the impact of the crisis on the liquidity of the banking system.

The whole process of demonetization began with the shrinking of currency in circulation (which is a Central Bank liability) since the beginning of 1998. Table 16 shows the corresponding changes on the asset side of the Central Bank balance sheet. It demonstrates clearly that the main cause of monetary contraction was the shrinking of Net Foreign Assets.

Later, the Table shows a highly unhealthy process of a rapid increase in the credit to the government sector and a decrease of credit of the NBM to banks and of the banking sector to the non-government economy. The NBM had to save the government from the danger of default. At the same time, to squeeze lei liquidity and thus facilitate the defense of the exchange rate the NBG raised the required reserve ratio for banks from 8% to 25%.

Part of the outflow of Net Foreign Assets and the corresponding shrinking of lei currency in circulation is visible also on the activity on the interbank Foreign Exchange. Since the beginning of 1998 the NBM was forced to intervene constantly on the market, selling

about $41 mn. in the first half of 1998 and $81 in the second half of the year. The NBM was selling dollars and accepting lei in return, thus removing them from circulation.

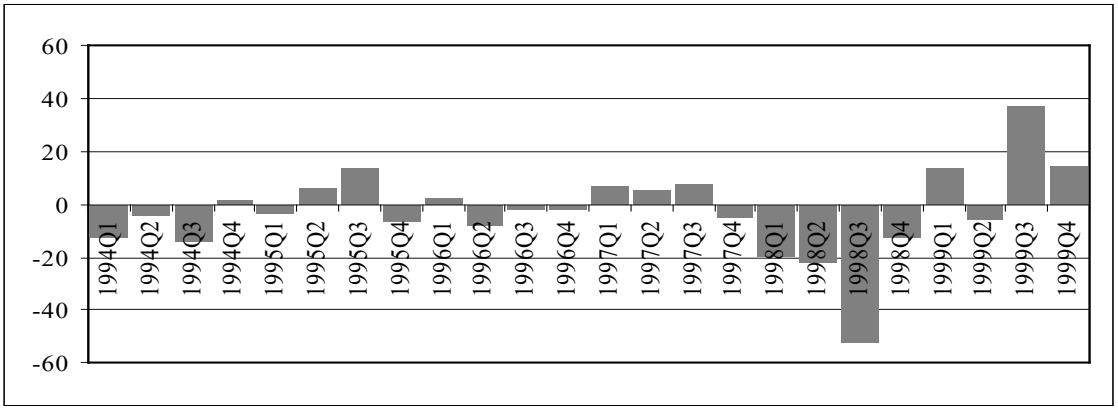
Table 16:
NBM Assets - Contributions to Reserve Money growth (in %)

	Dec 97-Jun 98	Jun 98-Dec 98	Dec 98-Jun 99
NFA adjusted	-19.4%	-81.6%	18.9%
Net Claims on General Government	1.3%	82.3%	11.0%
Credit to Banks	3.6%	-8.3%	-8.5%
Other Items (net) + adjustment	1.8%	15.7%	-3.5%
sum: Reserve Money	-12.6%	8.1%	17.8%

Note: NFA (Net Foreign Assets) contributions have been decreased by the valuation adjustment (adjustment for the change in the leu value of dollar assets caused by the devaluation), which was added to Other Items.

Source: own calculations on the basis of data from IMF (1999).

Figure 5:
NBM net currency purchases on the Chisinau Interbank Currency Exchange (USD mn.)



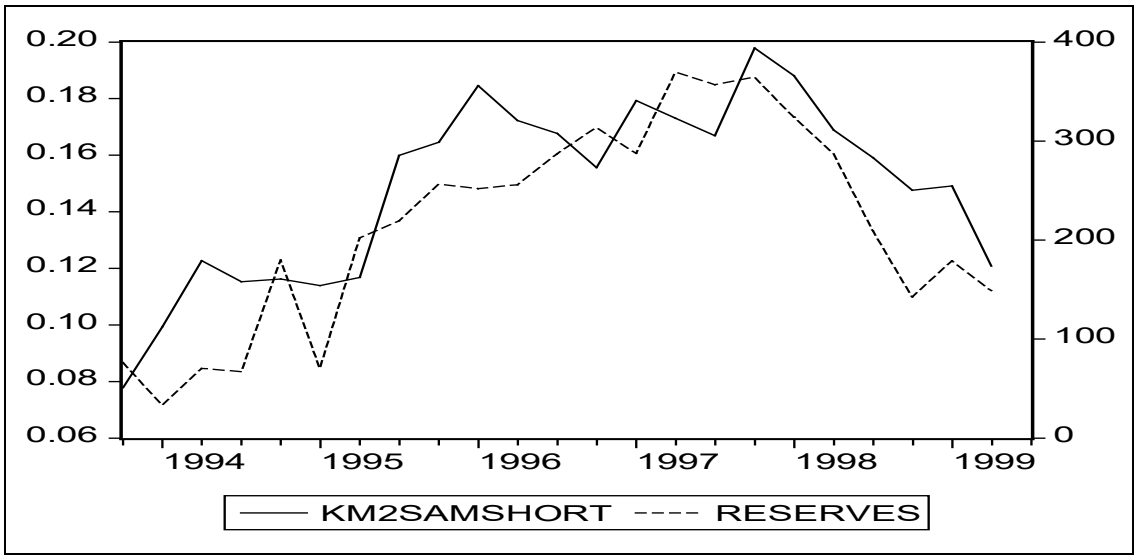
Source: NBM.

Changes in the international reserves of the NBM were tightly linked with the level of monetization. Interventions on the currency exchange have a direct impact on the amount of currency in circulation. Also, when the Central Bank has a higher level of reserves to back up the domestic currency then people have more confidence in its stability and are more willing to hold it.

Explaining the outflow of Foreign Assets of the NBM is the key to understanding the reversal of the remonetization trend in 1997/1998. The answer can be found in the Balance of Payments. In the beginning of 1998 the Current Account deficit increased and simultaneously the Capital and Financial Account deteriorated. An outflow of Portfolio investments, which had begun already in the last quarter of 1997, accelerated. The asset position under Other Investment, which shows mainly non-repatriation of export receipts, in-

creased[4] (with the minus sign in the B.o.P.). Part of the increase of the liabilities position reflects accumulation of arrears. All these phenomena are a clear signal of an undermined confidence in the stability of the Moldavian economy and, especially, in its currency.

Figure 6:
NBM International Reserves (US dollars) and monetization (M2/GDP), annualized



KM2SAMSHORT – monetization (M2/GDP), RESERVES – NBM International Reserves.

Source: MET, own calculations.

Data presented in the introduction (Tables 1, 2 and 3) leave no doubt that the explosion of public debt was leading straight to a collapse – a balance of payments crisis. In 1996 and partly in 1997 conditions were favorable for raising capital on the world markets, which made it possible for Moldavia to fall deep into the trap of indebtedness. In the middle of 1997 the Asian crisis begun and the climate on financial markets changed, especially with respect to investing in emerging market economies. Radziwiłł et al. [1999] note the following facts that preceded the debt catastrophe:

– In mid-1997 the IMF stopped disbursing credit's to Moldavia, which was followed by the withholding of World Bank loans. After that Moldavia could rely only on a much more expensive commercial capital. Budget deficit was financed with the help of the sale of Eurobonds.

– At the end of 1997 Moldavia was forced to reschedule credit's from Russia, totaling over $30 mn.. In 1998 debt arrears amounted already to $50 mn. and energy payment arrears to $103 mn. [IMF 1999]

– The spread on Moldavian Eurobonds increased from 380 basic points to 800 at the end of 1997.

– Foreign participation on the T-bill market decreased from 38% to 22%.

