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Zsolt Darvas–György Szapáry:

# FINANCIAL CONTAGION UNDER DIFFERENT EXCHANGE RATE REGIMES

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Zsolt Darvas is senior economist, Economics and Research Department
E-mail: darvaszs@mnb.hu
György Szapáry: is Deputy President of the National Bank of Hungary
E-mail: szaparygy@mnb.hu


H-1850 Budapest
Szabadság tér 8-9.
http://www.mnb.hu

## Abstract*

This paper reviews the contagion effects of the global financial crises of 1997-99 on five small open economies: the Czech Republic, Greece, Hungary, Israel and Poland. We analyze how the financial markets of these countries were effected under different exchange rate regimes. We look at the impact on exchange rates, interest rates and stock markets. In order to shed some light on the behavior of financial asset holders at times of global crises, we examine the sources of capital flows in Hungary for which country we were able to gather the detailed data necessary for such an analysis. Based on our findings, we offer some concluding remarks regarding the choice of exchange rate regime and the role of capital controls.


## Contents




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## 1. Introduction

The global financial crises of recent years brought into the fore once again the question of appropriate exchange rate regime for small open economies particularly exposed to speculative capital movements because of their status as emerging markets. These countries are typically characterized by an interest rate premium vis-a-vis developed countries because of the higher risks perceived by the markets and/or because the authorities maintain high interest rates in order to bring inflation under control. Portfolio investments in fixed income instruments, typically in government securities, or in other forms are attracted to these countries to take advantage of the higher return when the fundamentals look reasonably healthy, such as after successful stabilization policies. Good fundamentals are not a precondition though, as evidenced by the large inflows into Russian GKO's prior to the summer of 1998. The foreign capital thus invested remains volatile and tends to leave the emerging market countries suddenly when a panic reaction develops in response to a financial crisis somewhere. Countries can be hit by an outflow of capital even if they have been following sensible policies and their trade and financial links to the country of origin of the crisis are weak.

There is a vast literature discussing the appropriate exchange rate regime for countries facing volatile capital flows. Behind the discussion lies the suggestion that there are trade-offs between the degree of flexibility of the exchange rate system on the one hand, and the variability of the exchange rate and the level and volatility of interest rates, on the other hand. We would like to contribute to the discussion in the literature by examining the experiences of four European countries -- the Czech Republic, Greece, Hungary and Poland -- and Israel. These countries share similarities from the point of view of examining the effects of contagion. All five of them are small open economies with weak economic and financial links to the countries where the recent financial crises originated from, yet all of them were more or less seriously effected by the crises. They are closer to the developed world than countries usually classified as emerging markets because of the important trade links and financial integration with the industrialized countries, nevertheless they have characteristics which have exposed them to swings in capital flows. The Czech Republic, Hungary and Poland are at an advanced stage of accession negotiations with the European Union and are among those transition

countries which have made the most progress toward full-fledged market economies. However, they still have a long way to go to catch up with the industrialized world in terms of modernization and standard of living. Greece has been a member of the European Union (EU) since 1982, but its per capita income is the lowest within the EU and it is not yet a member of the Economic and Monetary Union (EMU). In Israel, where per capita income is higher than that in some EU countries, the peace process has often placed political issues at the center of government policies. These characteristics have exposed these countries to volatile capital movements. Since they have adopted different monetary and exchange rate regimes, it is interesting to examine if there are any possible links between the contagion effects and the exchange regimes in place.

There were three international financial crises in the past three years: the South-East Asian crisis of 1997, the Russian crisis of 1998 and the Brazilian crisis of early 1999. The Asian crisis unfolded through a series of events, starting with the announcement by the Bank of Thailand that it would let the bath float on July 2, 1997, followed by the floating of the Indonesian rupee in August and of the Korean won in December. Following these actions, all three currencies depreciated strongly and Asian stock prices nose-dived, sending shock waves to stock exchanges throughout the world. The heaviest impact on international stock prices took place in the wake of the nearly 25 percent fall of the Hong Kong stock market in October 20-23[1]. The Russian crisis unfolded significantly faster. Russian stock prices began to fall in May as market confidence started to shake. The real crisis started on August 17 when the ruble was let to float, leading to a sharp depreciation (210)[2] of the Russian currency within the following three weeks. At the same time, a 90-day moratorium was placed on private external debt amortization, while it was announced that a compulsory restructuring of domestic government debt would take place. The Russian events sent stock prices falling around the world as well. The Russian default had a deep impact on Brazil where capital outflows accelerated. The Brazilian authorities tried to contain the pressure on the exchange rate by raising interest rates and offering additional incentives in the form of interest rate and exchange rate guarantees to holders of government debt. In the end,

[1] In the charts presented in this paper, we selected October 23, 1997 as the date to pinpoint the start of the contagion effect of the Asian events.

[2] The rates of depreciation mentioned in this paper are calculated on the basis of domestic currency unit per foreign currency unit.

the Brazilian authorities were forced to let the currency float in January 1999, which led to a depreciation of the real by 78 percent in the subsequent two months. The Brazilian devaluation, too, sent jitters throughout the stock markets of the world.

The main spill-over effects of the financial crises on the five countries selected were capital outflows accompanied by pressures on the exchange rates, upward movements in interest rates and fall in equity prices. However, the magnitude and duration of these effects varied. In most cases, the largest impact was caused by the Russian crisis. This is not surprising given the geographic closeness of Russia to these countries. The important point to note is that strong financial contagion occurred even though these countries' trade with Russia is small. For the three transition economies considered, trade with Russia had been substantially reduced by 1997: exports to Russia accounted for approximately 3 percent, 5 percent and 8 percent of total exports of the Czech Republic, Hungary and Poland, respectively (Table 1). About 77 percent of the exports of Hungary, 70 percent of the exports of Poland and 65 percent of the exports of the Czech Republic go to industrial countries. The exports to Russia of Greece and Israel is even less: about 2 percent and 1 percent, respectively, of their total exports. Clearly, the fact that the five countries considered are regarded as emerging markets or catching-up economies geographically close to Russia played a dominant role in the stronger contagion effects experienced by these countries following the Russian crisis.

**Table 1: Percent Distribution of Trade Flows, 1997**

| | Czech Rep. | | Greece | | Hungary | | Israel | | Poland | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Exp.* | *Imp.* | *Exp.* | *Imp.* | *Exp.* | *Imp.* | *Exp.* | *Imp.* | *Exp.* | *Imp.* |
| **Industrial countries** | **65.4** | **60.8** | **64.0** | **77.2** | **76.7** | **71.7** | **74.0** | **86.4** | **69.1** | **73.2** |
| US | 2.4 | 3.9 | 5.2 | 3.7 | 3.2 | 3.8 | 33.6 | 20.2 | 2.6 | 4.5 |
| Europe | 62.1 | 54.4 | 56.4 | 70.3 | 72.6 | 64.2 | 33.6 | 61.0 | 65.8 | 66.4 |
| o.w.: Austria | 6.5 | 4.4 | 1.5 | 1.0 | 11.5 | 10.6 | 0.4 | 0.5 | 1.9 | 2.0 |
| France | 3.1 | 3.8 | 4.5 | 9.4 | 3.8 | 4.0 | 2.9 | 4.1 | 8.7 | 5.9 |
| Germany | 36.1 | 26.9 | 18.7 | 13.9 | 37.2 | 13.1 | 4.5 | 10.1 | 33.0 | 24.1 |
| Italy | 3.7 | 5.4 | 14.0 | 18.1 | 6.2 | 7.4 | 2.9 | 7.4 | 5.9 | 9.9 |
| Netherlands | 2.5 | 2.0 | 2.8 | 6.5 | 2.8 | 2.6 | 4.6 | 4.1 | 4.7 | 3.6 |
| UK | 3.1 | 3.4 | 5.8 | 6.0 | 3.3 | 3.1 | 6.5 | 9.0 | 3.8 | 5.5 |
| **Developing Asia** | **3.0** | **5.3** | **3.5** | **4.8** | **1.1** | **6.4** | **14.3** | **7.7** | **2.6** | **8.1** |
| o.w.: crisis countries* | 0.5 | 1.4 | 1.0 | 0.9 | 0.1 | 0.8 | 3.7 | 2.1 | 0.9 | 1.2 |
| **Developing Europe** | **28.6** | **31.9** | **22.0** | **6.7** | **20.2** | **19.6** | **5.8** | **3.2** | **25.2** | **15.5** |
| o.w.: Russia | 3.3 | 6.8 | 1.9 | 0.8 | 5.1 | 9.2 | 1.2 | 0.6 | 8.4 | 6.4 |
| Slovak Rep. | 12.9 | 8.4 | 0.1 | 0.1 | 1.4 | 1.9 | 0.1 | 0.0 | 1.2 | 1.2 |
| **Other** | **3.0** | **2.0** | **10.5** | **11.3** | **2.1** | **2.4** | **6.0** | **2.7** | **3.1** | **3.3** |

Source: IMF, Direction of Trade Statistics.
* Indonesia, Korea, Malaysia, Philippines, Thailand

Section 2 reviews briefly the monetary and exchange regimes and the macroeconomic situation of the countries under study. This is followed by an examination of the impact of the international financial crises on exchange rates (Section 3), interest rates (Section 4) and stock markets (Section 5). In Section 6, we analyze the sources of capital flows in Hungary in order to shed some light on the behavior of financial asset holders at times of global crises. Hungary was the obvious choice for us for that analysis because of our access to the relevant data and our familiarity with the underlying developments. Finally, in Section 7 we present some concluding remarks.

## 2. Monetary and Exchange Regimes and Macroeconomic Situation

The Czech koruna was fixed to a currency basket practically without band until February 1996 when a ± 7.5 percent wide band around the fixed rate was introduced (Chart 1a). In May 1997, speculation against the Czech koruna led to the abandonment of the fixed rate and the adoption of a free floating and inflation targeting regime.[3] In Greece, the exchange regime was classified as managed floating prior to 1998 but, as argued by Detragiache and Hamann (1997), the drachma was actually managed as a crawling peg against the ECU, a development that seems to be confirmed by looking at Chart 1b. In March 1998, following a step devaluation of 14 percent, Greece joined the ERM with a ± 15 percent wide band. Greece's announced policy goal is to join the euro zone, hence its monetary regime can be regarded as a mix of inflation targeting and exchange rate anchoring.

Until March 1995, Hungary had an adjustable peg to a currency basket and the forint was depreciated 22 times during the period from January 1990 to February 1995. Since March 1995, Hungary has maintained a preannounced crawling peg with a relatively narrow band of ± 2.25 percent against a currency basket (Chart 1c)[4]. The monetary regime of Hungary can be characterized as an exchange rate anchored regime where, taking into account the faster rate of productivity growth in Hungary compared

[3] Lessons from the Czech exchange rate crisis is studied by Begg (1998).

[4]The introduction of the crawling band regime was preceded by a 9 percent devaluation. The rate of crawl was reduced from 1.9 percent per month at the start of the crawling band regime to 0.5 percent per month in July 1999.

to its trading partners, the rate of crawl is set somewhat below the expected rate of inflation differential so as to help disinflation while also maintaining competitiveness. Israel moved from an adjustable band to a preannounced crawling band in December 1991. The band was widened in several steps to the current ± 15 percent (Chart 1d)[5]. The monetary regime of Israel is more often characterized as inflation targeting, although heavy central bank intervention that took place on several occasions is not normally a characteristic of inflation targeting regimes. Finally, Poland has had a preannounced crawling peg since October 1991, first with no band, then with a band which was widened in steps to ± 15 percent currently (Chart 1e)[6]. The authorities characterize their monetary regime as inflation targeting.

Thus, among the five countries examined, the exchange regimes in place during the financial crises include a free floating regime (the Czech Republic); a fixed rate regime with a wide band (Greece since March 98); and three preannounced crawling bands, one of which with a narrow band (Hungary) and the two others with wide bands (Israel and Poland). This gives an example of practically all the varieties of exchange regimes with the exception of a rigidly fixed rate, which can only be maintained in the

