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FINANCIAL CRISES IN TRANSITION COUNTRIES: MODELS AND FACTS

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1 Summary

Vulnerability to financial crises is an important concern for transition economies, 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 in the light of existing crisis models. To achieve this goal a short summary of the theoretical literature is offered, then we proceed via case studies to eventually match facts to models. A theoretical framework allowing us to address a hitherto neglected aspect of monetary and exchange rate policies is also developed.

Concerning the empirical part conclusions can be summarized as follows. Patently weak microeconomic foundations and inconsistent policies characterized Russia, Bulgaria, and Romania. In the Czech Republic and Slovakia macroeconomic indicators painted a rather favorable picture of the economy, but they concealed very serious microeconomic problems. The Baltic countries in general succeeded by introducing rigid exchange rate systems in order to facilitate macroeconomic stabilization and to increase the credibility of exchange rate system. Slovenia and Poland, in different ways, tried to retain some flexibility in influencing the exchange rate in order to respond to macroeconomic developments. Hungary's successful sticking to a crawling system with a rather narrow band, puts its more recent experience closer to the Baltic countries.

The theoretical part of the paper starts with the observation that in several cases policy makers have been intent to fight inflation with high interest rates, and this, together with good fundamentals, led to capital inflows, and to reverse attacks. Accordingly we ask when it is reasonable to use interest rate policy for reducing inflation in a pegged, but adjustable, exchange rate regime under the condition of perfect capital mobility. Under our assumptions on price formation it may make sense to increase the home nominal interest rate above the exogenous foreign rate in order to reduce expected inflation only if the country in question is relatively large and closed in a sense precisely defined by model parameters. Capital mobility implies that raising interest rates will result in higher devaluation, and therefore a higher burst of inflation, whenever it occurs. In other words, even if higher interest rates can buy some reduction in expected inflation it is achieved at the cost of increasing the variability of inflation. Then we look for some motive that makes devaluation ex post rational in some state of the world, making interest rate premia sensible for small open economies, too. It is assumed 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. An interesting feature of our model is that the portfolio choice of foreign investors is determinate, despite uncovered interest parity.

2 Introduction[1]

Financial vulnerability has become 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 paper we shall first ask whether there has been a veritable boom of financial crises in transition economies. Section 2 is devoted to definitions, and it briefly lists some facts about the incidence of financial crises in 11 transition economies, restricting attention to the period 1995-1999, in order to avoid issues pertaining to the beginning of transition. Thereafter we focus on currency crises and ask what the theoretical models tell us about these. Section 3 recapitulates the theoretical literature, and assesses in what sense it explains currency crises. Section 4 contains 11 case studies. (Appendix 1 includes Tables and Charts.) Then Section 5 suggests the existence of some missing links, and speculates on features models should exhibit to better explain the transition experience. In Section 6 a (neglected) theoretical aspect of currency crises is studied, in the framework of a simple model that is analyzed in detail in Appendix 2. Section 7 summarizes the link between crisis models and recent economic history in Eastern Europe. Finally Section 8 offers brief comments related to policy.

3 A boom of 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 in an informal way.

A currency crisis can happen when a precommitted peg abandoned, which 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) cur-

[1]An initial version of this paper was presented at the conference "Financial Development in Eastern Europe: The First Ten Years" (Klausenbach Castle, Chemnitz, February, 2000), and another one at a conference held in Halle (13-14 July, 2000, "Financial Crises in Transition Countries: Recent Lessons and Problems yet to Solve"). We thank several conference participants for very useful comments on these earlier drafts.

rency. In this case the change in the exchange rate is not a discrete jump, but it is still abrupt and large enough. The currency crisis definition subsumes 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 losses 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 usually reaches extremely low levels. 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 may 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. Debt crises and currency crises usually go together, as confidence in the local currency is shattered in both cases.

We examined the crisis history of 11 transition countries. 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 saw the implementation of elementary structural reforms (some of the countries are still struggling with them), and the economies were not functioning as market economies, we focused on the period since 1995. By the above definitions most of the transition countries experienced some type of financial crisis since 1995.

The clearest case is probably Russia; here virtually all types of crises appeared together in 1998. There was first a stock market crisis with significant real repercussions, then a sharp devaluation with foreign (including private) debt moratorium and with bank runs resulting in a collapse of the payments system.