4 See: A comment on the Balance of Payments data for 1998 in the *NBM* internet site: http://www.bnm.org

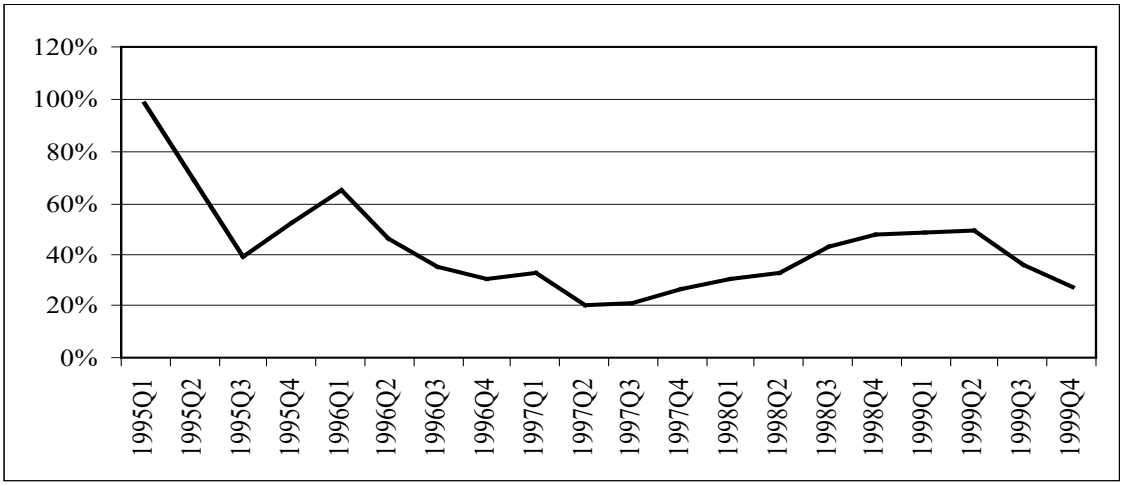
Interest rates on 3 month T-bills increased from 21% in 1997 Q3 to 31% in 1998 Q1 in spite of stable (only seasonally fluctuating) inflation.

Table 17:
Moldavia – Balance of Payments 1997-1999 (semiannually, $mn.)

	97H1	97H2	98H1	98H2	99H1
Current account	**-148.6**	**-118.8**	**-182.3**	**-151.4**	**-14.5**
Trade balance	-180.3	-164.7	-216.1	-182.4	-62.7
export (FOB)	395.2	494.4	363.9	280.2	192.5
import (FOB)	-575.5	-659.1	-580.0	-462.6	-255.1
Services	-29.7	-32.3	-34.5	-38.9	-29.4
Income	30.6	32.5	23.6	17.0	18.3
Current transfers (net)	30.7	45.7	44.6	52.9	59.3
Capital and financial account	**155.0**	**101.5**	**179.3**	**127.1**	**35.1**
Capital account	-0.1	-0.1	0.0	1.5	115.5
Financial account	155.1	101.6	179.3	125.6	-80.4
Financial account less Reserves	**177.7**	**131.1**	**101.3**	**-19.0**	**-49.9**
Direct investments (net)	30.2	41.3	45.2	41.1	11.6
Portfolio investments (net)	236.2	0.4	-12.4	-42.4	-141.7
Other investments	-88.6	89.4	68.5	-17.7	80.2
assets (net)	0.5	0.2	-22.8	-26.3	-35.5
liabilities (net)	-89.1	89.2	91.3	8.6	115.7
Reserve assets (net)	**-22.7**	**-29.5**	**78.0**	**144.6**	**-30.4**
Errors and omissions	-6.3	17.3	3.0	24.3	-20.6

Source: National Bank of Moldavia, http://www.bnm.org.

Figure 7:
Interest rates on 3-month T-bills (quarterly weighted average) (% per annum)

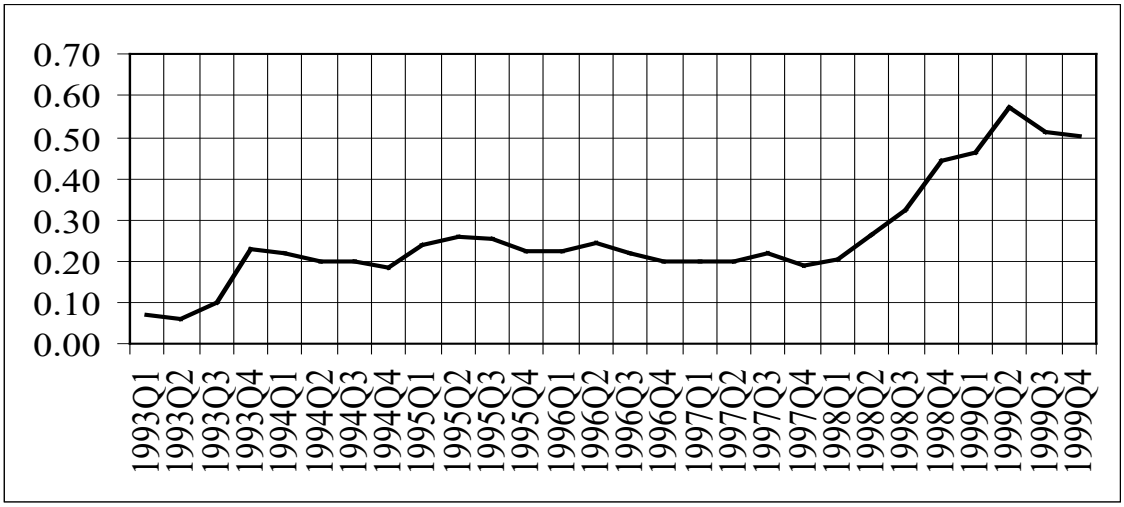


Source: MET, own calculations.

Another signal of the increasing expectations of depreciation was the growth of deposits Dollarization. The reversal of the remonetization trend in the early 1998 was accompanied by a rapid and unprecedented growth of Dollarization.

So, the outflow of demand for Moldavian leu and outflow of capital had begun already about 8 months before the Russian crisis. This resulted in a demonetization – a falling share of domestic money in GDP.

Figure 8:
Dollarization of deposits (share of foreign currency deposits in total deposits) (%)



Source: MET, own calculations.

Conclusions

Many people believe that in 1998 Moldavia was a victim of the Russian financial crisis, which on its turn was caused by the Asian crisis. The importance of links between economies, especially in case of close trading partners like Moldavia and Russia, in propagating financial crises, is not to be underestimated. However, for several years preceding the crisis Moldavia was on an unsustainable path and economic pressures were mounting. The Russian crisis was merely a trigger of a crisis, which, if the existing policies had been maintained, would have emerged sooner or later anyway.

The fiscal imbalance caused a real appreciation, which was incompatible with a slowly growing competitiveness of Moldavian industry. This effect was combined with a too slow restructurization and toleration of non-payment in some areas of the economy. The result was an unsustainable growth of the level of consumption in GDP, which was financed by inflow of foreign capital.

As a result of the open crisis, the adjustment came about through depreciation of the leu, which reduced the purchasing power of the population. Devaluation accompanied by a

further decline in domestic supply, caused growth of the price level, a suppression of the share of consumption in GDP, and an even greater reduction in real consumption.

Dependence of Moldavia on remittances from citizens working abroad and on current transfers from abroad increased. Unfortunately, these inflows of additional disposable income from abroad will be, in the future, counterbalanced by a growing burden of interest payments on the foreign debt.

Investment in Moldavia shrank noticeably, but still remains surprisingly high, considering the depth and the length of the economic depression. However, the influence of these investments on competitiveness of producers is not manifesting itself. Although in nominal terms investments follow the GDP, their relative price rises and their real level falls faster than the real GDP.

Apart from causing a macroeconomic disequilibrium, unsustainable fiscal policy and rapid growth of debt undermined credibility of the attained monetary stabilization. The decrease of confidence manifested itself in high interest rates, growing Dollarization and an outflow of the NBM foreign reserves. All those signals were observed long before the open balance of payments crisis emerged in the last quarter of 1998.

Monetization of an economy is a good indicator of a long term stability and confidence in the domestic currency and banking sector. In Moldavia monetization increased initially, but later its growth stagnated, although there was still plenty of room for its growth (see Appendix). A falling trend in domestic money share in GDP emerged prior to the open crisis, along with other signals of imminent danger.

So far the banking sector went intact through all the economic turmoil. The volume of deposits and credit's in GDP, although low by world standard, is much higher than in most other CIS countries. However, because of the uncertainty about the future stability of the leu, people converted much of their deposits into dollars and Dollarization reached more than 50% of deposits.

Moldavia is yet another, among the CIS countries, example of the fact, that partial reforms bring unproportionally poorer results than the comprehensive ones. Monetary stability is relatively easy to attain, especially when conditions on the world financial markets are favorable for raising capital and central bank credit's to government can be substituted by foreign credit's. However, it is the fiscal adjustment that provides the key to a long term stability. Without it, tight monetary policy can at best postpone a currency depreciation an+d a return of inflation.

In the case of Moldavia, the balance of the partial reforms without fiscal adjustment, conducted since 1993, was disastrous. Only in the years 1995-1999 the cumulative real GDP contraction amounted to 16%, while the burden of foreign debt rose from 21% of GDP in 1993 to 129% of GDP in 1999.