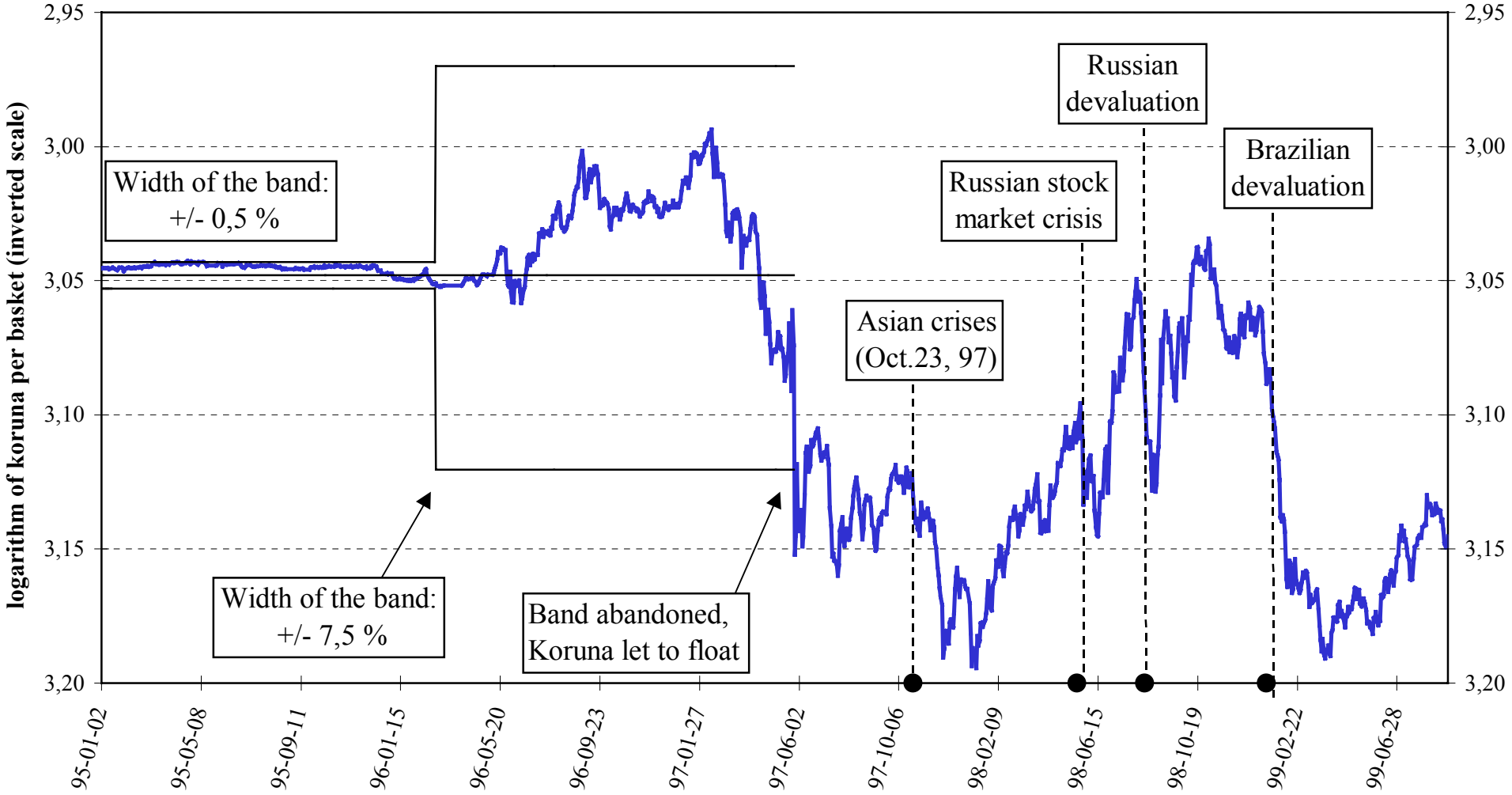
[5] In Israel, the rate of crawl was initially set at 9 percent per year and was preceded by a 3 percent devaluation in December 1991. Subsequently, three smaller (1-3 percent) discrete devaluations were effected. Currently, the rate of crawl is asymmetric: 2 percent per year for the strong edge of the band and 4 percent per year for the weak edge.

[6] The rate of crawl was reduced from 1.8 percent per month in October 1991 to 0.3 percent per month in March 1999. The introduction of the crawling band was not preceded by a step devaluation, but two discrete devaluations of 10.7 percent and 7.4 percent and a revaluation of 6 percent were effected subsequently.

long run if several macroeconomic conditions are all met. This is rarely the case for small open catching-up economies facing domestic inflationary pressures. A fixed rate, such as under a currency board arrangement, may make sense under certain circumstances, but such arrangements remain the exception even if their popularity seems to have increased in recent years, particularly in transition economies.[7]

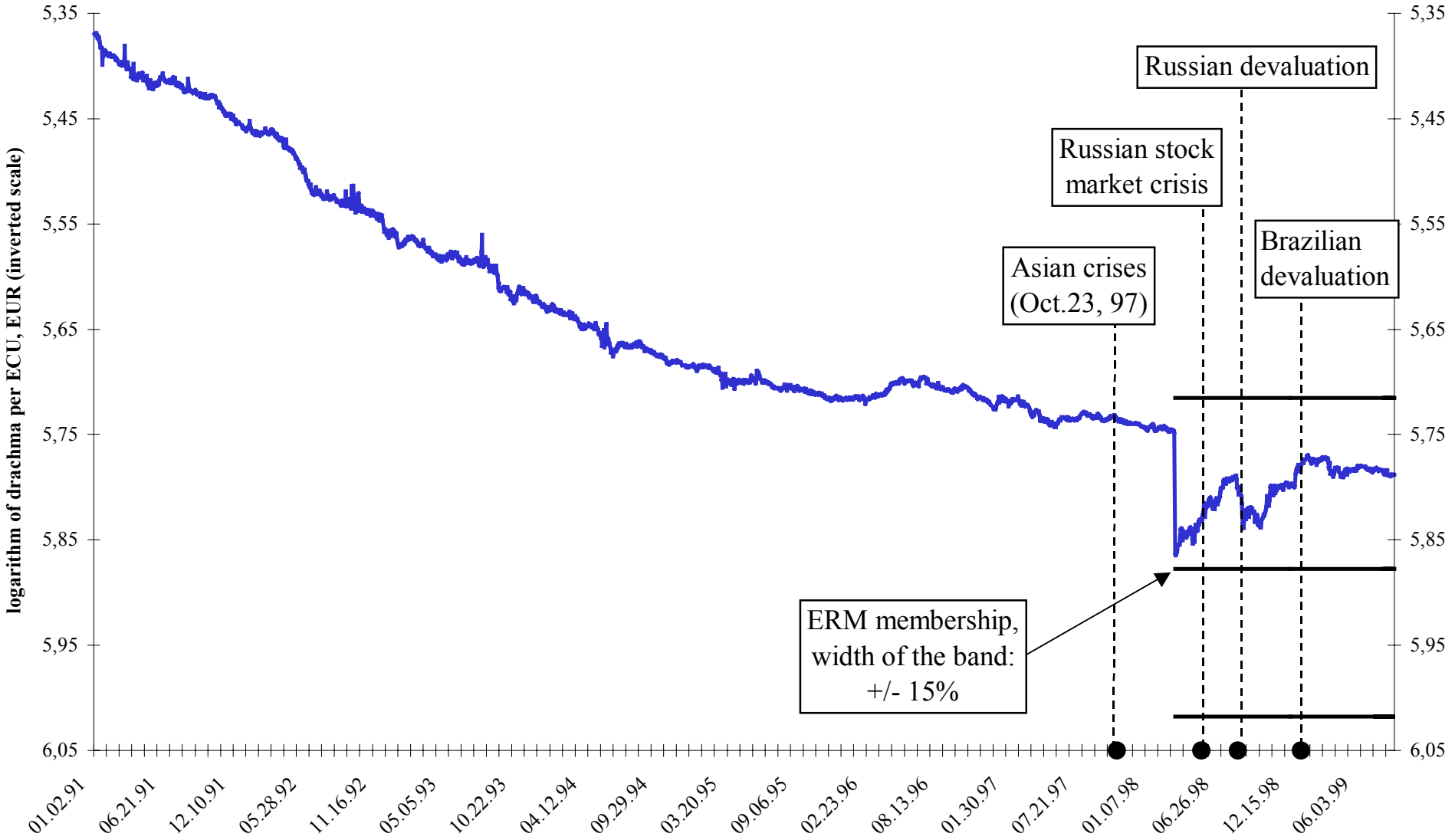
[7] Problems with exchange rate fixing are emphasized, inter alia, in Begg-Wyplosz (1999), Mishkin (1998), Obstfeld (1995) and Obstfeld-Rogoff (1995).

## Chart 1/a: Nominal Exchange Rate of the Czech Koruna, January 1996 - August 1999

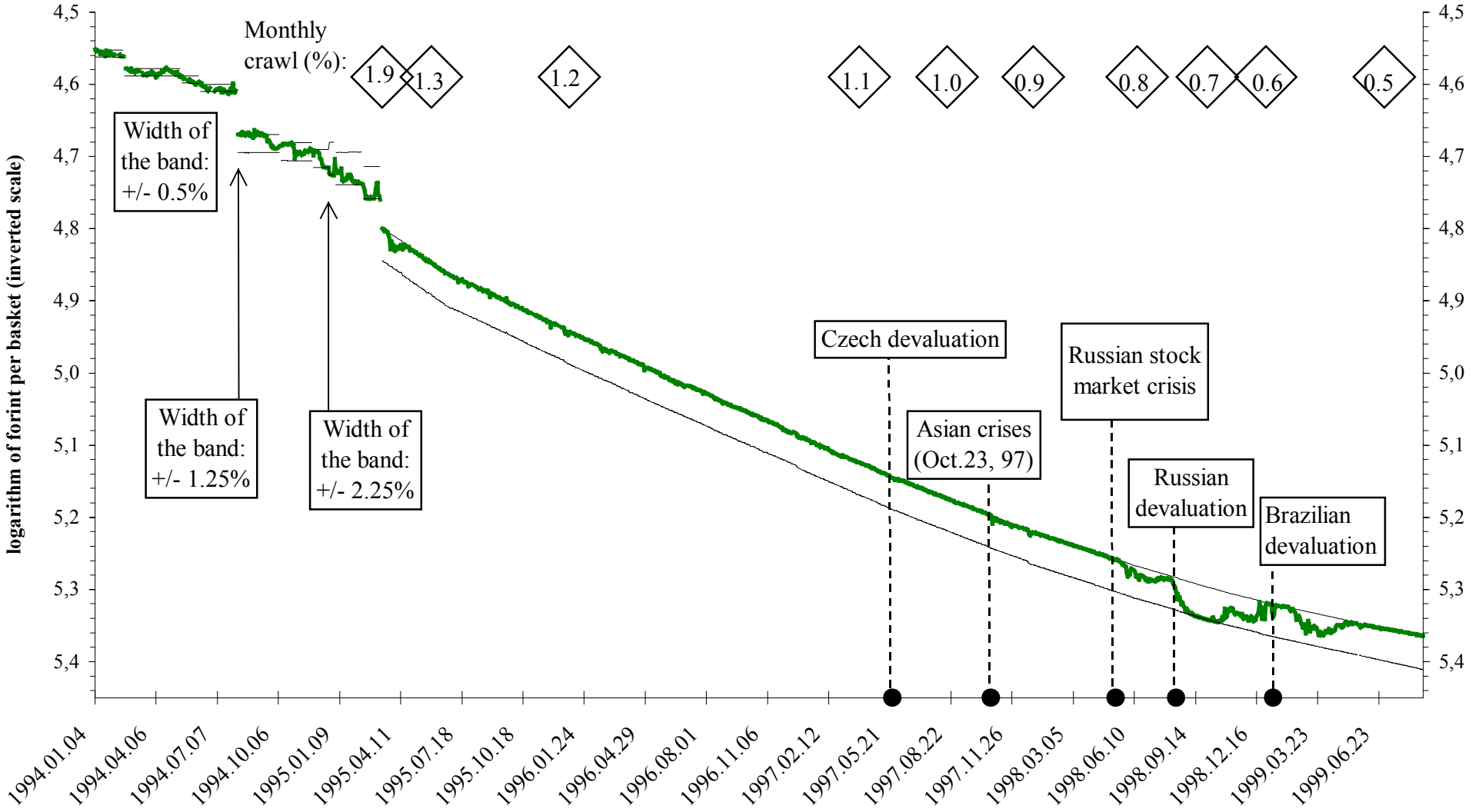



Basket used prior to May 1997: 65% DEM - 35% USD. We used the same basket for the floating period for comparision purposes.

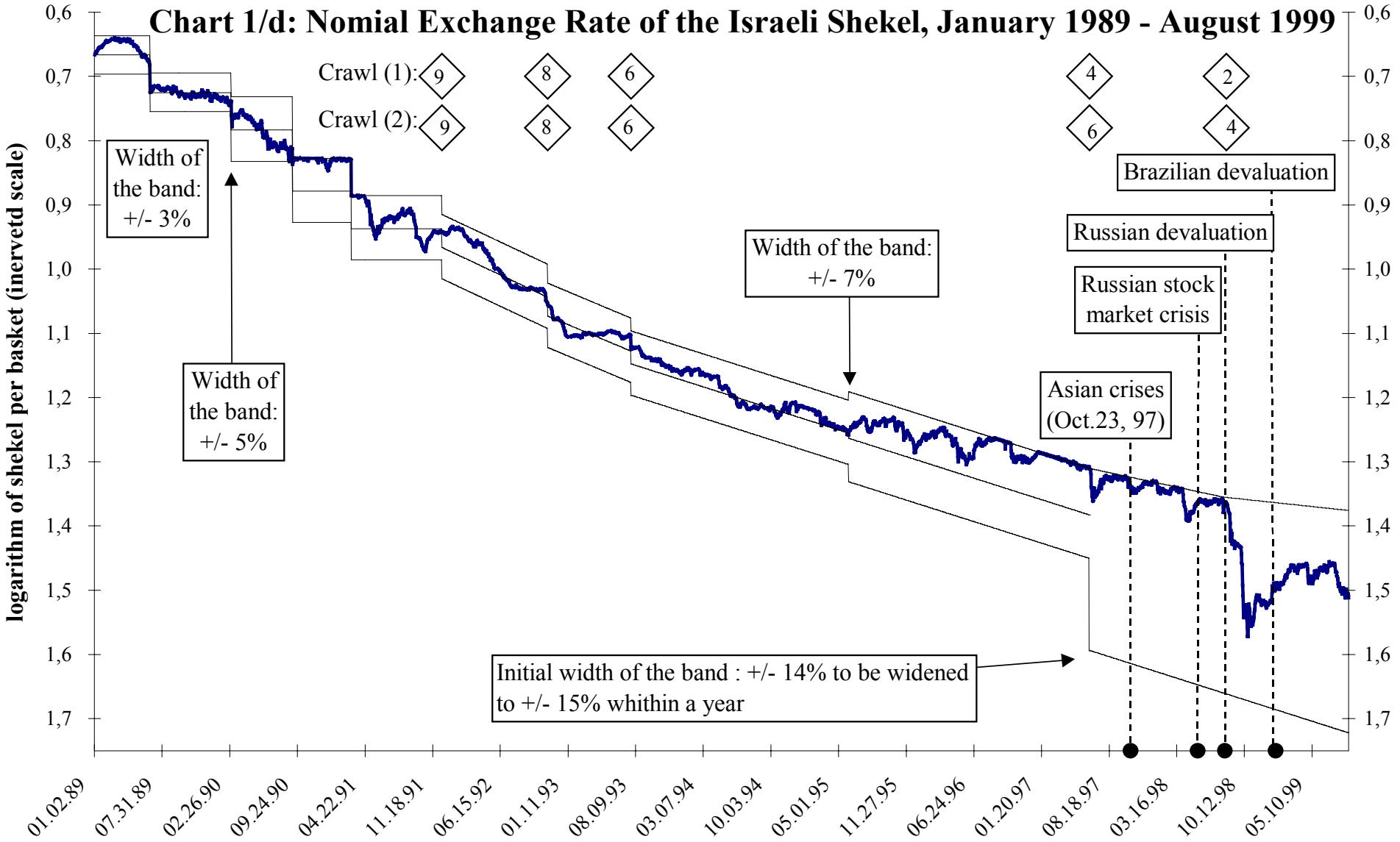
## Chart 1/b: Nominal Exchange Rate of the Greek Drachma, January 1991 - August 1999