Bulgaria saw in 1997, after years of currency instability and banking sector problems, a veritable (successful) currency attack happen, and a full-blown banking crisis with runs developed. Default was avoided, and there was no stock

market crisis, as there was no stock market to speak of.

In Romania banking and currency problems have prevailed continuously. In 1997-98 the foreign exchange situation exhibited the features of a crisis with large depreciation, though bank runs and the collapse of financial intermediation did not ensue. Financial markets and the stock market had not been developed enough to cause much trouble in themselves.

The Russian crisis had quite a severe impact on Latvia due to the economy's high exposure to Russian markets, but the currency board system did not have to be abandoned. Even though we cannot speak of a full-blown banking crisis, several banks experienced bank runs and liquidity crises following the Russian crisis. There was a modest rise in interest rates, though capital flight was not substantial as foreign participation in Latvia's capital markets was insignificant. Stock prices had been declining for several months already by the time of the crisis; thus, there was no significant immediate effect on the stock market.

Although Lithuania was also quite vulnerable to contagion from Russia, the currency board arrangement survived the storm and the consequences of the Russian crisis were more substantial in the real economy than in the financial markets. Financial markets reacted basically the same way as in Latvia.

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. As an automatic response to the liquidity shortage in a currency board system, there was an immediate rise in interest rates, but capital flight was not substantial.

The Slovak Republic had been able for long to defend its fixed exchange rate system despite an attack during the Czech crisis of 1997. The Russian crisis of 1998, however, triggered the collapse of the fixed exchange rate system and led to a large depreciation of the koruna. The banking system has been struggling with serious problems for years.

The Czech Republic was hit by speculative attacks on the Czech koruna in May, 1997, which the monetary authorities were not able to withstand, and the fixed exchange rate system had to be given up. The repercussions of the currency crisis in the capital market were less severe than expected. Though the currency crisis did not lead to a liquidity crisis in the banking system, the serious problems of the Czech banking sector - which had been accumulating for years - became more visible.

After widening the fluctuation band in several steps, Poland's monetary authorities finally let the zloty float in April 2000. This may have been influenced by the consideration of having an "independent" monetary policy, and also taken with a view towards preempting potential speculative attacks.

In Hungary banking problems were solved via consolidation before 1995, though its cost may have contributed to the recurrent small attacks on the currency through 1994-95. The currency problem was managed via a larger devaluation, and the implementation of a stabilization program. In 1998, after the Russian crisis, stock prices dropped sharply, but without important real effects. The exchange rate came under some pressure, but was defended almost

costlessly.

Slovenia is a case of avoiding all sorts of crises at the cost of maintaining relatively strong capital controls, and pursuing extremely cautious macroeconomic policies.

4 The theory 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, following Jeanne (1999), we distinguish between currency attack and escape clause models.

4.1 A formal framework

Let

$$F(E_t\left[\phi\left(s_{t+1,}R_{t+1,}x_{t+1},m_{t+1}\right)\right],s_{t,}R_t,x_t,s_{t-1,}R_{t-1,}x_{t-1,}u_t,m_{t-1},m_t)=0 \tag{1}$$

describe the behavior of an economy. Here s_t is the nominal exchange rate measured as the domestic currency price of one unit of foreign currency, and R_t the level of international reserves. Other state variables are denoted by x_t. Also besides the shocks (u_t) there exists some monetary policy instruments (m_t). It must be noticed that all of the models are fundamentally non-linear, in the sense that a global (log)linear approximation cannot be taken to approximate the dynamics of the system.

4.2 Currency attack models

The main features of this type of models are as follows:

1. There exists a prespecified level of reserves $\underline{R}$ below which central bank reserves cannot fall.

2. There exists a monetary policy rule.

$$m_t=P(s_{t-1,}R_{t-1},x_{t-1},u_t,m_{t-1})$$

3. The shadow exchange rate $\widetilde{s}_t$ is defined as the floating exchange rate that would prevail if the level of reserves were $\underline{R}$ from period t on 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), are distinguished from first generation models as second generation ones. These assume 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)).

The second-generation models have been developed to explain speculative attacks for cases when the exchange rate seemed sustainable for a long period of time, but it was still attacked. The switch in beliefs concerning the future paths of fundamentals can be attributed to numerous factors, e.g., political reasons, contagion, etc. Second generation models focus on the panicky nature of speculative attacks, the main idea here is very similar to the famous Diamond-Dybvig (1983) bank-run model with a "good" (no attack) and a "bad" (attack) equilibrium. The attack is self-fulfilling: if everybody believes that the others are going to panic, then the flight is rational independently of what one thinks about the fundamental reasons behind it.