Appendix: Quantifying Public Confidence in the Leu

Below we present intermediate results of the research conducted by CASE, Warsaw and CLS, Sofia, in the framework of the project "Credibility of Exchange Rate Policies in Transition Economies" financed by the Freedom House, Budapest.

There exist no survey's of public expectations regarding the exchange rate in Moldavia. Thus, statements about the level of confidence in the national currency and its influence on other variables are only speculations. Let us engage in such a speculation, stating clearly all the underlying assumptions.

The starting point of the analysis is a money demand function. For simplicity, let us abstract from the effect of interest rates on money demand. Assume that the alternative investment is in cash US dollars and the depreciation of the exchange rate is the opportunity cost of holding domestic money. Therefore, consider a money demand function of the form:

$$\ln M - \ln P = a + k \ln y - n\, E\{de/e\} \qquad (1)$$

where M is a money aggregate, P – price level, y – real GDP, e – exchange rate (MDL/USD) and E{de/e} is the ***expected rate of depreciation***.

The National Bank of Moldavia considers national currency stability as one of its primary goals[5] and for most of the period it intervened in the foreign exchange market to support the leu. Therefore, the ***expected rate of depreciation*** can be expressed in terms of the credibility of the National Bank commitment to stabilize the exchange rate. Let us express the ***expected rate of depreciation*** as a weighted average of the stability scenario (i.e. depreciation rate equal to zero) and a depreciation scenario (say, that the exchange rate will depreciate enough to reverse all the real appreciation, which occurred since the time just before stabilization, the latest moment when the exchange rate had been free floating for a longer period of time).

Then in the time period t, the expected rate of devaluation is:

$$E\{de/e\} = \theta * 0 + (1-\theta) * [P_{Mold}(t)/[e(t)*P_{USA}(t)]] / [P_{Mold}(t_0)/[e(t_0)*P_{USA}(t_0)]] \qquad (2)$$

where t_0 denotes the last quarter of 1993, P_{Mold} is the Moldavian CPI, P_{USA} is the CPI in the USA.

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5 "The main objective of the National Bank of Moldavia is the maintenance of the national currency stability. This objective can be achieved through the implementation of a severe monetary and credit policy and through the implementation of a foreign exchange policy that corresponds to the situation of the market of the Republic of Moldavia. In the condition of deterioration of external balance of payments and absence of a durable economic growth, the stability of the Moldavian Leu exchange rate is one of the main pillars that contribute to the stability of the national currency and attraction of foreign investments." *National Bank of Moldavia*, 1997 Annual Report, NBM internet site: http://www.bnm.org.

The key parameter of interest here is θ. It provides a measure of the credibility of the National Bank commitment to the leu stability. For example, assume that there are only two sorts of economic agents in Moldavia – optimists, which believe that the NBM will keep its promise and pessimists, who believe that the depreciation scenario will come true. Then θ is the share of optimists in the population. Alternatively, θ and (1-θ) can be understood simply as the probability weights that people assign to the two scenarios.

To illustrate the interpretation of monetization developments in Moldavia in terms of public confidence in the national currency, one can calculate the values of θ for each period. What is needed for that, is to assign values to the parameters of the money demand function. The values for a, k and n, were chosen in the following way:

k – real income elasticity of real money demand was assumed to be equal to 1, so that monetization is not influenced by the real growth or shrinking of the economy;

a – constant term was chosen so that in the situation of the credible exchange rate stability monetization increases to about 37% of GDP – the average value for a country with the income level as in Moldavia (see Figures 9,10 and regression in Table 22);

n – elasticity of the money demand with respect to the expected depreciation was chosen so, that in the situation of a perfectly certain 50% depreciation, monetization decreases to 3.7% of GDP, or one-tenth of the 'stable-exchange-rate' value.

The choice of the parameters is therefore fairly arbitrary. However, whatever values are chosen, they do not influence the qualitative characteristics of the resulting series of θ values. The series reflects the assumptions of the model:

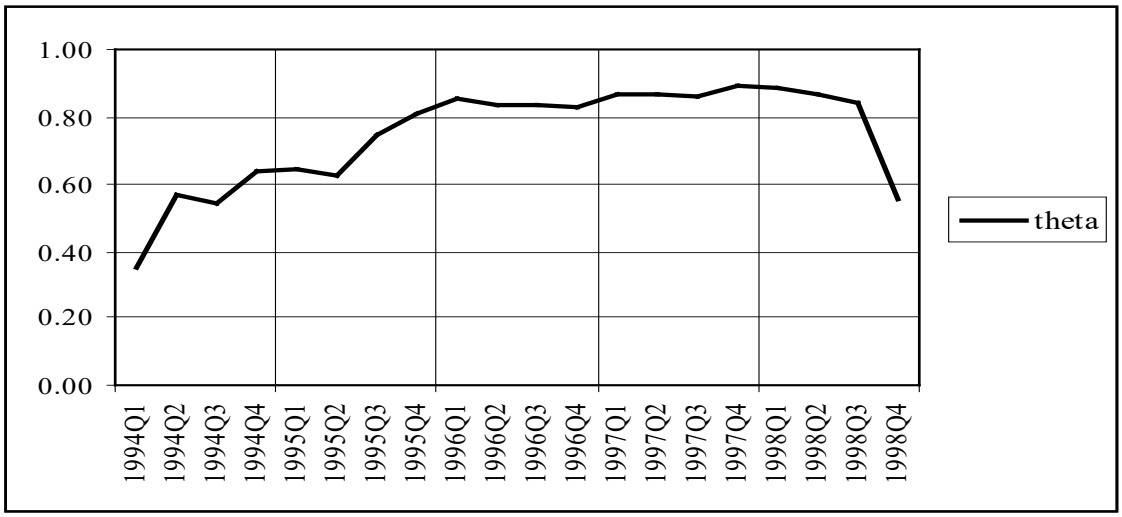
– Growth of monetization is ascribed to the growth of public confidence in leu.

– When inflation in Moldavia accelerates, the risk that the exchange rate would become unstable increases. If, nevertheless, economic agents do not reduce their lei holdings, this is again ascribed to the growth of public confidence in leu (and vice versa).

The exemplification of the time path of θ values calculated with all the above assumptions is presented in the Figure below.

The interpretation of monetization developments in Moldavia in terms of the framework described above is following. Since the currency reform and introduction of the leu, public confidence in its stability was increasing steadily, initially very fast and more slowly starting with 1996. The peak was reached in the last quarter of 1997. Already in the first quarter of 1998 the confidence begun to decrease and in the crisis in the last quarter it dropped sharply.

Figure 9:
Public confidence in the stability of the leu



Source: own calculations.

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Financial Crises and Slovakia

Jozef Makúch[1]

JEL Classification: E52, E6, F3, F34, G10

Economy is a very variable mechanism and is not sufficiently explainable even by cyclicity. It is marked by extraordinary fluctuations, the reasons of which are sought ex post in particular when the swing has been sufficiently dangerous for the economic system as such. Solutions are sought in a new financial architecture and continuing globalization and integration processes aiming to stabilize the system. In my contribution, I decided to dedicate my attention to a small and, in view of these aspects, uninteresting economy of the Slovak Republic. On the other hand, for such a small economy, these systemic changes are very important, because even if we do not want to acknowledge it, openness of the economy and the ensuing dependence on developed markets is the only long-term solution to stability of a small economy as a constituent of a large economic community. From this point of view, I shall try to answer the question whether there was a crisis in the Slovak Republic, what has caused it, what were its consequences, how can they be prevented or their negative consequences diminished.

Was there a Crisis in the Slovak Republic?

Financial equilibrium was twice seriously disrupted in the Slovak Republic in 1997 and 1998. In both instances, the symptoms of the disruption of the equilibrium were similar. The main indicator was the collapse of short-term interest rates.

In both instances, rates have risen sharply (during periods of a massive swing, Pribor fixing was discontinued) from a level below 20 percent and in a relatively short period, rates decreased and stabilized somewhat higher than the initial level. In 1998, the development slightly differed. The rate increase took place already in the middle of August, rates then stabilized at a higher level and in the second half of September exploded similarly as in 1997. Also stabilization in 1998 was different.

The main causes of differing development in 1997 and 1998 was the reaction of the central bank (NBS) to the critical development. In both instances, before the crisis emerged the NBS applied the regime of a fixed exchange rate allowed to fluctuate within a set boundary (+/-7 percent). In both instances the NBS intervened in order to keep the exchange rate within the set fluctuation band: in 1997 the swing lasted about two weeks (May 22 - June 4). During this period, the NBS intervened, spending 567 million USD.