# Chart 1/c: Nominal Exchange Rate of the Hungarian Forint, January 1994 - August 1999

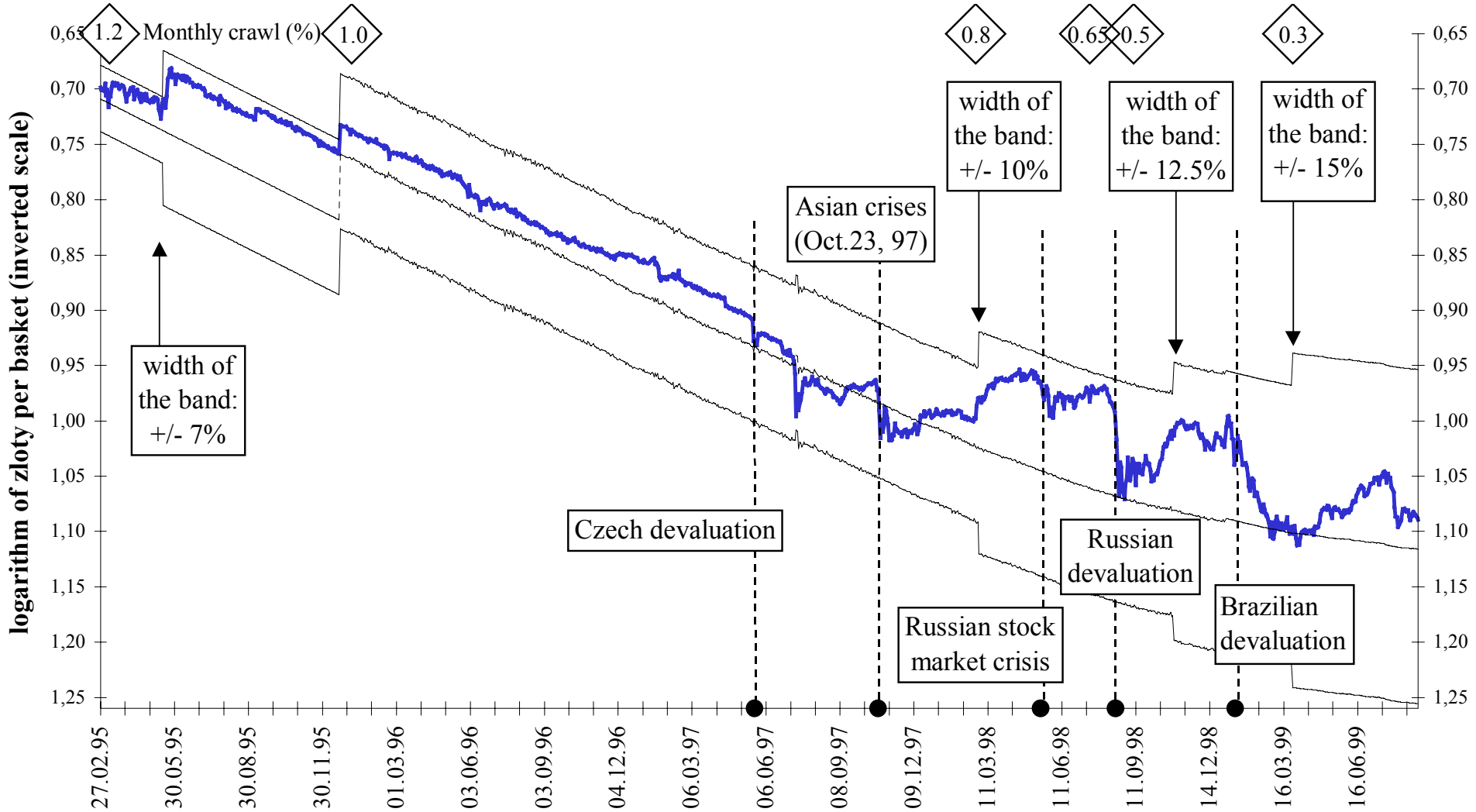



Composition of the basket: 50% DM+50% USD for August 1993 - May 1994; 70% ECU+30% USD for May 1994 - December 1996; 70% DEM+30% USD for January 1997 - December 1998; 70% EUR+30% USD since January 1999.




Crawl (1): annual preannounced devaluation of the strong edge of the band, Crawl (2): annual preannounced devaluation of the weak edge of the band. The composition of the basket has varied. At the end of 1998, the percentage composition was: 62% USD, 19.7% DM, 8.2% GBP, 4.8% FRF, 5.3%

## Chart 1/e: Nominal Exchange Rate of the Polish Zloty, February 1995 - August 1999




Composition of the basket prior to 1999: 45% USD, 35% DM, 10% GBP, 5% FRF, 5% CHF, since 1999: 55% EUR , 45% USD.

Naturally, the macroeconomic situation also has an influence on how the markets perceive the risks in a country at a time of international financial crisis. The current account deficit -- a much watched indicator to assess risks -- narrowed in the Czech Republic, Greece and Israel, while it widened in Poland and Hungary between 1996 and 1998 (Table 2). In 1998, the lowest current account deficit was recorded in the Czech Republic (1.8 percent of GDP) and the highest in Hungary (4.8 percent) and Poland (4.4 percent). Inflation has been on a downward trend in all five countries over the past several years, although it increased temporarily in the Czech Republic in 1997-98 and in Israel in the second part of 1998 (Chart 2). The rate of inflation in July 1999 was the highest in Hungary (10.1 percent) and the lowest in the Czech Republic (1.1 percent) and Greece (2.1 percent). The rates of GDP growth slowed in the Czech Republic, Israel and Poland in 1997-98 and increased in Greece and Hungary. The highest rates of growth were recorded in Poland and Hungary, in the range of 6 to 5 percent on average over the two years 1997-98. The lowest growth was experienced in the Czech Republic where GDP actually declined by about 2 percent in 1998. Overall, it can be said that during the period of the international financial crises from mid-1997 to early 1999, none of the countries considered suffered major macroeconomic imbalances, although some of them exhibited weaknesses, such as the widening current account deficits in Hungary and Poland and the fall in GDP in the Czech Republic.

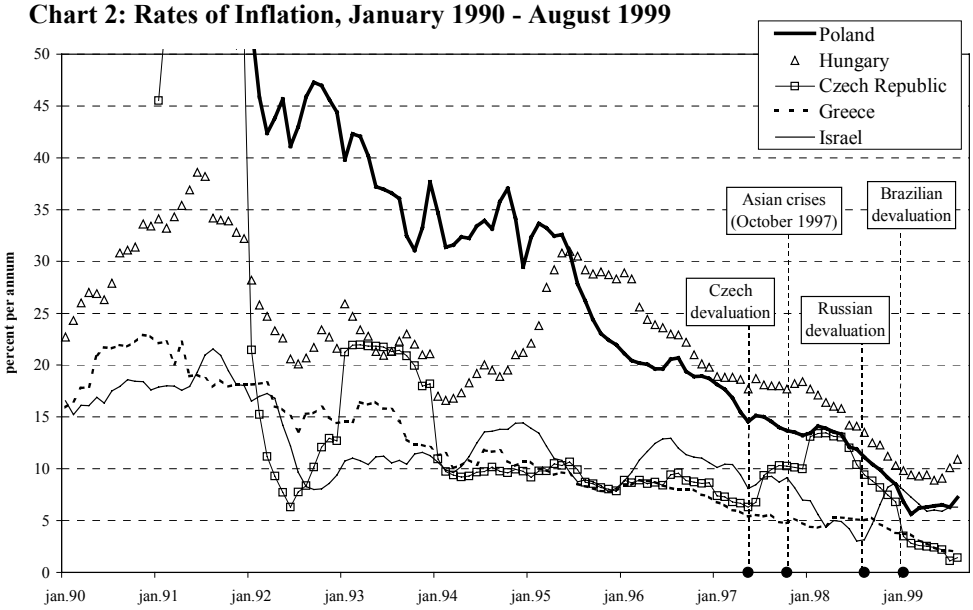
**Table 2: Growth, Current Accounts and Budget Balances, 1994-98**

| | Gross domestic product (percent change) | | | | | Current account (percent of GDP) | | | | | General government balance (percent of GDP) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1994 | 1995 | 1996 | 1997 | 1998 | 1994 | 1995 | 1996 | 1997 | 1998 | 1994 | 1995 | 1996 | 1997 | 1998 |
| Czech R. | 3.2 | 6.4 | 3.9 | 1.0 | -2.3 | -2.1 | -2.7 | -7.6 | -6.1 | -1.9 | | -2.5 | -2.3 | -2.3 | -1.6 |
| Greece | 2.1 | 2.0 | 2.6 | 3.2 | 3.7 | -0.1 | -2.5 | -3.7 | -2.6 | -2.6 | -10.0 | -10.3 | -7.5 | -4.0 | -2.5 |
| Hungary | 2.9 | 1.6 | 1.3 | 4.6 | 5.1 | -9.4 | -5.6 | -3.9 | -2.2 | -4.8 | -9.6 | -7.3 | -4.6 | -5.1 | -4.9 |
| Israel | 6.8 | 7.1 | 4.5 | 2.3 | 2.0 | -4.8 | -6.1 | -6.6 | -3.3 | -3.0 | -1.2 | -3.2 | -4.1 | -2.4 | |
| Poland | 4.8 | 7.9 | 6.1 | 6.9 | 4.8 | 1.0* | 0.7* | -1.0* | -3.1* | -4.4* | -3.2 | -3.3 | -3.6 | -3.3 | -3.0 |

Sources: IMF, International Financial Statistics and World Economic Outlook; BIS: Annual Reports; National Bank of Hungary: Annual Reports

* Data on current account includes the surplus on unrecorded trade transactions as estimated by the IMF.

**Chart 2: Rates of Inflation, January 1990 - August 1999**




## 2. Impact on Exchange Rates

Following the Asian and Russian crises, the nominal exchange rates depreciated in all five countries under review due to an outflow of capital (Charts 3a and 3b)[8]. The Asian crisis brought less depreciation than the Russian crisis, which underlines the significance of the regional aspect of market reactions. Following the Brazilian devaluation, only the three transition countries experienced a depreciation of their currencies, indicating that this group of countries remains especially exposed to contagion. After each crisis-induced depreciation, all currencies strengthened, showing that the contagion effect typically contained an element of overshooting. However, the strength of the recovery varied. The Czech koruna depreciated after the Brazilian crisis even more than following the Russian events and the subsequent recovery of the currency was much weaker. This coincided with the weakening of growth performance of the Czech economy and the wider recognition that the Czech Republic has been lagging behind the other two transition countries in the area of structural reforms. This

[8] In order to obtain a better comparison, we used for all five countries the same basket of currencies to calculate the nominal and real exchange rates. This is an average trade-weighted basket of the five countries. The weights are the following (in percent): Germany, 39.1; Italy, 14.5; USA, 14.9; United Kingdom, 8.9; France, 9.0; Austria, 7.2; Netherlands, 6.5. We used the same basket to derive foreign interest rate when calculating interest rate premia below.

may be a sign that following an initial contagion effect, markets tend to become more sensitive to the underlying fundamentals of the economy. The lowering of interest rates by the Czech authorities in response to the slowdown in growth and an unexpectedly low inflation[9] has no doubt also contributed to the depreciation of the koruna. The Polish zloty did not recover its pre-Brazilian crisis strength either. The pronounced deterioration of Poland's current account may have played a role in that development. As expected, the depreciations were larger in the Czech Republic, Israel and Poland which have maintained more flexible exchange rate regimes than in Hungary which has kept a narrow band regime. The smallest depreciation on a trade-weighted basis took place in Greece, despite the wide band within the ERM. Clearly, Greece seems to have benefited from the credibility provided by the policy commitments associated with membership in ERM, which has been accompanied by an improvement in the external position and a decline in the rate of inflation.

The case of Israel illustrates the problems that swings in capital flows can cause. In May 1995, the Bank of Israel widened the band to ± 7 percent which was followed by an appreciation of the sheqel within the band. The continuous upward pressure on the exchange rate prompted the central bank to intervene and international reserves doubled within a year between mid-1996 and mid-1997. To relieve the upward pressure on the exchange rate by creating more uncertainty, the Bank of Israel widened the band to ± 14 percent in July 1997, but it did it asymmetrically by widening only the weak side of the band. It also reduced interest rates in steps by a total of 350 basis points. Nonetheless, the sheqel remained at or close to the strong edge of the band up to two months prior to the Russian crisis. Following the crisis, the sheqel depreciated by 20 percent and the central bank was forced to raise interest rates in two steps by a total of 400 basis points to defend the currency, even though the economy had shown signs of recession at that time (industrial production had fallen and GDP growth had slowed from 6 percent to less than 2 percent). The fact that in just a few months a strong pressure for appreciation turned into a strong pressure for depreciation triggering wide fluctuations in interest rates shows the damaging impact of speculative capital flows against which a wide band

[9] The inflation target of the Czech National Bank is defined in terms of 'net inflation' and was set at 4 percent for 1999. Actual net inflation was minus 0.6 percent in June 1999.

does not necessarily provide protection on the grounds that it is less vulnerable to attacks than a fixed or a narrow band regime.