4.3 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. We suppose that there exists a loss function of the monetary authorities $L(g_1, g_2, ...g_t, ...)$, where $g_t(x_t)$ is a (vector) function of the state variable.

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.[2]

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. However, because of the fixed opting-out costs, this shadow rate must "definitely" exceed the peg to make the abandonment of the peg 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 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 cases where private sector indebtedness is significant and private 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.

The 1997 Asian crisis gave incentives again to reconsider the theory of currency crises, since it seemed that it could not be explained by either of the existing models. (See (Krugman, 1998), (Corsetti- Pesenti-Roubini, 1998).) Was the Asian crisis new in the sense that models aiming at its explanation need to be called third generational? We think that it is unnecessary, and regard the new models as either currency attack or escape clause models where the set of fundamentals determining the shadow exchange rate is extended to include financial fragility, banking collapse, balance sheet quality, (implicit) government guarantees, etc. In fact, this tendency of extending the set of fundamentals had been present in the former escape clause models that were once called second generational.

[2] Notice that reserves are not necessarily part of the model.

4.4 Evaluation with the help of the models

Most models have focused on specific crises or on a certain type of crisis. The comparison of speculative attacks and currency crises in the 1990s shows that reasons behind, and the dynamics of, attacks may vary substantially, and different model types can explain different crises. Although the literature on currency crises is getting more and more extensive, the new models are usually lagging behind events. Models emphasizing self-fulfilling prophecies were developed and became popular after the 1992-93 ERM crisis when some of the currencies attacked (e.g. the French franc) had apparently no problems with fundamentals. The theoretical aftermath of the 1997-98 Asian events also indicates that speculative attack models are mostly ex post justifications rather than predictions (see (Krugman, 1998)).

One can claim that currency attack models do not explain crises, rather they focus on certain features, such as sudden reserve loss, timing of attack, existence of multiple equilibria, the "fundamental" or "sunspot" nature of crises, the path of interest rates, role of guarantees, role of financial intermediation, the effect of bond financing etc. Policy inconsistency is a built-in feature of these models; thus we cannot really say that they offer an explanation. On the other hand, escape clause models are so general that they can virtually explain anything by a judicious choice of fundamentals and government preferences.

In the next Section we shall try to categorize the crises observed in transition countries to decide whether they fall within the domain of a currency attack or an escape clause model. However, crisis models should also shed light on periods or cases where no attack occurs. Of course, it is a much more complicated issue to decide whether a period is essentially tranquil, or it is one leading up to an attack despite the calm surface. We will attempt to make such categorizations, and ask whether the models inform us about such episodes. Crisis models have also something to say about the exchange rate arrangements themselves, as it is obvious that the sustainability of a peg, or a quasi-peg, is a very important consideration when exchange rate regimes are devised or operated. Thus we can try to explain the choices of exchange rate regimes with the help of crisis models whenever the regimes are created with a view towards preempting currency attacks.

We believe that there is no reliable way to distinguish between a fundamental and a sunspot equilibrium. The old rationale for self-fulfilling equilibria, namely the observation of fast switches in behavior, has been criticized on the ground that one can set up models with rational learning, informational cascades, or convex adjustment costs producing such abrupt behavioral changes for no "visible" reason. Indeed, there is an easy way to find sunspot equilibria: build a poor empirical model, and conclude that fundamentals cannot explain the crisis. On the other hand, models featuring multiple equilibria are not without fundamental reasons. As noted above the parameter space usually contains a region where fundamentals are bad enough to make an attack possible, but not as bad as to make one inevitable.

5 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 Appendix 1.

5.1 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 privatization, and the reform of government finances. The process was surrounded by a general aura of optimism, which 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.

In early 1998 there must have remained only one question: would an international bailout occur 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 stands a good chance of being classified as a

currency attack type crisis, with policy inconsistencies resulting in bad fundamentals, which inevitably led to a situation where reserves could have fallen to a level where defending the exchange rate any further 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. Apparently investors believed that there was a chance that Russia's reserves were unlimited because of the "too big to fail" syndrome, which 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 is 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 being 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.