1 This research was undertaken with support from the European Union's Phare ACE Programme 1997. The content of the publication is the sole responsibility of the author and it in no way represents the views of the Commission or its services.

It managed to keep the exchange rate within the set boundary and further interventions were not necessary. Pribor interbank rates have stabilized.

In 1998, the NBS began to intervene in mid-August. Interventions lasted seven weeks and their extent amounted to 944 million USD. It was not possible to sustain the exchange rate, and the NBS decided to abandon the fixed exchange rate regime. At be beginning of October, the NBS floated the currency and stopped its interventions. A gradual decline of interest rates continued for five more weeks and then interest rates stabilized.

The reaction of commercial banks to the development of interest rates was also different. In 1997, they clearly responded by failing to meet the minimum reserve requirement during the entire period of high volatility of interbank rates and only in the last week in June the situation stabilized. (The situation is documented in Chart 1.)

In 1998, the development of minimum required reserves was marked by major swings in both directions - see Chart 2. The most significant swing (October 7, 1998) was thereby clearly a reaction to the change of the exchange rate regime from the beginning of October. The subject of crisis identification in this period was dealt with by Carsky and Gavura[2]. They applied to the circumstances of Slovakia the speculative pressure index (EMP - Exchange Market Pressure), which takes into account not only fluctuations of the exchange rate, but also changes in the volume of foreign exchange reserves and interest rates, which absorb the pressure on the exchange rate and pacify its movements. Crises identified using this index then involve not only instances when a significant depreciation of the exchange rate took place, but also instances when measures of the central bank averted a devaluation or having to abandon an exchange rate peg.

To identify speculative pressure, the EMP index is used as a weighted average of the percentage change of the exchange rate($\%\Delta e_t$), interest rate (Δi_t) and percentage change of reserves of the central bank ($\%\Delta r_t$).

$$EMP_t = \alpha * \%\Delta e_t + \beta * \Delta i_t - \gamma * \%\Delta r_t \qquad (1)$$

The index constructed in this way reflects movements of the exchange rate, as well as the already mentioned reactions of the central bank in an effort to maintain stability of the exchange rate, whereby depreciation of the exchange rate and growing interest rates have a programmed effect on the index. On the other hand, growing foreign exchange reserves of the central bank cause the index to drop. In a period of economic and fiscal equilibrium, the value of the EMP index approaches zero. In cases of speculative pressures, the EMP gets into positive values and to measure their effect it is necessary to define a decisive criterion. A possible crisis is then deemed a situation when extreme values of EMP exceed the value set by this criterion. One of the possible approaches is the following statistical criterion:

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[2] *Carsky, R.; Gavura, M.,* 1999. Identification and Causes of Monetary Crises - Application for the Slovakia, Biatec 8, 11-16.

Chart 1:
Overview of meeting the minimum reserve requirement by the banking sector in the first half of 1997

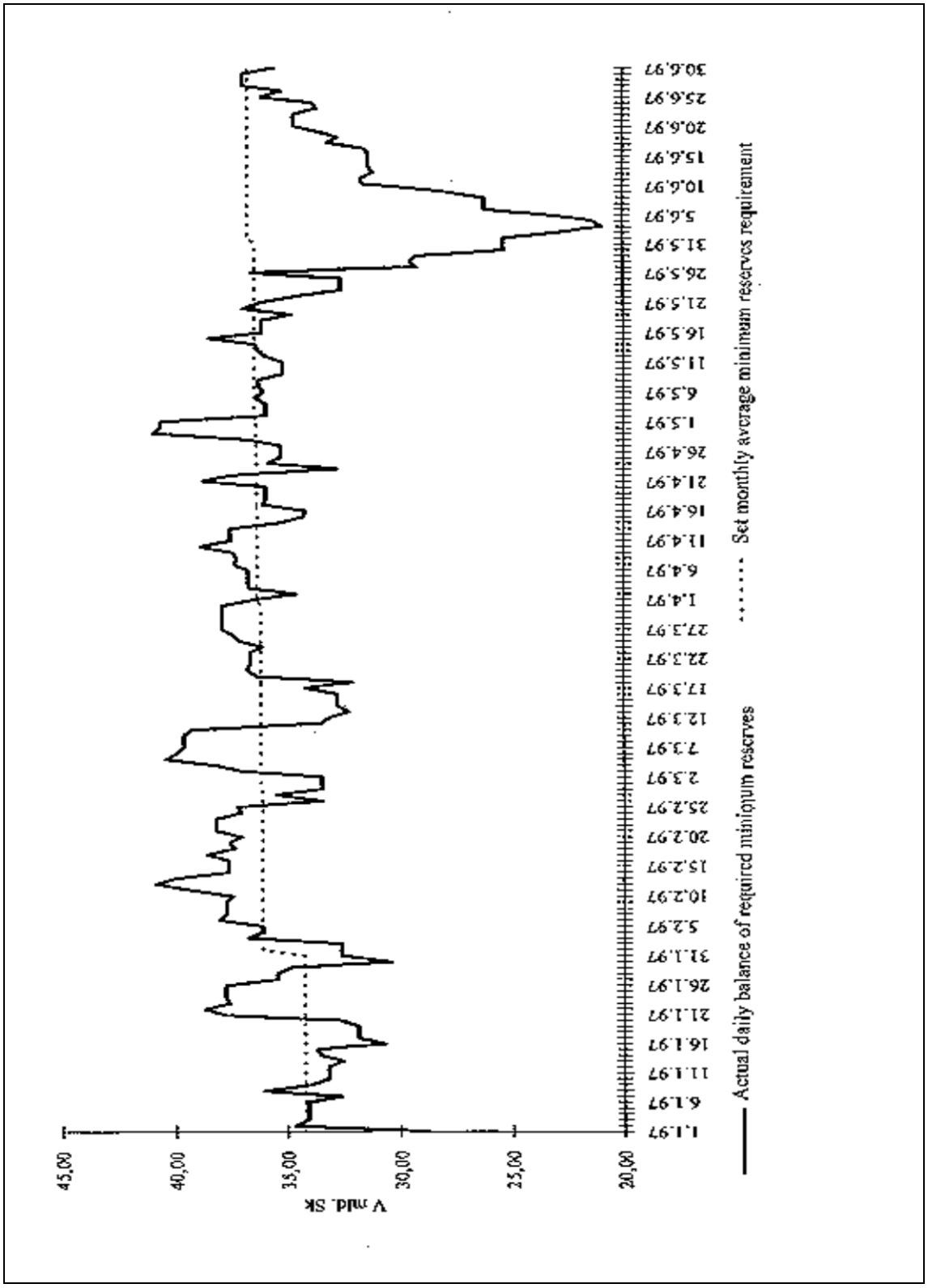
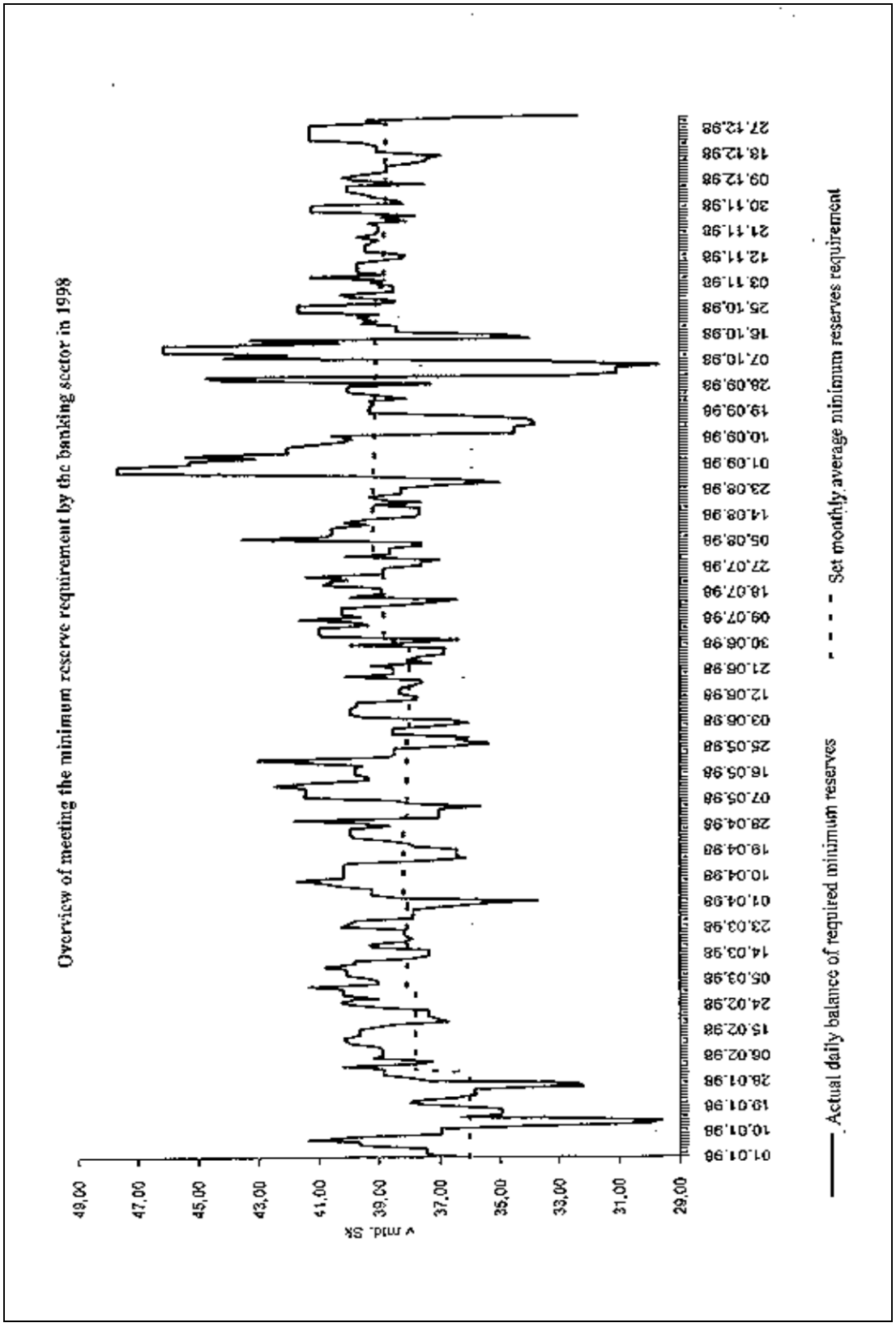