**Chart 3/a: Nominal Exchange Rates, January 1997 - August 1999**

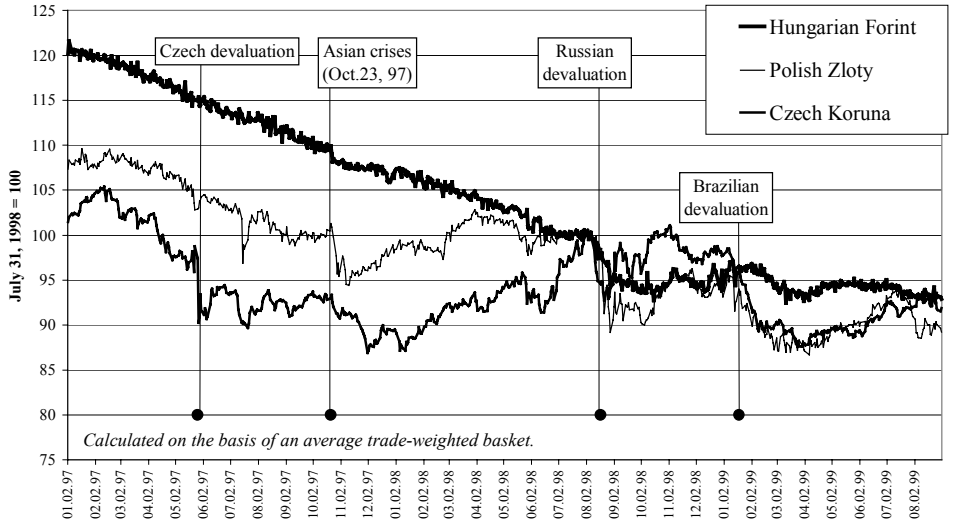
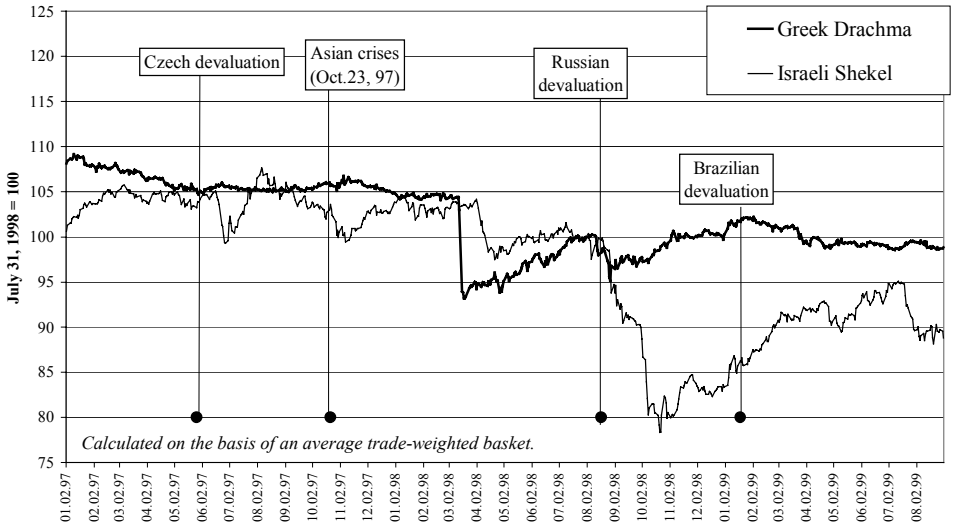



**Chart 3/b: Nominal Exchange Rates, January 1997 - August 1999**




Developments in the real exchange rates show the impact on competitiveness of different exchange rate regimes adopted (Chart 4). In the more flexible regimes of the Czech Republic and Poland, the real rates were allowed to appreciate significantly in response to the capital inflows. The authorities of these two countries probably hoped that the nominal appreciation will simply lower inflation without lasting impact on competitiveness. They may also have wanted to avoid the cost of sterilized intervention, although the central bank of Poland is reported to have intervened on several occasions

to limit the appreciation of the zloty.[10] In Hungary, on the other hand, the authorities have limited the appreciation by keeping the exchange rate within the narrow band through sterilized intervention. The Hungarian authorities placed special emphasis on maintaining competitiveness, due in part to the relatively high external indebtedness of the country. Nonetheless, disinflation in Hungary has been approximately as fast as in Poland where the real exchange rate appreciated significantly (see Chart 2). Sterilization in Hungary, of course, involved budgetary costs, but as demonstrated in Szapáry and Jakab (1998) that cost was relatively limited (estimated at 0.16 percent of GDP per year from March 1995 to end-1997) compared to the benefits provided by the maintenance of competitiveness and the credibility of the exchange rate which, inter alia, helped to obtain lower interest rate premia as compared to the Czech Republic and Poland (see below). In Greece, the noteworthy development is the modest but continuous real appreciation over the past several years, indicating the emphasis placed by the authorities on reducing inflation to meet the Maastricht criteria.

**Chart 4: Real Exchange Rates, January 1990 - June 1999**

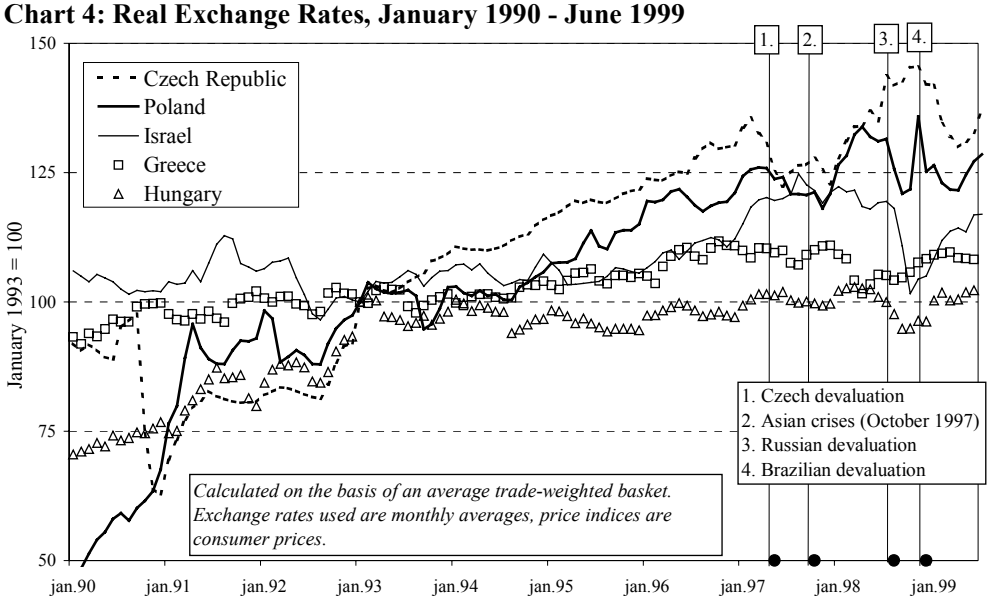



Table 3 reveals a significant relationship between the variability of the real exchange rate and the exchange regime. As one would expect, the most rigid regime, the fixed exchange rate without band in the Czech Republic until February 1996, resulted in the most stable real exchange rate. This is followed in terms of variability by the narrow band crawling peg regime of Hungary and the de facto managed crawling peg regime of

[10] Between end–1995 and July 1998, Poland's international reserves grew by about 10 billion dollars to 25 billion dollars.

Greece prior to March 1998. The wider crawling bands of Israel and Poland and the free floating regime of the Czech Republic after February 1996 led to much more pronounced real rates variations. These findings seem to hold irrespective of the time period considered, since the Hungarian and Greek rate variability increased only slightly during the crises periods of 1997-99. The fact that Greek rate variability did not increase when Greece moved to the wider band within ERM suggests that when credibility is enhanced by underlying policies, this becomes a more important factor effecting variability than the regime itself.

**Table 3: Real Exchange Rate Variability, 1994-99**

| | Czech Republic | | | Greece | | | Hungary | | | Israel | | | Poland | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *CS* | *SD* | *AC* | *CS* | *SD* | *AC* | *CS* | *SD* | *AC* | *CS* | *SD* | *AC* | *CS* | *SD* | *AC* |
| 94 | 0.81 | 0.59 | 0.62 | 1.23 | 0.99 | 0.75 | 1.21 | 1.59 | 1.16 | 1.45 | 1.30 | 1.11 | 2.03 | 1.03 | 0.86 |
| 95 | 0.61 | 0.46 | 0.57 | 1.24 | 1.08 | 0.89 | 1.28 | 0.87 | 0.72 | 1.60 | 1.09 | 0.82 | 1.92 | 1.50 | 1.24 |
| 96 | 0.85 | 0.88 | 0.81 | 1.28 | 1.39 | 1.20 | 1.30 | 1.06 | 0.82 | 1.39 | 1.01 | 1.05 | 1.94 | 1.35 | 1.05 |
| 97 | 2.45 | 2.08 | 1.88 | 1.25 | 1.14 | 0.92 | 1.30 | 0.95 | 0.74 | 1.72 | 1.64 | 1.48 | 1.96 | 1.59 | 1.18 |
| 98 | 2.54 | 2.33 | 2.05 | 1.31 | 1.73 | 1.44 | 1.22 | 1.46 | 1.10 | 3.02 | 3.13 | 2.16 | 2.52 | 4.63 | 3.41 |
| 99.I-VII. | 3.73 | 2.57 | 2.05 | 1.21 | 0.95 | 0.69 | 1.17 | 1.61 | 1.30 | 1.55 | 1.44 | 1.70 | 3.33 | 1.69 | 1.50 |

Sources: Calculations based on data in IMF, International Financial Statistics
Calculated on the basis of annual averages of monthly data multiplied by 100.
*CS*: Conditional standard deviation calculated form the GARCH(1,1) model specified as $rer_t = \beta_0 + \beta_1 t + \beta_1 rer_{t-1} + u_t \quad , \sigma_t^2 = \alpha_0 + \alpha_1 u_t^2 + \alpha_2 \sigma_{t-1}^2$ for time period January 1993 - April 1999, where $rer_t$ is the logarithm of the real exchange rate, $t$ is the time trend, $u_t$ is error term with conditional variance $\sigma_t^2$; $\alpha_i$ and $\beta_i$ are parameters. The Lagrange Multiplier ARCH test rejected the null of no conditional heteroskedasticity in Greece (4%), Israel (1%), and Poland (2%), while it did not reject in cases of the Czech Republic and Hungary. Nonetheless we estimated the model for the latter two countries as well for comparison purposes.
*SD*: standard deviation of changes of the logarithm of the real exchange rate.
*AC*: absolute change of the logarithm of the real exchange rate.

Opinions differ on how bad real exchange rate variability actually is. Those who tend to dismiss its potential negative influences generally argue that well functioning financial markets allow the hedging of exchange rate risk and, therefore, variability leads to no change in profits if all transactions are hedged. This argument has some serious weaknesses. Uncertainties regarding the duration of exchange rate deviations necessarily make hedging imperfect. Hedging instruments are typically available for up to one year which may be shorter than the planning period of exporters and importers. Furthermore, exchange rate hedging can only stabilize the nominal value of export receipts and import costs, but does not provide insurance against the domestic cost

consequences of exchange rate changes. In addition, all risk hedging involves costs, including indirect costs arising from misjudging the duration of the deviation of the exchange rate. Hence, variability makes cash flow planning more uncertain which adversely effects investment decisions[11]. This is even more so for transition economies where access to the derivative markets is limited by liquidity constraints due to the generally small size of market participants. Under the current conditions of high capital mobility which exposes small open emerging markets to contagion effects, a free floating regime or a crawling peg with a wide band carries the danger of excessive real exchange rate variability with negative effects on resource allocation.

## 3. Impact on Interest Rates

The financial crises had different effects on nominal interest rates in the countries under consideration (Charts 5a and 5b). Looking at the three transition countries, the Asian and Brazilian events had little or no effect on short-term (3 months) nominal interest rates[12]. The Russian crisis did not effect significantly the short-term nominal interest rates in the Czech Republic and Poland, but increased the three-month nominal rate by about 4-5 percentage points (to 20-21 percent) in Hungary[13]. Thus, one could argue that the less flexible exchange rate regime led to a jump in interest rates in Hungary; had the exchange rate been let to depreciate further, interest rates would not have increased.

[11] Campa (1993) empirically analyzed entry and exit decisions to markets in the US and found that real exchange rate variability negatively correlates with investment decisions. Baldwin and Krugman (1989) present models that demonstrate possible persistent trade effects of large real exchange rate movements. Analyzing French job reallocation, Gourinchas (1999) found that real exchange rate movements have substantial impact on job creation and destruction in the traded goods sector.

[12] In these countries, long-term domestic credits are almost exclusively granted at variable interest rates, generally tied to short-term interest rates. The most widely used benchmark rate is the three-month interest rate.

[13] The interest rate on five-year government bonds in the Czech Republic increased by 2 percentage points, though.