5.2 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 alongside significant asset stripping, which was accompanied by a 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 stabilizations 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. Rather than being reduced fiscal imbalances were exacerbated in Bulgaria, but despite 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. 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).

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. 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 choose 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 depreciations in a floating system occurred, a currency crisis of this type and a banking crisis followed a failed stabilization in 1996-97. 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.

5.3 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 nominal anchor which was key to reigning in inflation for some time. In 1996-7 a full-blown currency crisis developed, which 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 keep 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.

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 would have become 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 of 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 stabilization attempts that are not fully credible, and where this lack of credibility undermines their very success. After 1997 inflation reaccelerated, 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.

5.4 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 had been promising, the exchange rate peg to the SDR contributing 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-a-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, and credit expansion was very rapid between 1996 and mid-1998. Due to its location and historical reasons, Latvia has 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 a 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 is similar to Estonia (see below), that is there was no significant speculation against the lats. It can be classified as an escape clause model situation, where the maintenance of the exchange rate peg was given priority.

5.5 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 down the country's currency board arrangement (established in 1994 as a peg to the US dollar). Real GDP growth had been sizeable after 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-a-vis Russia and 80% vis-a-vis the EU. The real appreciation vis-a-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 accept-

able, 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 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 thanks to their limited direct exposure and strict prudential regulation. The stock market, however, was hit hard by the Russian crisis with the index plunging 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 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.

5.6 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 Estonian kroon to 1 Deutsche Mark) remained unchanged until January 1, 1999, when the Estonian kroon 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 kroon 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 attained 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 by foreign direct investment. 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 reach an advanced stage by the end of the1990s. 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 quite efficient, the share of bad loans is remarkably low. The budget has been 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 kroon 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 kroon 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 immediate rise in interest rates, but capital flight was not substantial. As there has been no significant speculation, Estonia 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.

5.7 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 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 only recently 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% at 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 had been relatively low in the preceding years. Unlike the Czech Republic, the Slovak economy was rather closed, the country had 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.

5.8 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. Before 1997, real exchange rate appreciation and the accompanying loss of competitiveness led to an increasing current account deficit which amounted to roughly 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, were 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 had been at that time allowed to fluctuate in a +/-7.5% wide band as of 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 had been based on the maintenance of the fixed exchange rate. Another important reason was that foreign debt accumulation by the corporate sector, whose exchange rate risk was mainly unhedged, had been significant in the preceding years. 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. We think that the central bank finally deemed the costs of defending the Czech crown higher than those incurred by giving it up. 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 being the openness of Czech capital markets and the active participation of non-residents in the attack. Ever 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 depreciations.

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.

5.9 Poland

Polish transition has been considered as one of the success stories among transition economies. The country was 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 consolidation 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 has gone through several changes in the last few years. At first it was based on a crawling peg with a fluctuation band around it. The monthly devaluation rate was 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 is partly due to the preemptive measures taken by Polish monetary authorities: the fluctuation band around the central parity of the Polish zloty had been widened five times after the introduction of the crawling band regime and before it was finally 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 keeping real interest rates high in an economic environment characterized by disinflation and high growth.

5.10 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 thereof. 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 because 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). For 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 occurred, 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 was a very substantial switch of revenues.

The stabilization package, though far from being 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 being tested by successive waves of crises. Recently reverse attacks have been more of a danger than normal ones.

5.11 Slovenia

Slovenian economic policy has always exhibited definite preference for stability, and it has been put into practice in a consistent way. In the area of micro reforms the country has privatized, but with many restrictions, while 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, a conservative fiscal stance and tight monetary policies have been implemented. However, 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 traditionally 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 devaluations, were engineered whenever there was a good reason. On the other hand, none of these adjustments were 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 also noticed 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.