Chart 2:
Overview of meeting the minimum reserve requirement by the banking actor in 1998



A crisis at time t is identified if

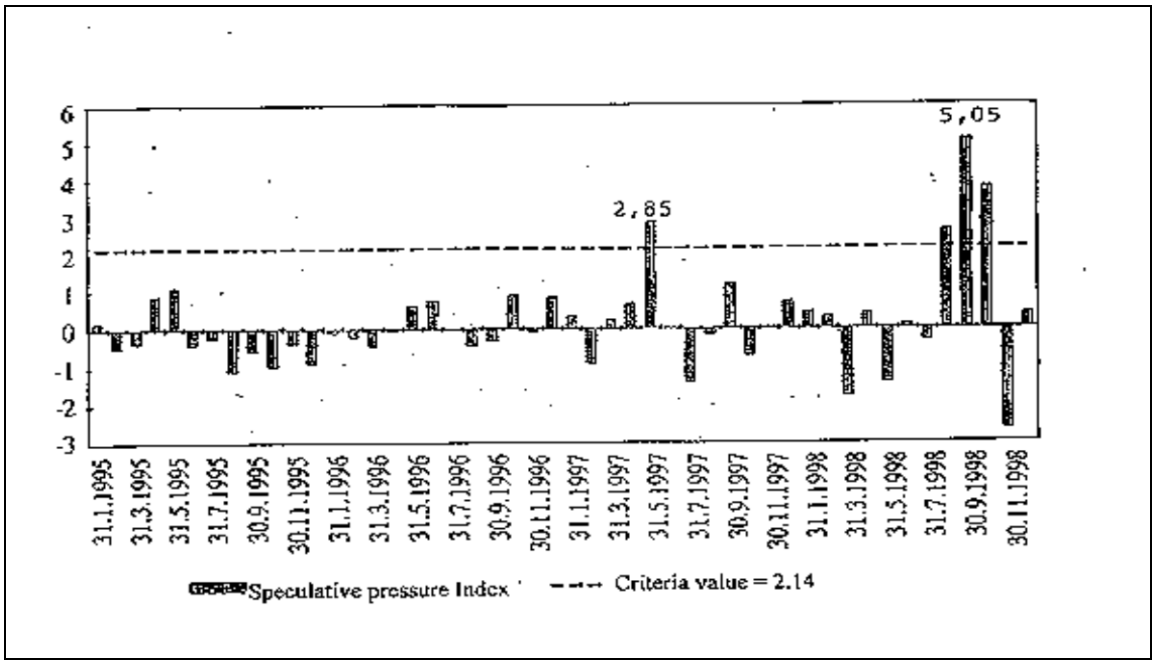
$$EMP_t > \mu_{EMP} + 1{,}5 * \delta_{EMP} \qquad (2)$$

where μ_{EMP} and δ_{EMP} are the median values (average) or a standard deviation of EMP.[3]

The most important task is to select the weights of individual components for the calculation of speculative pressures. It is necessary to take into account in determining the individual weights the necessity of balancing variations of all entering components, which would eliminate the domination of whichever of the components.

The index of speculative pressures constructed for Slovakia identified two periods that could be considered a monetary crisis based on the selected criteria - Chart 3.

Chart 3:
Speculative pressure index



The first crisis was identified in May 1997, when the index mildly overstepped the value of the set criterion. Growth of the index was above all the result of a notable negative balance on the foreign exchange fixing. At the same time, also interbank rates increased, whereby the exchange rate (NBS) remained almost unchanged.

While in 1997, the NBS maintained the exchange rate within the set boundaries, in 1998, after the exchange rate regime was abandoned and the currency floated, the cur-

3 *Wyplosz; Rose; Eichengreen,* 1996, Contagious Currency Crisis. NBER Working Press 5681.

rency weakened by 17 percent compared with the former parity (with DEM as reference currency – see Chart 4).