**Chart 5/a: Three-Month Nominal Interest Rates, January 1995 - August 1999**

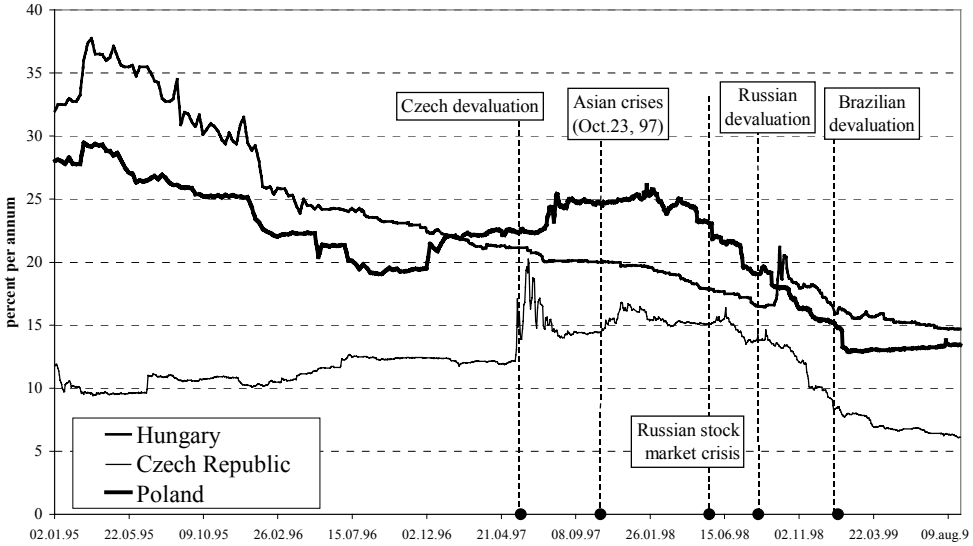



**Chart 5/b: Three-Month Nominal Interest Rates, January 1995 - August 1999**

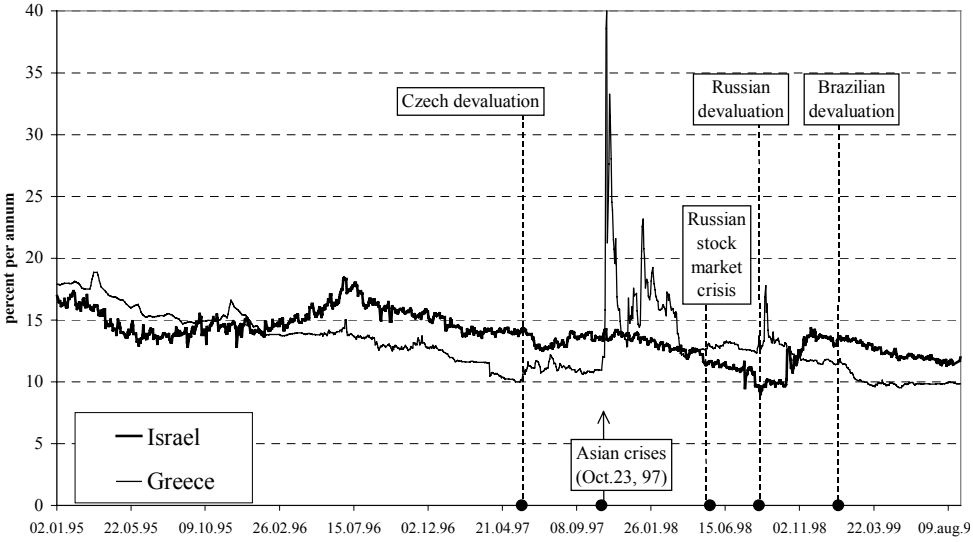
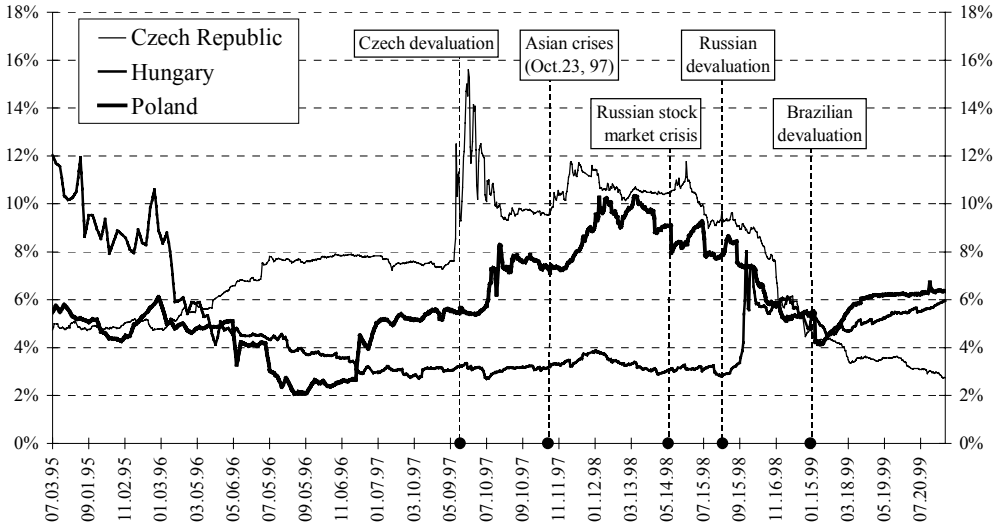
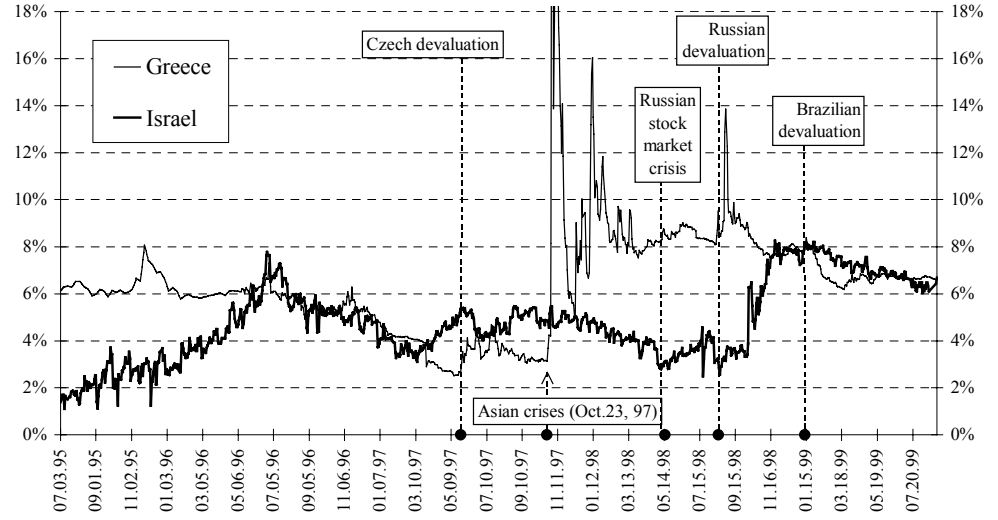


**Chart 6/a: Interest Rate Premia, July 1995 - August 1999**




*Interest rate premium is calculated on the basis of 3-month interbank rates and preannounced depreciation. No adjustment for exchange rate changes is made for the Czech Republic where the currency was either fixed or floating.*

**Chart 6/b: Interest Rate Premia, July 1995 - August 1999**




*Interest rate premium is calculated on the basis of 3-month interbank rates and preannounced depreciation. No adjustment for exchange rate changes is made for Greece after it has entered the ERM.*

However, a more nuanced conclusion emerges if one looks at the evolution of interest rate premia, calculated as the difference between domestic and foreign interest rates adjusted for the preannounced exchange rate depreciation where such a regime was in effect (Charts 6a and 6b)[14]. From mid-1997 until the Russian crisis, the interest rate premium in Hungary was much lower than in the other two transition countries. This probably reflected the good fundamentals of the Hungarian economy (accelerating growth rate, falling inflation and declining fiscal and current account deficits), which strengthened the credibility of the narrow band exchange rate regime. Following the Russian crisis, the fear of contagion, coupled as it was with a weakening of Hungary's external position, generated more uncertainty regarding the Hungarian exchange rate regime, which caused the interest rate premium to increase, but only to the level of that of the Czech Republic and Poland. Therefore, a more valid argument would be that a certain level of risk commands a certain level of premium and that following the Russian crisis, the risk of Hungary perceived by the markets increased to the level which had prevailed in the two other transition countries, irrespective of the exchange regime

[14] We calculated the interest rate premium in the following way. Domestic interest rates are determined by foreign interest rates, the expected change in the exchange rate, plus some risk premium provided that uncovered interest parity do not hold:

$$R_t = R_t^* + E[\Delta FX_{t+s}] + RP_t(E[\Delta FX_{t+s}]) \equiv R_t^* + CP_{t+s} + E[\Delta AFX_{t+s}] + RP_t(E[\Delta AFX_{t+s}]),$$

where $R_t$ is the domestic interest rate for *s* periods; $R_t^*$ is the foreign interest rate for *s* periods; $E[\Delta FX_{t+s}]$ is the expected change of the exchange rate in *s* periods ahead; $RP_t(E[\Delta FX_{t+s}])$ is the risk premium that is the function of the expected change of the exchange rate; $CP_{t+s}$ is the announced depreciation for *s* periods ahead, and $E[\Delta AFX_{t+s}]$ is the expected change within the band or the expected devaluation of the band. As it is indicated by the equation, the expected exchange rate change can be decomposed into preannounced depreciation (which is zero in a fixed or a freely floating exchange rate regime) and an additional depreciation expectation over the preannounced depreciation. Lack of data for exchange rate expectations allows us only to calculate the sum of two components,

$$IP_t = R_t - R_t^* - CP_{t+s} = E[\Delta AFX_{t+s}] + RP_t(E[\Delta AFX_{t+s}]),$$

where $IP_t$ stands for the interest rate premium. The problem with this measure of interest rate premium is that in a wide band or free floating system it does not take into account the expectation of a depreciation beyond the preannounced rate of depreciation. Nonetheless we believe that assessing the risk attributed to fixed income investment in domestic currency is better measured this way than by the simple interest rate differential because it takes into account the preannounced element of the exchange rate risk where such element exists.

in effect. As tensions in the international financial markets eased, the premia in all three transition countries declined in the later part of 1998, but the premium in Hungary remained at roughly the same level as in the other two transition countries. In other words, the regional effect became dominant and Hungary was no longer able to benefit from lower risk premium by distinguishing itself from the other countries by its economic performance. It is important to point out the regional effect, as it shows that at a time of a financial crisis in a region, markets suddenly reassess the risks attributed to those countries of that region which are regarded as emerging markets. In the two transition countries where the current account and fiscal deficits have widened – Hungary and Poland – the interest rate premia have increased since early 1999 and stood at about the same level in both countries in July. These similar developments took place both in a narrow and a wide band exchange regime.

The case of Israel after the Russian crisis reinforces the impression that the nature of the exchange regime had less of an effect on how interest rates reacted to the crisis. Despite the wider exchange rate band, the interest rate premia increased in Israel, and even more sharply than in Hungary. A slight difference with Hungary is that in Israel the central bank took the lead and raised interest rates, while in Hungary the central bank followed the rise in market rates. In Hungary, the central bank intervened for a few weeks to keep the forint within the narrow band, but there was no need for continuous intervention which was spread over four weeks during the period from late August to mid-October and the loss of reserves was relatively limited (see below).

From the point of view of our analysis, the conclusion of these developments is that contagion led to an increase in interest rate premia in a narrow as well as a wide crawling band regime. Greek interest rate developments further support the view that it is credibility rather than the regime that matters. After the Asian crisis, the three- month nominal interest rate rose sharply for a prolonged period (long-term interest rates also rose), while after the Russian crisis there was only a small and short-lived rise in interest rates. This probably reflects the increased credibility associated with the policy commitments of membership in the ERM and the improvement in the external position and the progress with disinflation.

Table 4 shows real interest rate developments. Measuring real interest rates is always hindered by the lack of data for inflationary expectations. This is particularly so in periods of relatively rapid disinflation; using past inflation as a proxy might overstate

expectations, while using actual inflation one year ahead probably understates expectations, in addition to losing the most recent year from the sample. To overcome this problem, we used two proxies: past inflation and a vector autoregressive (VAR) model for estimating expectations[15]. Table 4 shows real interest rates calculated with both measures of inflation expectations. The data confirm our previous finding on interest rate premia: Hungary benefited from lower real rates than the Czech Republic and Poland during 1996-97 when the narrow crawling band enjoyed high credibility and the risk premium was lower[16]. It is noteworthy that Greece had the highest real rates among the countries considered throughout 1996-99, a sign that disinflation has a price when a country has a long track record of high inflation; Greece experienced 10 percent to 25 percent inflation rates per year from the first oil shock up to 1994.

**Table 4: Real Interest Rates, 1994-99**

| | Czech Republic | | Greece | | Hungary | | Israel | | Poland | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *P* | *M* | *P* | *M* | *P* | *M* | *P* | *M* | *P* | *M* |
| 94 | -1.2 | -5.0 | 10.5 | 10.3 | 9.4 | 3.8 | 0.7 | 0.1 | -1.4 | -1.5 |
| 95 | 1.3 | -1.6 | 7.2 | 6.2 | 6.1 | 8.2 | 4.3 | 4.0 | -0.4 | -0.7 |
| 96 | 3.1 | 0.2 | 5.3 | 6.0 | 2.0 | 2.2 | 4.7 | 6.7 | 1.4 | 2.3 |
| 97 | 6.0 | 5.7 | 7.1 | 6.0 | 2.8 | 1.3 | 5.0 | 4.6 | 7.5 | 5.0 |
| 98 | 3.6 | 5.6 | 8.7 | 7.4 | 4.2 | 5.4 | 7.0 | 4.2 | 7.0 | 8.8 |
| 99.I-VII. | 4.8 | -2.7 | 7.2 | 8.5 | 6.2 | 5.6 | 6.3 | 6.7 | 7.3 | 9.9 |

Source: Calculations based on data in IMF, International Financial Statistics and data from Reuters

[15] In order to proxy inflationary expectations we estimated VARs with three variables: excess twelve months consumer price increase over foreign inflation, twelve months nominal depreciation, and interest rate differential. All three variables of each countries seemed to be nonstationary according to several unit root tests. In order to derive forecasts, the rationale of estimating a VAR for integrated variables instead of a VAR for their stationary transformation or instead of a vector error correction model (VECM) is discussed, for example, in Hamilton (1994) p. 651-653. For each months during January 1994 - May 1999 we estimated the VAR using data from only the most recent four years with appropriately selected lag length. This rolling estimating procedure seemed sensible since structural changes make past information less informative for the future. Of course, shorter sample leads to more uncertainty in the estimates and made us to set the largest possible length of the VAR to 4. In each month, we generated out of sample forecast of the inflation differential twelve months ahead that we added to current foreign inflation, that is, we assumed that that foreign inflation is expected to be unchanged in a year.

[16] A comparison of real interest rates among countries needs to consider the different cyclical positions. The slowdown in growth in Hungary in 1995-96 and the Czech Republic in 1998-99 probably had a downward impact on real interest rates in these countries.

Annual averages of monthly data.
In column P, we used past inflation to calculate real interest rates, in column M, we used model based inflationary expectations. See Footnote 15.
Interest rates used are: PRIBOR for the Czech Republic, ATHIBOR for Greece, Treasury bill rate for Hungary and Israel, and WIBOR for Poland. All are three-month interest rates.

Since exchange rate variability was lower in Hungary with a narrow band exchange regime than in the Czech Republic, Israel and Poland with a more-flexible exchange system, a question to be asked is whether that led to greater variability in interest rates in Hungary. Table 5 reveals that during the crisis years of 1997-99, Hungary experienced on average the lowest variability of three-month nominal interest rates among the five countries considered. Looking at real interest rates, a similar picture emerges. One can not conclude from these observations that the lower exchange rate variability in Hungary translated into higher interest rate variability. Instead, the general picture emerging from Table 5 is that interest rate variability was higher under the more flexible exchange rate regimes of the other countries. This observation is in line with the findings of McKinnon (1996) who found that long-term interest rates in developed countries were more volatile under floating than under fixed rate exchange regimes. He explains this by the occasionally erratic speculation in foreign exchange markets which increases risk premium and renders interest rates more volatile.

**Table 5: Variability of Three-Month Interest Rates, 1997-99**

| | Nominal interest rates | | | | |
|---|---|---|---|---|---|
| | Czech Rep. | Greece | Hungary | Israel | Poland |
| 1997 | 1.55 | 2.64 | 0.28 | 0.45 | 0.47 |
| 1998 | 0.62 | 1.33 | 0.68 | 1.01 | 0.52 |
| 1999.I-VIII. | 0.49 | 0.39 | 0.40 | 0.18 | 0.61 |
| Average of 1997-99 | 0.88 | 1.45 | 0.45 | 0.54 | 0.53 |
| | Real interest rates* | | | | |
| | Czech Rep. | Greece | Hungary | Israel | Poland |
| 1997 | 2.13 | 2.66 | 0.50 | 0.66 | 0.66 |
| 1998 | 1.20 | 1.62 | 0.83 | 1.00 | 0.53 |
| 1999.I-VII. | 0.73 | 0.49 | 0.53 | 0.46 | 0.34 |
| Average of 1997-99 | 1.35 | 1.59 | 0.62 | 0.71 | 0.51 |
| | Real interest rates** | | | | |
| | Czech Rep. | Greece | Hungary | Israel | Poland |
| 1997 | 2.17 | 2.28 | 0.80 | 0.87 | 2.03 |
| 1998 | 1.71 | 1.86 | 1.66 | 1.74 | 3.21 |
| 1999.I-VII. | 3.57 | 1.43 | 1.87 | 0.79 | 1.48 |
| Average of 1997-99 | 2.49 | 1.86 | 1.44 | 1.13 | 2.24 |

Variability is defined as standard deviation of monthly changes.
* Real interest rates calculated with past inflation
** Real interest rates calculated with model based expectations
Source: Calculations based on data in IMF, International Financial Statistics

## 4. Stock Market Reactions

The regional aspect of contagion is demonstrated also in the behavior of equity prices in the five countries considered, which fell much more strongly in the wake of the Russian events than following the other crises (Chart 7)[17]. The most salient feature of Chart 7 is the strong performance of the Hungarian stock market during 1996-97, followed by a sharp drop after the Russian crisis. From end-1995 up to the Asian events, Hungarian prices tripled in dollar terms, vastly outperforming the other stock exchanges. Following

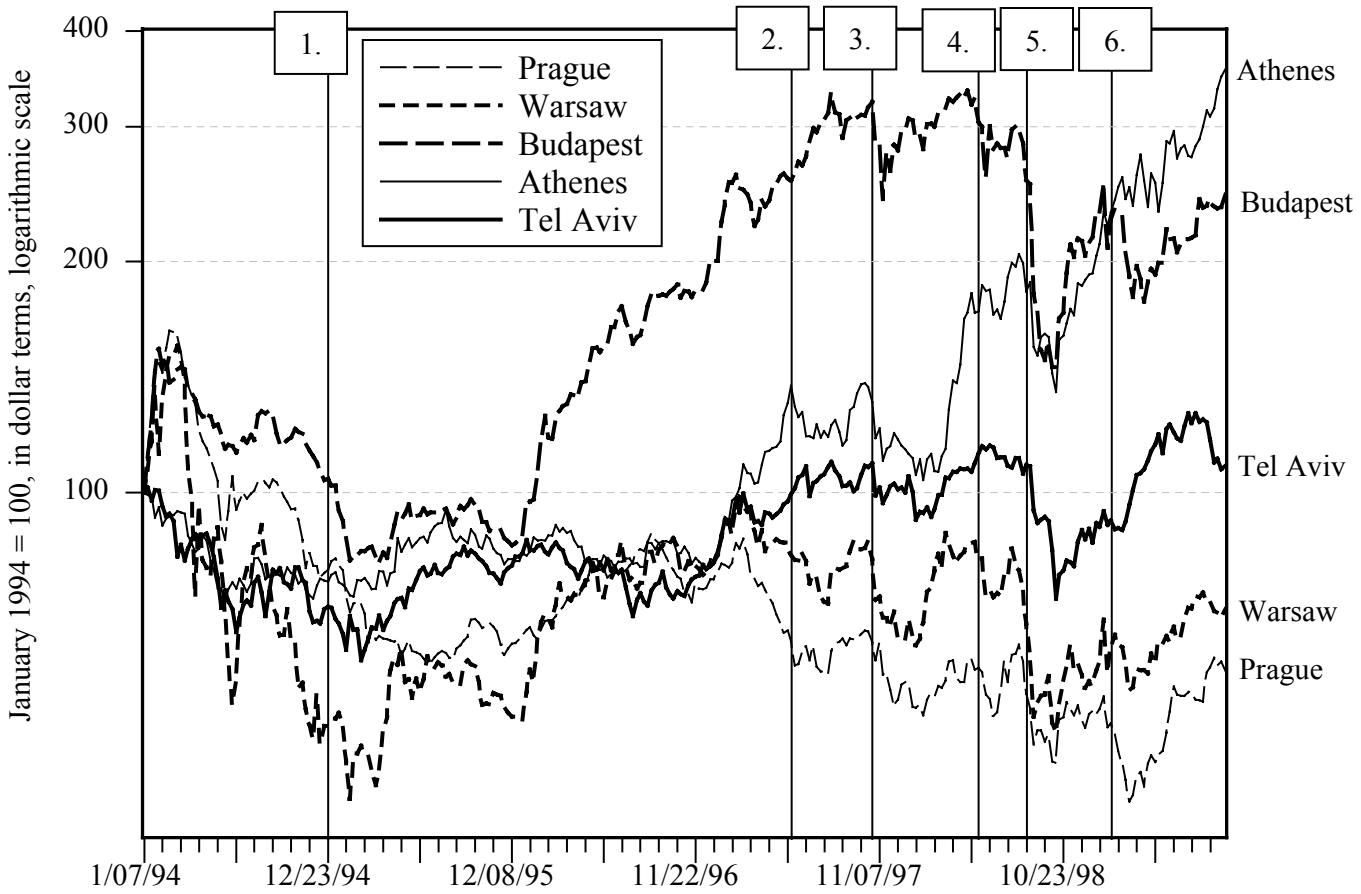
[17] Throughout Europe, the Russian crisis sent down stock market prices much more sharply than either the Asian or the Brazilian events. On the other hand, the Asian crises effected much more than the Russian crisis the prices on the Tokyo stock exchange. Stock prices in the United States were more effected by the Russian than the Asian events.

the Russian crisis, Hungarian stock prices fell by 55 percent and have, like in the Czech Republic and Poland, only partly recovered since then. The deterioration of the current account positions of Hungary and Poland and the weak growth performance of the Czech economy may have contributed to the failure of the stock prices to recover their pre-Russian crisis levels.

A question to be asked is why Hungarian stock prices performed so differently from those of the other two transition countries. The rapid growth in 1996-97 may be explained in part by the credibility of policies, buttressed by the success of the stabilization efforts and the progress in privatization and structural reforms. Hungary has attracted by far the most foreign direct investment per capita in the region[18], enhancing the expectations for economic growth. One could also argue that the lower Hungarian real interest rates contributed to the rapid stock price increase in 1996-97 and, after the Russian crisis, the expected rise in real interest rates contributed to the sharp fall in equity prices. If this were true and a link could be established between the increase of the Hungarian real interest rates and the narrow band exchange system – a link that, as seen, our analysis does not confirm – one could argue that the drop in stock prices is indication of the cost of maintaining a narrow band.

[18] Per capita foreign direct investment during the period from 1998 to June 1998 totaled more than 1600 dollars in Hungary, as compared with about 900 dollars in the Czech Republic, and 300 dollars in Poland (source: United Nations, Economic Commission for Europe, Economic Survey of Europe).

## Chart 7: Stock Price Developments, January 1994 - August 1999




1: Mexican crisis, 2: Czech devaluation, 3: Asian crises, 4: Russian stock market crisis,
5: Russian devaluation, 6: Brazilian devaluation

In our view, the drop in Hungarian stock prices after the Russian crisis has to be seen against their earlier rapid growth. This growth built on the credibility of the stabilization-cum-reform polices, but contained an element of overreaction. As can be seen from Table 6, futures Budapest Stock Index (BUX) open positions rose from 0.0025 percent of GDP in the fourth quarter of 1995 to 0.31 percent of GDP in the third quarter of 1997. During the same period, the turnover of futures BUX contracts increased from 0.03 percent to 8.3 percent of GDP. When there is this kind of increase in a relatively short period of time in futures open positions and transactions, the existence of overreaction can not be disregarded. The rapid development of the BUX futures market provided opportunities for both domestic and foreign investors to take up leveraged long speculative positions. The overreaction was helped by stock buying through margin loans which reached relatively high levels in Hungary.[19] There was also a strong tax incentive for buying shares listed on the Budapest Stock Exchange. The incentive was introduced in 1995 to promote the development of the capital market: investors holding stocks got a tax credit equivalent to 30 percent of the additional investment is stocks[20]. The overreaction is evidenced by the fact that the implied interest rate content of futures contracts of the BUX largely exceeded the six months Treasury bill rates until the Asian financial crisis (Chart8).[21] Following the Russian crisis, an initial drop in stock prices led to the liquidation of both open futures positions – as evidenced by the dramatic fall of implied interest rate content – and margin loans. Both induced heightened spot sales and price declines.

[19] Both futures trade in the stock index and buying through margin lending were negligible in the Czech Republic and Poland.

[20] Beginning in 1999, the tax credit was reduced to 20 percent of the additional investment in stocks and a maximum limit of 200,000 forints (about 820 dollars) was placed on the tax credit that one can claim in any one year. No such limit existed prior to 1999.

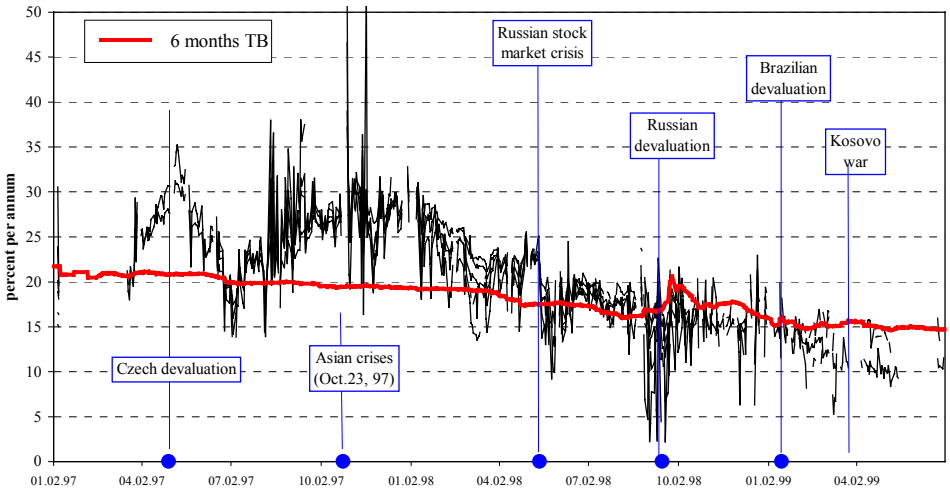
[21] The fact that the large differential between the implied interest rate and the Treasury bill rate was not arbitraged away prior to the financial crises probably reflects the relative inexperience of the Hungarian market participants with this kind of arbitrage opportunity.

**Table 6:Turnover and Open Positions at the Futures Market of the Budapest Stock Index (BUX), 1995-99**

| | Quarterly futures BUX turnover (percent of quarterly GDP) | Futures BUX open positions (percent of annual GDP) |
|---|---|---|
| 1995 Q2 | 0.003 | 0.0003 |
| 1995 Q3 | 0.007 | 0.0007 |
| 1995 Q4 | 0.025 | 0.0024 |
| 1996 Q1 | 0.145 | 0.0068 |
| 1996 Q2 | 0.300 | 0.0144 |
| 1996 Q3 | 0.832 | 0.0335 |
| 1996 Q4 | 1.368 | 0.0565 |
| 1997 Q1 | 5.243 | 0.1289 |
| 1997 Q2 | 5.479 | 0.1850 |
| 1997 Q3 | 6.510 | 0.3106 |
| 1997 Q4 | 8.328 | 0.1898 |
| 1998 Q1 | 5.992 | 0.1365 |
| 1998 Q2 | 5.739 | 0.0674 |
| 1998 Q3 | 3.621 | 0.0586 |
| 1998 Q4 | 3.065 | 0.0693 |
| 1999 Q1 | 2.885 | 0.0586 |
| 1999 Q2 | 2,967 | 0.0703 |

Source: Calculations based on data from the Budapest Stock Exchange.