Chart 4:
Exchange rate SKK/DEM, August 1998-December 1999, end period

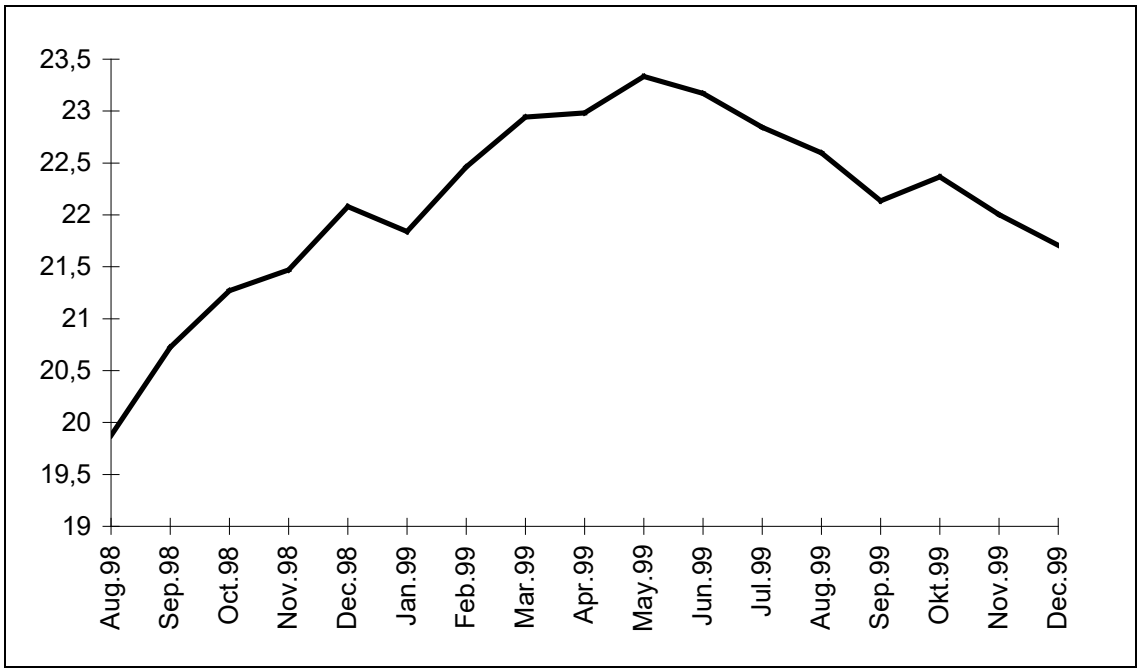


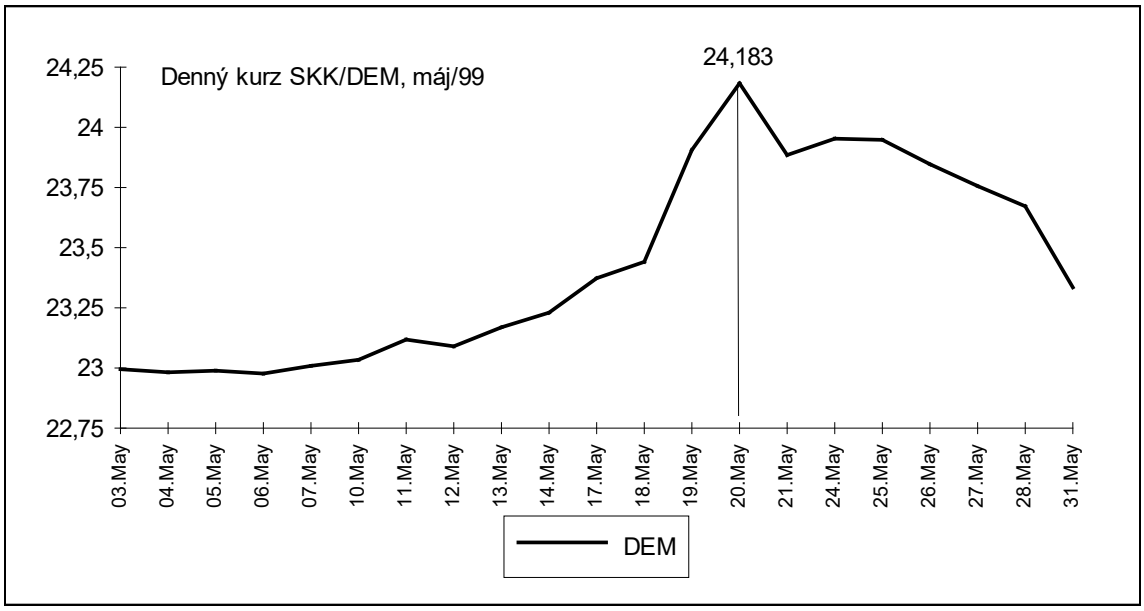
Table 1:
Recapitulation of the Crises in 1997 and 1998

Year	1997	1998
Maximum swing of Pribor O/N	185%	100%
Duration of higher interest rates in weeks	1	12
Sum of intervention (million USD)	567	944
Fluctuations of required reserves in weeks	5	7
Depreciation of the exchange rate (in % towards +/-7.5 percent band)	-	10
Maximum swing of EMP from the criterion value	+0.71	+2.91

Another Pribor hike was registered in May 1999. This was in fact the last shimmer of the crisis in 1998; at that time, on May 20, 1999, also the SKK exchange rate culminated at 24.183 SKK/DEM - Chart 5. After the currency was floated, it weakened continually until June, when it strengthened significantly. A positive trend continued until the end of 1999. The EMP index did not overstep the criterion value in this period. Interventions of the NBS during this time reached 96 million USD, which was well below the volume of interventions in 1997 and 1998. However, if we accept that this was the

last manifestation of the crisis of 1998, the interventions of 1998 and 1999 should be evaluated jointly. Hence the cumulative volume of interventions for this monetary avalanche was 1040 million USD. That was almost one third of foreign exchange reserves.

Chart 5:
Daily FX rate, SKK/DEM, May 99



Since the effect of the crisis on the exchange rate began to appear only after the fixed exchange rate regime was abandoned in October 1998, I consider it appropriate to summarize its development since the start of weakening until the end of 1999. I will use the SKK/DEM exchange rate as the basis, although from January 1, 1999, DEM was replaced as the reference currency by the EUR. However, their mutual exchange rate has been fixed. On the other hand, in 1998 the exchange rate SKK/EUR could not have been evaluated because the EUR was nonexistent.

If we compare the stabilization after the financial crisis in the Slovak Republic through stabilization of the exchange rate with countries that underwent similar crises, we could contribute to a more precise answer about the extent of the crisis in the Slovak Republic.

As is evident from this comparison, the depth of the crisis in the Slovak Republic has not nearly achieved the level of the crises in the reference countries. The overall change of interest rates in Slovakia was approximately at the starting level in these countries. The fact that the crises was not very deep there is demonstrated by the devaluation of the Slovak crown on a level 10% only. However, the stabilization period lasted nine months, which can be explained by the essential change in the system of government after parliamentary elections of 1998 that required a certain time to restart economic reforms in Slovakia.

Table 2:
Speed of stabilization after financial crises[4]

Country	Thailand	Indonesia	South Korea	Slovakia
Starting change of exchange rate* (%)	-19.6	-14.4	-17.1	-4.3
Total change** (%)	-52.6	-83.6	-41.2	-17.7[5]
Number of months of exchange rate weakening	7	11	4	9
Start of the crisis /month, year	7/97	8/97	11/97	9/98

* % from the preceding month. – ** % for the month in which the crisis culminated/ month preceding the start of the crisis.

Let's make a similar comparison with swings of interbank interest rates during the crises based on the maximum swing of the overnight (O/N) rate:

Table 3:
Maximum overnight rate in %:[6]

Country	Czech Republic 97	Thailand 97	Indonesia 97	South Korea 97	Slovakia 97	Slovakia 98
O/N max in %	197.5	27.4	300.0	27.2	185.0	100.0

Swings of overnight interest rates in Slovakia had clearly a character of a crisis in both instances and along with the usage of reserves, they ranked among the stronger components of the EMP index.

The answer to the question whether there was a crisis in the Slovak Republic is unambiguously positive. However, it remains an open question whether both swings in 1997 and 1998 should be labeled as a crisis, or whether this is a lasting process of an overall crisis of the economy.

What Caused the Crisis

Analyses that dissect crises in countries of emerging markets provide a number of reasons that could have been the cause of the disruption of financial stability. I do not think

4 Methodology and data for Mexico, Thailand, Indonesia, and South Korea. Report of the Working Group in Financial Crises in Emerging Markets. *Institute of International Finance* 1999.

5 Maximum swing as of the culmination date (May 20) was 21.7%.

6 Data from the reference countries are from the annual report of the BIS, June 1998.

that monetary stress can be explained for example by "a contagion from South-East Asia (1997)". This approach has two basic shortcomings:

– the crisis in Asia also had to be caused by something, and it is necessary to find which factors leading to the crisis occurred in the countries of origin as well as in countries into which the crisis has spread,

– what caused that the crisis has not erupted in each of the transforming countries of central and eastern Europe (for example it avoided Hungary), and why has it emerged only in some countries, and why specifically in these countries.

I consider relevant those explanations that stem from analyses of the environment and systemic measures that were implemented in this environment (countries of central and eastern Europe as a result of transformation).

For these reasons, I shall try to describe how in the conditions of the Slovak Republic, the following matters reflected:

– problems of economic development,

– crisis of the banking system, expansion of lending activities, and moral hazard,

– influx of foreign investments,

– the implemented foreign exchange regime,

– political instability.

Economic development in the Slovak Republic from 1995 to 1998

The evaluated period followed a so-called stabilization phase, the priority of which has been disinflation (end-year inflation dropped from 25.1 percent in 1993 to 7.2 percent in December 1995, average inflation dropped from 23.2 percent to 9.9 percent in the same period), state budget performance (budget deficit dropped from 6.2 percent of the GDP in 1993 to 1.6 percent in 1995), and growth of foreign exchange reserves (foreign exchange reserves grew from 0.45 billion USD at the end of 1993 to 3.42 billion USD on December 31, 1995), GDP growth (from -3.7 percent in 1993 to 6.9 percent in 1995). The balance of payments moved from a deficit of 5 percent of the GDP in 1993 to a surplus of 4.8 percent of the GDP in 1994 and 2.3 percent of the GDP in 1995.