**Chart 8: Hungary: Implied Interest Rates of Futures Contracts of the Budapest Stock Index (BUX), January 1997 - June 1999**




Notes: Implied interest rates are calculated from settlement prices. Days without trade are not shown.

These factors seem to better explain the movements in Hungarian stock prices prior and after the financial crises than developments in real interest rate expectations. It is estimated that about 70 percent of the stocks listed on the Budapest Stock Exchange are owned by non-residents who account for 70-80 percent of the turnover. It is

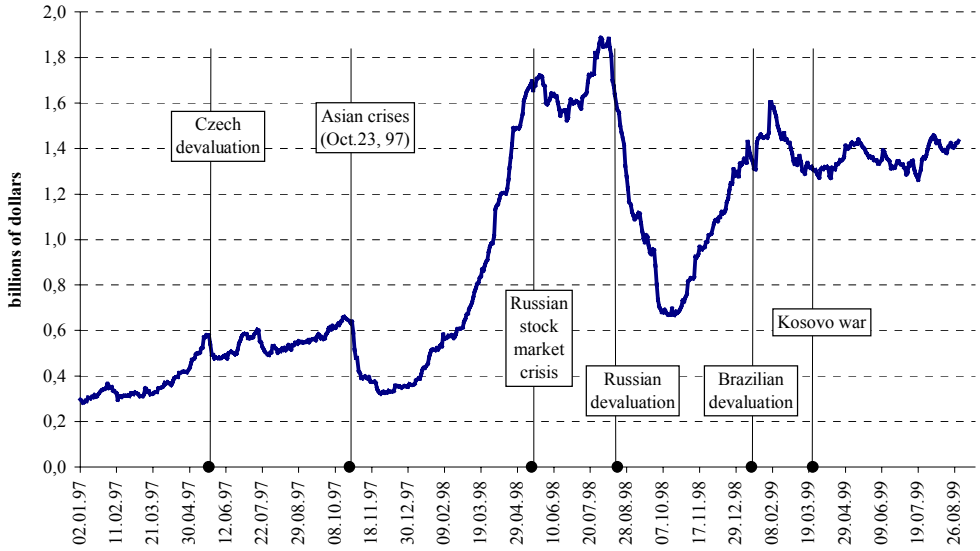
reasonable to assume that non-residents do not wish to spend all their future income in Hungary and therefore Hungarian real interest rates are probably not a very important factor in determining their decisions to buy or sell Hungarian stocks. Furthermore, non-residents evaluate expected real interest rates in conjunction with expected real exchange rates. The currencies in the Czech Republic and Poland appreciated much more than the Hungarian forint so that investing in assets in these countries would have, ceteris paribus, assured higher returns in dollar terms. Nevertheless, stock prices stagnated in dollar terms in those two countries. On the other hand, in Greece, where real interest rates were the highest among the five countries considered and rose in 1998, stock prices nearly tripled between January 1998 and July 1999. Finally, it should be pointed out that stock prices in Hungary, even though they fell more sharply after the Russian crisis than stock prices in the Czech Republic and Poland, increased faster after the crisis than the stock prices in the other two countries (Chart 7b). It is reasonable to conclude from these observations that interest rate developments did not play any significant role in the fall of Hungarian stock prices. If the narrow band exchange system had any effect on stock price developments, it probably cushioned the fall in prices and helped the subsequent recovery, since the exchange rate kept its credibility during the crisis as there was no strong attack against the currency: purchases of foreign exchange at the futures markets, which characterized the adjustable peg regime prior to the introduction of the crawling peg, did not take place to any significant extent during the Russian crisis.

## 5. Capital Flows in Hungary

The case of Hungary permits a closer look at how contagion effected capital flows. Basically, there were three channels through which crisis induced conversions between foreign exchange and domestic currency took place in the wake of the international financial crises. The most important channel was non-resident holdings of Hungarian forint denominated government securities (Chart 9). As the crawling band exchange regime gained credibility and the exchange rate remained at the strong edge of the band, foreigners bought government securities to take advantage of the prevailing interest rate premium. After the Asian crisis, non-resident holdings of government securities fell by about 300 million dollars, from a level just over 600 million dollars. In the subsequent

ten months, these holdings jumped to almost two billion dollars only to fall back to about 700 million dollars following the Russian crisis. They rose again to reach 1.6 billion dollars by early 1999. These movements led to wide swings in the demand for Hungarian forints which paralleled closely the fluctuations in the exchange rate. The sharp increase in non-resident holdings during the first eight months of 1998 took place at a time of narrowing interest rate premium, which must have reflected the enhanced credibility of the exchange rate.

**Chart 9: Hungary: Non-Resident Holdings of Forint Denominated Government Securities, January 1997 - August 1999**




The Hungarian authorities have tried to discourage the inflow of potentially fickle capital by prohibiting non-resident holdings of government securities with an original maturity of less than one year. The restriction was backed up by moral suasion and sanctions against those banks which tried to circumvent the restriction by entering into short-term repurchase agreements at the time of the purchase of the government security[22]. The experience of the Hungarian authorities is that these restrictive measures have muted the inflow of short-term speculative capital.

A second important channel of conversions between foreign exchange and domestic currency was forward and futures sales of foreign exchange. Since confidence in the exchange rate remained strong, a convenient way for making profit from the

[22] The sanctions included fines and the temporary suspension of access to the central bank's repo facilities.

existing interest rate premium was through the forward and futures markets.[23] Resident speculators sold forward foreign exchange to resident banks either on the interbank forward market or on the futures markets at the two Budapest exchanges.[24] The banks sold a similar amount of foreign exchange at the spot market and invested the forints received in government securities or deposited them with the NBH. By these operations, the open foreign exchange positions of the banks did not change, hence their profits were not dependent on changes in the exchange rate. Banks obtained the foreign exchange sold at the spot market either from borrowing from abroad, which increased by about one billion dollar during January-July 1998 (Table 7), or from foreign exchange deposits held by enterprises and households in Hungary, which the banks have partly redeposited with the NBH. Since the opening of futures positions required a deposit of only 3 percent of the contract value, speculators could make large profits if the preannounced rate of crawl was kept and the exchange rate remained at the strong edge of the band, a risk that many speculators were prepared to take given the exchange rate's previous track record within the band. During 1996-97, when the interest rate premium fell to 3-4 percentage points, the return on such speculation was still above 100 percent.

[23] Credibility of the crawling peg exchange rate regime and developments of the futures market is analyzed in more detail in Darvas (1996).

[24] Futures foreign exchange transactions can be carried out at both the Budapest Commodity Exchange and the Budapest Stock Exchange. While non-residents are allowed to carry out futures BUX transactions within certain limits, only residents are allowed to carry out foreign exchange derivative transactions in Hungary.

**Table 7: Capital Flows in Hungary, 1998-99 (millions of dollars)**

| | Jan. – Jul. 1998 | **Aug. – Oct. 1998** | Nov. 1998 – Feb. 1999 | March – May 1999 |
|---|---|---|---|---|
| **Balance of payments** | | | | |
| 1. Current account | -1072 | **-373** | -1092 | -596 |
| 2. Net direct investment | 1002 | **136** | 555 | 195 |
| 3. Non-resident portfolio investment in government bonds * | 1460 | **-1131** | 715 | -6 |
| 4. Non-resident portfolio investment in stocks | 342 | **-37** | 417 | 356 |
| 5. Change in commercial banks assets ** | 7 | **-144** | 10 | -414 |
| 6. Change in commercial banks liabilities ** | 864 | **-606** | -174 | 31 |
| 7. Government and NBH net borrowing from abroad | -1174 | **-79** | 938 | 44 |
| 8. Other inflows, net | -172 | **348** | 307 | 23 |
| 9. Net errors and omissions | 219 | **52** | -163 | -76 |
| 10. Valuation change of reserves | -131 | **332** | -340 | -228 |
| 11. Change in reserves | 1345 | **-1501** | 1172 | -672 |
| **Memorandum items** | | | | |
| 11. NBH foreign exchange intervention | 3377 | **-2515** | 358 | 59 |
| 12. Change in open futures foreign exchange positions | 526 | **-953** | -321 | -144 |
| 13. Change in commercial banks foreign exchange deposits at the NBH ** | -595 | **966** | 292 | -301 |
| 14. Change in commercial banks net foreign exchange credits to enterprises ** | 423 | **32** | 102 | -27 |
| 15. Change in household foreign exchange deposits | 13 | **213** | -83 | -101 |
| 16. = Principal causes of NBH intervention (3 + 4 + 12) | 2328 | **-2121** | 811 | 205 |

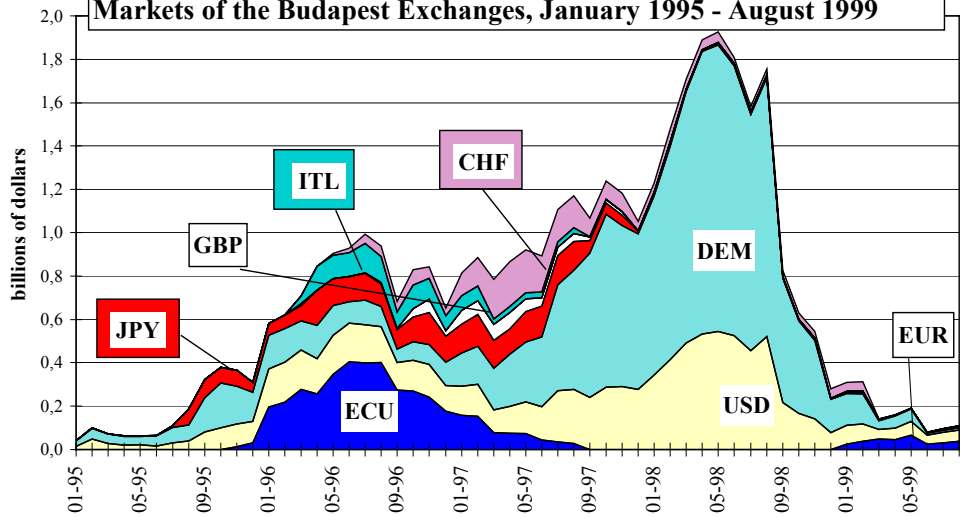
Sources: National Bank of Hungary and Budapest Stock and Commodity Exchanges
*: Hungarian forint denominated government bonds.
**: The term "commercial banks" refers to resident credit institutions.

As can be seen from Chart 10, the open positions at the futures foreign exchange markets started to increase in mid-1995 to reach 1.9 billion dollars by June 1998[25]. Depreciation of the forint within the band, followed by the increase in interest rates after the Russian crisis, forced speculators to buy from banks foreign exchange forward in order to liquidate their positions. Banks, to remain within the statutory limits on their open positions, bought from the NBH foreign exchange at the spot, which they sold at the futures market to the speculators. The unwinding of the speculators' positions and the associated reduction in the banks' net foreign asset position strongly contributed to the depreciation of the forint within the band and the need for the NBH to intervene.

[25] No accurate data are available for forward foreign exchange transactions on the interbank market. Chart 10 therefore only shows futures foreign exchange open positions at the Budapest exchanges. Most foreign exchange derivative transactions took place at the futures markets.

During the post-Russian crisis period of August-October 1998, the open futures foreign exchange positions decreased by one billion dollars and the net foreign asset position of banks fell by about 700 million dollars. Chart 10 shows that the open futures foreign exchange positions dropped to an insignificant amount by early 1999. This is a clear indication that the build-up of open positions was associated with pure speculation of resident market participants and with the corresponding interest rate arbitrage of the domestic banking sector, and had little to do with genuine hedging of export and import transactions. It is important to note that only residents were allowed to have open futures foreign exchange positions at the Budapest stock exchanges: the exclusion of non-residents with greater capital strength than domestic participants helped limit the build-up and subsequent unwinding of speculative positions, thereby also limiting the in- and outflow of associated speculative capital.

**Chart 10: Hungary: Open Positions at the Futures Foreign Exchange Markets of the Budapest Exchanges, January 1995 - August 1999**




A third channel of capital flows was portfolio investment in the stock market. Interestingly, the net outflow of capital on that account in the period May-September 1998 was only about 260 million dollars (Table 8). Unfortunately, there is no data available on the turnover of stocks broken down according to residents and non-residents. The finding that a relatively small amount of capital left Hungary on account of net stock selling by non-residents could mean either that non-residents were holding Hungarian stocks in a longer term perspective, or that they were caught by the sudden sharp fall in prices to levels at which it became attractive to hold on to the stocks. The view was expressed at that time that the fall in Hungarian stock prices may have been

due to massive selling by non-residents taking advantage of higher liquidity of the Hungarian stock market compared to other emerging markets. As the Russian crisis shook the confidence of investors in emerging market stocks, the Hungarian stock market would have been the scene of a "sell what you can not what you want" syndrome. The small amount of net selling by non-residents of Hungarian stocks does not support that view. Investor confidence returned fairly rapidly after the Russian crisis, as net non-resident portfolio in the stock market began to rise starting already in October 1998.

**Table 8: Non-Resident Net Portfolio Investment Flows into Hungarian Stocks, 1996-99 (millions of dollars)**

| | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|
| January | 1 | -129 | 6 | -3 |
| February | 31 | -80 | 75 | 172 |
| March | 53 | 4 | 368 | 21 |
| April | 42 | 34 | 67 | 128 |
| May | 13 | 340 | -161 | 207 |
| June | 75 | 10 | -110 | 340 |
| July | 80 | 73 | 97 | |
| August | 43 | 74 | -55 | |
| September | 4 | -10 | -32 | |
| October | -7 | 53 | 51 | |
| November | 8 | 462 | 86 | |
| December | 16 | 173 | 162 | |

Source: National Bank of Hungary

The intervention of NBH during August-October 1998 amounted to 2.5 billion dollars (Table 7), but international reserves fell by only 1.5 billion dollars (to 8.3 billion, 4.3 month of imports at the end-October 1998). The difference is largely explained by the increase in the deposits of commercial banks with NBH. Hungarian banks collect foreign exchange deposits from resident households and companies, a large part of which is redeposited with the NBH. As mentioned, when speculators built up open positions at the futures foreign exchange market, banks obtained the foreign exchange to buy forints partly by borrowing from abroad and partly by drawing down their deposits with NBH. When the operations were reversed, the foreign exchange that banks bought from NBH against forint was in part used to repay the loans from abroad and in part redeposited with NBH. The fact that Hungarian banks accumulated foreign exchange deposits with NBH which they could use to cover part of their futures foreign exchange transactions helped mitigate the in- and outflow of capital, but the pressure on the exchange rate through conversions remained the same as if the capital flows actually

took place; only the level of reserves fluctuated less. NBH generally offers sub-Libor rates for commercial bank deposits and banks find it useful to maintain a certain level of foreign exchange working balances with NBH. This is a form of short-term borrowing the cost of which is relatively low, but its level needs to be monitored closely when assessing the adequacy of reserves.

The correction of the stock market overreaction and the forced liquidation of speculative positions in the futures foreign exchange market in the wake of the Russian crisis led to losses estimated at about 0.4 percent of GDP in the financial sector[26]. Before tax profits of banks decreased dramatically in the second half of 1998 and it is estimated that over half of the 87 brokerage houses closed 1998 with a loss.[27] Twelve brokerage firms not backed by banks went bankrupt. These are not insignificant losses. However, no bank went down because of the financial turmoil and the banking system as a whole remained strong, with the average capital adequacy ratio staying at 17 percent at end-1998, the same as at end-1997[28]. In a way, the Russian crisis served as a lesson for the relatively inexperienced Hungarian investors, driving it home that speculation on the stock market and the foreign exchange derivative markets is not a one way street. Hopefully, this will reduce the risk of bubbles building up in the future contributing to the stability of markets.

[26] Since open positions at the futures stock index market reached about 0.3 percent of GDP and stock prices fell by about 50 percent, the loss attributable to futures stock index activities was about 0.15 percent of annual GDP. Total forward and futures foreign exchange open positions are estimated to have reached approximately 6 percent of GDP. Since the forint depreciated by about 4 percent, the negative cash flow implied by forward and futures foreign exchange rate transactions is estimated at 0.25 percent of GDP. In total, the negative cash flow effect of forward and futures activities is estimated to have reached about 0.4 percent of GDP, which had to be assumed mostly by the financial sector as many speculators were unable to pay.

[27] Because banks in Hungary were prohibited from engaging in stock and futures market transactions at the Budapest exchanges until 1999, several banks have set up their own brokerage houses. Since the beginning of 1999, regulation has moved toward universal banking, allowing banks to carry out stock and futures market transactions.

[28] The Hungarian banking system has been largely privatized. The private sector accounts for about 80 percent of the banking system's share capital and foreign-owned banks represent about 60 percent of the share capital.

## 6. Concluding Remarks

We found no empirical evidence in the cases examined that the intensity of capital flows and the associated pressures on the exchange rates and interest rates were primarily influenced by the exchange rate regime itself. For example, heavy central bank intervention (and consequent increases in reserves) to limit the appreciation of the currency occurred both in a more flexible (Poland and Israel) and a less flexible (Hungary) exchange regime. A sudden external shock, such as the Russian financial crisis, caused interest rates to increase both in a narrow band (Hungary) and a wide band (Israel) exchange regime. If policies are sound and credible, the impact of external shocks on the exchange rates and interest rates diminishes even in wide band regime, as seen in the case of Greece after it has joined the ERM. We did not find evidence that the exchange regime had any significant effect on stock market behavior at the time of financial crises. The only thing that the nature of the exchange regime seems to directly influence at times of global financial crises is the variability of the nominal and real exchange rates: the more flexible regimes experienced greater variability. However, even this observation needs to be nuanced. The Greek experience before and after ERM membership underlines the important role of policies. The commitment to achieving the Maastricht criteria and the consequent visible improvement in Greece's external and internal balances no doubt explains why exchange rate variability did not increase when the country moved from a *de facto* rigid crawling peg to a fixed but wide band regime. The argument is often made that in a less flexible exchange regime, the "oppression" of exchange rate variability translates into greater interest rate variability. We found that the less flexible Hungarian regime with lower exchange rate variability was not accompanied by greater interest rate variability; on the contrary, interest rate variability in Hungary was lower during the periods of crises than in the other countries examined. In sum, our study of the reaction to global financial crises under different exchange regimes does not make a strong case for the choice of any particular regime.

For countries potentially exposed to volatile capital movements, a key question when considering the issue of exchange regime choice is to what extent the exchange rate system adopted may encourage overborrowing from abroad. The usual argument is that a fixed rate or a narrow band regime encourages foreign borrowing when the fundamentals are on the right track and there is an interest rate premium. A sudden

shock, such as a regional financial crisis, will then lead to a devaluation, causing serious losses for enterprises and banks. A floating rate, on the other hand, reduces the incentive to borrow in foreign exchange, due to the greater uncertainty involved.

Did the least flexible exchange regime considered in our study, the Hungarian narrow band, encourage overborrowing? There was certainly an element of overborrowing by banks associated with speculation at the futures foreign exchange markets, but this was probably due to the good macroeconomic indicators of the country at that time, which enhanced the credibility of the exchange rate, rather than to the narrow band, since even a depreciation within the band would have entailed -- as in fact it did -- large losses for the speculators. The same is true for foreign investors who held domestic currency denominated government securities. Looking at foreign borrowing by enterprises, the experiences of the Czech Republic under the floating regime and of Hungary under the narrow band regime do not reveal a major difference. In both countries, the share of foreign exchange borrowing from domestic banks and from abroad in total credits to enterprises grew substantially over time, even if that share was somewhat higher in Hungary than in the Czech Republic at end–1998 (Table 9). The reason why there is no significant difference between the two cases probably lies in the increasing share in production of multinational companies which account for most of the enterprise borrowing from abroad. These companies, which produce mostly for exports, have easy access to credit from abroad and a large part of their income is in foreign exchange. They probably consider their risks lower if a part of their borrowings is also in foreign exchange. In other words, these market participants hedge their risks by borrowing from abroad and they do not seem to be that sensitive to the exchange rate regime in place. The share of foreign direct investment in GDP is higher in Hungary than in the Czech Republic. This could be an indication that the share in production of multinational companies is higher in Hungary, which could explain the higher share of foreign borrowing in that country.

**Table 9: Outstanding Enterprise Borrowings in Foreign Exchange and Foreign Direct Investment, 1993-98 (in percent) [(1)]**

| | | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|
| Share of foreign exchange credits from domestic banks in total domestic bank credits | Hungary | 9.7 | 11.9 | 23.5 | 31.5 | 29.5 | 32.2 |
| | Czech Republic | 4.5 | 6.6 | 13.5 | 16.4 | 24.8 | 27.9 |
| Share of total foreign exchange credits in total borrowings | Hungary | 33.6 | 42.2 | 54.3 | 57.6 | 51.2 | 55.1 |
| | Czech Republic | 16.7 | 20.8 | 28.1 | 32.4 | 40.6 | 43.4 |
| Foreign direct investment / GDP | Hungary | 15.9 | 18.5 | 29.4 | 34.4 | 37.8 | 33.3 |
| | Czech Republic | 10.2 | 11.1 | 14.5 | 15.3 | 19.4 | 22.6 |

[(1)] end-year data
Sources: National Bank of Hungary and Czech National Bank

The risk of overborrowing remains a serious problem when the exchange rate is credible and there is a domestic interest rate premium.[29] When capital movements are largely liberalized, it is difficult to reconcile the goal of discouraging oveborrowing and that of maintaining a credible exchange rate system by following sound maroeconomic policies, which at times means maintaining the level of domestic interest rates above the level of foreign interest rates. In such circumstances, capital controls may be of some help. We are fully aware of the benefits of free capital movements. However, a premature liberalization of short-term capital movements may have more disadvantages than benefits. Emerging markets are too vulnerable to contagion which, as seen, can trigger sudden outflows of capital that entered the country previously, even if the given country has followed sensible policies. There is a vast amount of what is essentially short-term capital ready to take a higher risk and buy fixed income instruments in emerging markets in order to take advantage of higher returns. Fund managers throughout the world invest a small portion of their portfolio in emerging markets to maximize returns. Investment banks offer dedicated emerging market funds to investors, while advising them to invest only a small portion of their total portfolio into such funds. This all sounds very conservative from the point of view of the investor, but it adds up to tens of billions of volatile dollars available to move around among emerging markets. Compared to the size of these markets, the capital flows can be substantial and cause large volatility in the exchange rate and/or entail costly sterilization and loss of reserves. Derivatives markets might not be of help to moderate the impact of exchange

[29] For a modeling of the overborrowing syndrome, see McKinnon and Pill (1999).

rate fluctuations as seen in the case of Hungary, where the futures market was used primarily for financial speculation and not for hedging of trade transactions.

Short-term capital controls are notoriously ineffective once trade and long-term capital movements have been liberalized. They can nevertheless mute the magnitude of short-term capital movements by throwing sand into the wheels until such time that the vulnerability to speculative attacks has been greatly reduced by the solidification of the country's credibility. Also, for a full liberalization to be acceptable, the country has to be in a position where it can tolerate a possible real appreciation of its currency beyond that justified by the Balassa-Samuelson effect[30], a condition that is seldom acceptable for small catching-up economies which face balance of payments constraints. Alternatively, it has to accept the cost of sterilization which can reach a point where it becames no longer tolerable.

In light of the experiences of the recent years, those who have been urging emerging markets to fully liberalize capital movements should reflect on the experiences of the recent crises and perhaps have another careful look at the usefulness of short-term capital controls. Such controls have a limited, but positive role to play during the catching-up period, when the credibility of the country has increased enough to attract fixed income portfolio investment, but not yet enough to prevent the sudden outflow of that investment when the herd instinct takes over the financial markets. We mentioned that the restriction imposed by the Hungarian authorities on non-resident holdings of forint denominated government securities helped to discourage the inflow of capital. This restriction needs to be closely monitored though, because it can be circumvented by repurchase agreements as experienced in Hungary.

It is important to set limits on the banks' foreign exchange open positions to prevent the buildup of excessive speculative position by banks. Since forward and futures foreign exchange positions are off balance sheet items, the limits should be set on positions which include these items. It is also important to set the limits on a consolidated basis, including the positions of brokerage houses owned by the banks in order the avoid that banks take on excessive risks through their brokerage companies. These limits need to be supplemented by tight deposit and margin requirements for opening positions on the futures foreign exchange markets. It helps if only residents are

[30] Halpern-Wyplosz (1997) discusses the Balassa-Samuelson effect for catching-up economies.

allowed to the futures foreign exchange markets; if non-residents are also allowed, the risk of an excessive buildup of speculative positions greatly increases. When foreign borrowing by enterprises is liberalized, it is useful to maintain a notification requirement so that the authorities can monitor the development of foreign debt.

When there is a very rapid accumulation of short-term debt, the authorities face the trade-off of either using controls to discourage the inflow of capital or to change the mix of interest rate and exchange rate policy. This is a difficult choice to make when the policy mix has been successful in stabilizing the economy and there is no compelling reason to change. Another line of defense is to accumulate reserves at the time of capital inflows that can be used as a cushion against capital outflows. This involves sterilized intervention and a judgement about the desired level of reserves, taking into account the estimated size of hot money ready to leave the country in a short period of time. This judgement is difficult to make and involves a great deal of uncertainty, including the risk that the country holds too high reserves for too long. The opposite risk, that the country has to give up too soon the exchange rate system that has gained credibility and served its interests well is not less serious. A policy of using reserves as a buffer has its limitations and its success depends on the severity of the attack; there comes a point beyond which it does not make sense to lose reserves.

Where does all this lead us in answering the question what exchange rate system is most appropriate for small open emerging market economies? We agree with Williamson (1998) that free floating exposes the country to excessively large exchange rate fluctuations given the herd behavior of exchange markets. Free floating, or wide fluctuations bands for that matter, do not necessarily assure lower interest rates or smaller interest rate variability. On the other hand, we know that a rigidly fixed rate is only sustainable if the fundamentals support it. If the fixed rate is not credible, it will not permit a reduction in the interest rate premium.

This leaves us with the question of what degree of flexibility is desirable. It makes sense to have a wider band in the case of a fixed rate since questions about the sustainability of a fixed peg may arise more quickly. In a crawling peg system where the rate of crawl is set in accordance with the fundamentals, a narrower band, by reducing uncertainty, may provide the benefits of both lower interest rate premium and smaller exchange rate variability, combining the benefits of a nominal anchor with flexibility. The case for the wider band generally rests on the argument that it provides a shock

absorber in the face of volatile capital flows and gives a broader room for manoeuvre for monetary policy to influence domestic economic developments. That advantage has to be weighted against the possible costs of higher interest rate premium and/or excessive appreciation or depreciation of the currency. It should be emphasized, however, that an exchange rate regime can not be qualified as "good" as "bad" per se, only in conjunction with the other elements of macroeconomic policies, particularly fiscal, monetary and incomes policies. A fixed exchange rate can be appropriate if all the other policies are in place to sustain it. If the political commitment to maintain the fixed rate is strong, it can even help forge the necessary consensus to adopt those policies, as it did for example in Austria during the hard currency policy period from the 1970s to the 1990s. If the supportive policies are credibly in place, wide band regimes can provide as much stability as narrow band regimes.

There remains the question whether anything can be done in the source countries to discourage the flow of hot money into emerging markets. It is quite remarkable that investment banks and hedge funds bought Russian GKO's up to a few weeks prior to the collapse of the Russian market. Perhaps the fund managers' structure of incentives, which rewards profit but not the loss which was not made, needs to be reconsidered. A fund manager who is fired after he made a huge loss is like putting on a raincoat after rain.

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