In 1995, expansion in economic development of the Slovak Republic culminated, and for this reason I picked it as the starting point of my evaluation. Warnings that this development was not sustainable and of risks of the consequences of overheating of the economy were not taken into consideration. On the contrary, a strategy of an even greater expansion prevailed. Fundamental indicators in the evaluated period developed as follows:

Table 4:

Indicator	1995	1996	1997	1998
GDP % growth in fixed prices	6.9	6.6	6.5	4.4
Inflation rate (average in %)	9.9	5.8	6.1	6.7
State budget deficit in % of GDP	-1.6	-4.6	-6.3	-3.1
Foreign exchange reserves of the NBS in billions USD	3.42	3.47	3.28	2.92
Current account of the balance of payments % of GDP	+2.3	-11.2	-10.0	-10.1
M2 growth in %	21.1	16.5	8.9	2.8
Private sector share on the GDP in %	62.6	76.8	82.6	82.4
Foreign debt in billion SKK	5.8	7.8	9.9	11.8
Per capita (USD)	1099	1473	1867	2191

The development can be briefly characterized by continued high GDP growth rates with a dramatically high deficit on the current account of the balance of payments with a simultaneous decline of budgetary discipline. The reaction was a restrictive policy of the central bank. GDP growth was the "trump ace" of the government economists at that time. Therefore I consider it necessary to pay closer attention a detailed examination to this indicator. What caused its growth? I shall try to find the answer in an examination of its structure.

Domestic demand was higher than the GDP, whereby households consumption and investments developed most dynamically. These were above all investments into infrastructure project's. However, the high investment rate was not connected with an adequate accumulation of savings. The volume of domestic savings was insufficient to cover investment demand, which reflected in growing foreign debt. Inventory also decreased very sharply, which eventually reflected in decelerated growth rate in 1998.

It is evident from the presented figures that this economic strategy led to deepening internal and external disequilibria. Problems of the macrosphere had an impact on the micropshere. Profit significantly dropped in financial as well as non-financial organizations, profitability decreased, financial discipline worsened, which led to a domino effect in insolvency's of entrepreneurial entities.

The economic environment was hence clearly a pro-crisis one, monetary instability could have been caused by whatever internal or external impulses. The possibilities of monetary policy or the central bank to correct the systemic flaws of the government's economic policy were exhausted.

Table 5:

Indicator	1995	1996	1997	1998
GDP (billion SKK, fixed prices 1995)	516.8	550.8	586.8	612.7
Domestic demand (billion SKK, fixed prices 1995)	507.4	606.6	613.9	656.9
Investment rate (gross investments to GDP in percent)	28.4	37.5	36.5	36.7
Fixed investment rate to GDP	27.4	35.9	38.6	41.0
Rate of investment coverage from savings in %	106.4	73.0	79.3	80.4
Final consumption of households in % of the previous year	3.4	6.9	6.3	4.9
Change of inventory in billion SKK	5.1	8.6	-12.4	-26.1

Crisis of the Banking System

The banking sector was supposed to undergo a transformation phase from 1995 to 1998, during which government stakes in commercial banks should have been privatized. Risky assets of the banking sector were concentrated in three large state-controlled banks. In addition to them, a specialized financial institution, Konsolidacna banka, has been created. Irrecoverable claims from the period before 1990 were concentrated in this institution. In addition, also operating on the market were small banks without foreign capital, banks with foreign capital (some of which at the same time were partly owned by the government or state institutions), and branch offices of foreign banks. The number of banks in the evaluated period was stabilized; 24 banks operated on the market. The number of branch offices of foreign banks gradually deceased from ten in 1995 to two in 1998. This was the result of a gradual liquidation of branch offices of Czech banks that remained on the Slovak market following the dissolution of CSFR and did not meet the criteria for a branch office of a foreign bank (part of them were liquidated as a result of liquidation of their parent banks in the Czech Republic, because restructuring of the banking sector in the Czech Republic started in 1996 - 1998).

Development in the banking sector can be characterized by data in Table 6. An evaluation of the situation in the banking sector is simple. All figures indicate a deepening (and neglected) crisis in the banking sector:

– the banking sector stopped growing,

– the share of performing assets was persistently below 90 percent and was steadily decreasing,

– ROA and ROE got into negative digits and the situation constantly worsened,

– risk in the banking sector exceeded standard levels.

Table 6:

Indicator	1995	1996	1997	1998
Total assets growth in % from the previous year	18.3	32.0	10.0	1.8
Paid up capital growth in % from the previous year	15.7	15.3	8.0	1.3
Performing assets/total assets in %	87.4	85.9	85.9	83.6
ROE	7.47	-0.22	-0.44	-1.18
ROA	0.87	-0.02	-0.07	-0.12
Share of classified loans to total loans in %	43.0	34.0	36.7	37.3
Loan risk coefficient[7] in %	35.1	31.3	34.2	34.4

The environment can again be characterized as ideal for a monetary shock, whereby the probability of the emergence of such development increased with time.

As I already mentioned in the introduction to this part, the banking sector was structured and to a certain degree polarized. Let's look at the situation in individual groups of banks at the end of 1998.

Table 7:

	A	B	C	D
Total assets (bn. SKK)	366.5	61.3	82.0	149.8
Own capital	39.2	5.5	7.4	10.5
performing assets/total assets in %	81.4	73.1	78.2	91.3
ROE	-10.8	-2.8	5.3	26.2
ROA	-1.2	-0.3	0.5	1.84
Loan risk coefficient in %	42.0	19.5	14.3	4.0

A - banks designed for restructuring. – B - banks without foreign capital. – C - banks with foreign capital and at the same time significant share of the government or government controlled institution. – D - banks with a decisive share of foreign capital.

This picture allows identifying where the problems are concentrated in the banking sector in Slovakia and which way restructuring should take.[8] Deepening of the crisis of the banking sector in the Slovak Republic is comparable with V-4 countries:

7 Loan risk coefficient is calculated as a ratio of the required creation of provisions to the volume of loans

Table 8:

Country	Duration of crisis	Expenses in % of GDP
Czech Republic	from 1991	at least 12
Hungary	1991-1995	9 -12.2
Poland	from 1991	at least 5.7
Slovakia	from 1991	at least 16

Estimates according to E. J . Frydl, The Length and Cost of Banking Crises, IMF, March 1999, Washington.

The main causes of banking crises are attributed to moral hazard and lending expansion. As to the problem of moral hazard, in the Slovak Republic it played an important role above all in the form of direct government and government initiated interventions into banking.

As to the effect of lending expansion, an overview of the evaluated period is in Table 9.

Table 9:

Indicator	1995	1996	1997	1998
Growth of loans total (in percent of the preceding year=100)	13.9	20.5	3.9	2.4
Thereof loans in SKK	11.8	17.6	1.0	-0.6
Thereof foreign currency loans	48.4	56.8	30.9	24.7
Share of foreign currency loans from total loans	7.3	9.5	12.0	14.6

As we can see, SKK lending gradually eased and expansion was mainly in foreign exchange loans, which caused that their share of total loans doubled from 1995 to 1998.

Growth of SKK loans in 1997, 1998 was significantly lower than the rate of inflation, coinciding with a high state budget deficit. In SKK financing, the main Mediator of financial flows was the government (of course, using its own criteria). It was one of the accompanying phenomena of privatization strategy that aimed to create a so-called capital-generating social stratum from persons close to the governing elite. On the one hand, the share of the private sector increased, and on the other hand it continued to be financed from government resources – this was the most sophisticated moral hazard among the transforming countries. The shortage of SKK resources was substituted by growing foreign currency loans (many of these loans were provided on the basis of gov-

8 At present (May 2000) banks in group A are in the process of restructuring and preparations for a tender to select foreign investors are underway. Presumed cost of restructuring is around 100 billion SKK. From banks in group B, two no longer exist, another one is under forced administration, and the entry of a foreign investor is being prepared in two of them. In banks from group C preparations are made to sell the stake of the government or government institutions to foreign investors.

ernment guarantees, either for state-controlled companies or to businesses controlled by the aforementioned capital-generating stratum.[9]

The Exchange Rate Regime

The National Bank of Slovakia applied an exchange rate regime, and from January 1, 1997 extended the fluctuation band to +/- 7 percent. The exchange rate was set towards a currency basket comprising 60 percent DEM and 40 percent USD. The Czech Republic applied a similar regime with a +/- 7.5 percent fluctuation band and a currency basket of 65 percent DEM and 35 percent USD. The reactions to the monetary crisis in May 1997 differed. The Czech Republic abandoned the fixed exchange rate regime, while Slovakia decided to continue using this it. Already in the following year, with regard to a significant drop of FOREX reserves resulting from interventions to support the exchange rate, from October 1998 the NBS also had to float the currency. Another swing in May 1999 already in the regime of a floating exchange rate did not cause a monetary disruption. The Czech Republic even averted the monetary shock of 1998. This development confirms the assumption that the regime of a fixed exchange rate is a disadvantage at a time of fiscal imbalance. It is not in itself the cause of a crisis, but complicates handling the crisis and makes it more expensive.

Influx of foreign investments is enabled by liberalization of the foreign exchange regime. Preferred are direct foreign investments, while short-term usually speculative money transfers may be the triggering mechanism of a crisis. Development of foreign investments in Slovakia and a comparison within V-4 is shown below:

Table 10:
Direct Foreign Investments in Billions USD

Country	1995	1996	1997	1998
Slovakia	0.21	0.33	0.16	0.39
Czech Republic	2.57	1.44	1.29	2.73
Hungary	4.52	2.28	2.17	2.05
Poland	3.66	4.50	3.08	5.14

The influx of direct foreign investments into the economy of the Slovak Republic was low and not corresponding to its size.

The central bank strived to curb the influx of speculative capital in the following ways:

– commercial banks had free access to the NBS fixing under the condition that one the day of purchase of foreign exchange, the ratio of foreign exchange assets to foreign

9 The consequences can be documented by the example of VSZ, i.e. the flagship of Slovakia's industry, that essentially slipped into the regime of creditor management.

exchange liabilities has not exceeded 1.05. This regulation method applied until December 1998, after the currency was floated,

– the NBS introduced in 1996 a coefficient of the foreign exchange position of banks for monetary purposes. The coefficient was calculated as the ratio of foreign exchange assets of non-residents to the sum of liabilities in SKK and foreign exchange liabilities reduced by the amount of capital in a foreign currency. The size of this coefficient has been gradually increased from 0.65 (as of December 30, 1996) to 0.80 (June 30, 1997). The coefficient was monitored on a ten-day basis and from July 1997 on a daily basis. This was not a standard solution and its contribution to the prevention of financial crises has not been specifically verified.

Political Instability

Political instability is mentioned as one of the significant factors supporting economic instability and creating a favorable environment for an attack against the currency. The period from 1994 to 1998 passed without serious disruptions and the government has not changed during the whole election term. From a purely technical point of view, this was the first government since 1990 to survive over the whole election term, hence this was a period of political stability. With regard to its political program based on unsustainable presumptions, deepening economic disequilibria, halting economic reforms and the reform of the banking sector, and economic and political isolation of the Slovak Republic, this period can be evaluated as a period of negative political stability. Hence, although there was no political instability in the Slovak Republic, the political power, or the way it was implemented increased the pro-crisis tendencies.

Consequences of Crises

I assume that consequences will surface with certain delay. Therefore, in this part I compare the basic indicators of the economic development in the years when the financial crisis appeared with the following year.

Rating agencies reacted to the negative political and economic development in the Slovak Republic, which reflected in downgraded rating:

The consequences of the crisis development based on preferring unsustainable growth have appeared in the form of slower economic growth, growing rates of unemployment and inflation, worsened quality of the loan portfolio and downgraded rating. In July 2000 Standard and Poor's Agency ranked Slovak Republic among fifteen the most injured economies of the world.

The potential level of gross problematic assets is about 35% - 70% in this group of countries. According to analysts of the Agency the weakness of Slovak economy is caused by the inefficient privatization, poor corporate governance in the corporate sector, political influence in lending decisions in state-owned banks, and years of consumption-driven economic growth.

Table 11:

Indicator	1997	1998	1999*
GDP growth in %	6.5	4.4	1.9
Unemployment rate in %	12.5	15.6	19.2
Annual inflation rate in %	6.4	5.6	14.2
Current account of the balance of payments deficit in billions USD	-1.34	-2.06	-1.08
Exchange rate SKK/USD	34.8	36.9	42.3
State budget deficit	37.0	19.2	14.7
Classified loans/ loans (1999 first half year in %)	36.7	37.3	39.8
Direct foreign investments (billions USD)	0.16	0.39	0.19**

*1999 - preliminary figures. - ** for the period January - October 1999.

Table 12:

Agency	1997	1998	1999
Standard & Poor's	BBB-	BB+	BB+
Moody's Investor Services	Baa3	Ba1	Ba1
Fitch IBCA	BBB-	BB+	BB+

Measures to Overcome the Crisis

The core of the measures to overcome the crisis must be based on eliminating its causes. Let's therefore make a brief summary:

– an unbalanced economic environment,

– a crisis in the banking system,

– influence of foreign investments,

– exchange rate regime,

– political instability.

As far as disequilibria in the economic environment are concerned, it is necessary to continue economic reforms, including the privatization of so-called strategic companies. It is important to emphasize the sustainable nature of economic growth supported by tight fiscal policy. The government of the Slovak Republic adopted a medium-term program of economic and social development (until 2003), which respects these principles. From a long-term perspective, the pro-integration focus of the economic policy is important, aiming to meet economic criteria for membership in the European Union with outlook of joining the EMU. Participation in this European integration organization

would on the one hand mean giving up a part of our economic sovereignty (such as in monetary and budget areas), but on the other hand it would mean the elimination of risks which an open and small economy often unsuccessfully faces, because the possibilities of monetary and fiscal policy to prevent external (but also internal) negative effects are limited.

Restructuring of the banking system, based on the privatization of government stakes in commercial banks has already started. The government has selected as advisors J. P. Morgan and Deutsche Bank for the economic aspects of the process of selecting an investor and White and Case as the advisor for the legal matters of this process. In order to clean up the loan portfolio of the banks prepared to be sold, alongside Konsolidacna banka, an agency called Slovenska konsolidacna, a.s. was established, into which classified loans are transferred. The purpose of this institution is to settle these claims within the upcoming several years.

It is also necessary to complete the implementation of Basle core principles for the regulation, supervision, and the system of banking operations with the aim to stabilize the financial sector. It will be necessary to carry out legislative and institutional changes to do so. It is also unavoidable to improve the transparency of the financial market. A concept for comprehensive supervision over the financial market is being prepared with the aim to improve effectiveness of supervision and to stabilize the financial market.

Stabilization of the economic and political environment should increase the influx of foreign investments, which, apart from positive effects could also temporarily increase some risks, above all in association with an awaited lending expansion following the stabilization of the banking sector. These are factors that in 1997 and 1998 essentially were not effected or their importance was insignificant. These expectations are supported by completing liberalization in the foreign exchange area.

The exchange rate regime should not fundamentally change. Floating exchange rate with EUR as the reference currency could be replaced by a period of increased ties between the SKK and the EUR, above all as the date for becoming a member of the European Union becomes more realistic, and of course after joining, the SKK should be fixed to the EUR until Slovakia joins the European Monetary Union.

Concerning the problem of political stability, it is necessary to replace the model of "negative stability" by a model of positive stability, even though some politicians cannot give up experimenting with a peculiar alternative of "positive instability", although theoretically it is an even greater nonsense than "negative stability". Stabilization and above all standardization of the political environment is presumably the decisive precondition for Slovakia's intentional credibility and a guarantee of successful completion of economic reforms.

Conclusions

The economy of Slovakia is confronted with a lasting crisis of economic system, and the way out of the crisis should be the completion of the reform process and the achieve-

ment of integration ambitions. Monetary shocks in this period are much more probable and can be caused by seemingly insignificant impulses. When monetary disturbances emerged in 1997 - 1998, stability of the system was also disrupted by a shock from transgressing the reform process after elections in the autumn of 1994. Financial crises are caused by both external and internal reasons. The Czech and Russian crises were the main external reasons of Slovak crises which worked as a triggering mechanism. Among the main internal reasons in Slovakia we can involve the economic instability, lasting neglect of the situation, postponement of resolving the problems of the banking sector, intransparency and nonstandard features of the political scene. The internal reasons created pro-crises environment which facilitated the development of financial crises.

Reactions to the powerful swings in 1997 and 1998 (interventions of the central bank and the change of the exchange rate regime) were not sufficient to eliminate the causes that prompted the crisis of the economy in Slovakia. Only the completion of economic transformation can change the pro-crisis environment. A return to the process of transformation means halting the growth of Slovakia's debt by a tougher fiscal policy. Restructuring and privatization of the banking sector (2000 - 2001) is another precondition for achieving an equilibrium in the economy. Price liberalization and privatization of so-called strategic companies, together with legislative changes should mobilize foreign investors. Strategy of the economic policy of the government is creating space for these changes. Any political destabilization would on the other hand negatively influence the gradual formation of an environment more resistant to financial crises.

Small economies, among which Slovakia ranks, are very sensitive to changes in the surroundings with which they communicate. Changes in the orientation of foreign trade to the European Union should be followed by successful integration into the EU. This is a precondition for lasting stabilization of these economies as constituents of this prominent international economic organization.

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