6 What is missing from the literature?

It is a general feature of the models surveyed in Section 3 that they consider a period of exchange rate pegging, be it either constant or crawling, and ask when this arrangement will be abandoned. In practice very few actual exchange rate regimes belong to this category in the strict sense. In the continuous scale from strict pegs to pure floating one can observe regimes that switch between these extremes, monetary authorities intervene sometimes and virtually peg the exchange rate in certain periods, and let it float at other times. Wide bands and managed floats can describe the announced regimes but within either of these classes the operation of central banks can exhibit large differences. The literature has focused exclusively on pegs, or target bands. Both general experience and our transition examples reveal that most developing countries manage their exchange rates to some extent, but fewer and fewer apply pegs in the strict sense. In our sample Estonia, Lithuania, Latvia, and, more recently,

Bulgaria have adopted very rigid exchange rate arrangements (currency boards) whereas none of the others have exhibited a policy of absolutely no intervention. However, attacks can occur on currencies that are flexible to a significant degree. Of course, modeling a managed float is difficult, because there exists a very wide range of policy rules that monetary authorities may follow, lying between a peg and a pure float. Still it is possible that certain types of exchange rate management strategies can be distinguished. With such intermediate types of monetary policies the definition of a crisis or an attack becomes a non-trivial issue. Clearly a possibility is to define a successful attack as a change in the policy rule from some managed float to a pure float. Or more generally the abandonment of a certain exchange rate rule for the sake of another with an enhanced degree of flexibility can be an appropriate definition.

The two types of models we have distinguished between can in principle be merged, i.e. one can set up a model where reaching some domain in the state space results in a currency attack, whereas in some other domain an escape clause type attack materializes. Here two shadow exchange rates would exist: one defined by reserves falling to their minimum level, the second via policy preferences. Indeed, in such a model the type of crisis would itself be an endogenous (stochastic) event. Several of the transition stories suggest that for many countries both crisis regimes may have been relevant, and contingencies pushed these economies into one or the other compartment. Indeed, it seems plausible that an escape clause scenario comes earlier than a currency attack type one, and the danger of the latter can be a powerful reason why central banks act preemptively, by abandoning a commitment they may keep today, but are afraid that they might be forced to give up in the future. The assumption of a minimum feasible level of reserves is an expression of this idea, but in a rather specific manner.

Existing models treat the political dimension rather simplistically. In currency attack models the reserve bound can be interpreted as an expression of some political constraint, whereas in escape clause models the government's preferences may have this role. However, as several examples (Russia, Bulgaria, the Slovak Republic) proved the development of crises has had a more intimate, even endogenous, relationship with political events. Political changes could effectively alter social preferences, and they are partly the outcome of the economic situation. Again it is true that making politics endogenous would be very difficult, but its exogeneity is a disadvantage when one wishes to match models to the facts. And especially the Russian example has taught us that politics can have a truly international dimension, at least as much as the run on foreign exchange reserves does.

It has been noticed for many years that in currency attack models reverse attacks can be studied in the same framework, essentially, as normal ones. The simple trick is to assume an upper, rather than a lower, bound for reserves. Though formally correct, this solution has much less of an appeal as a plausible hypothesis. On the other hand, escape clause models can also be rephrased in a way where the monetary authorities may be willing to give up a peg, because its defense requires too low, rather than too high, interest rates. Indeed 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 a reverse attack (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 completely 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.

Today it is almost commonplace that microbehavior on stock and foreign exchange markets should be invoked to explain the development of financial prices, and a purely macroeconomic approach toward the exchange rate is insufficient. Therefore, it is somewhat surprising why this aspect is largely absent from crisis models. However, from an empirical point of view, our case studies indicate that the market microstructure facet can clarify why certain countries suffered and others not (or not so much). At least the timing of collapses must have been definitely influenced by market microstructure. (See Darvas-Szapáry (2000).)

Finally there is an issue pertaining to financial crises (emphasized by Allen-Gale (1998)) that has not been raised by scholars of currency upheavals. This is the possible "optimality", or at least Pareto improving feature, of a crisis scenario. The Allen-Gale idea is based on the observation that a traditional loan contract does not have good risk sharing characteristics. In this view bank-runs that are implied by real causes, i.e. a true collapse of asset values, may improve risk sharing with respect to a contract where depositors never suffer. Indeed, if crisis prone developing countries issue domestic currency denominated debt to foreigners, and a currency crisis ensues when things turn bad for a perfectly good extraneous reason, then a crisis would reduce the yield of foreign investors "in order to" make them share the losses with the developing country. This might be a less costly way to implement risk sharing than outright default. Of course, the incentive compatibility of this implicit contract may raise interesting questions, but it is not too farfetched to interpret some of the crises in our sample in such a manner (Hungary, the Czech Republic, Russia).

7 A model

In this section we shall 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. The optimal policy thus derived would not be time consistent, however. One needs some other motivation that makes devaluation optimal in some state of the world. Therefore we shall analyze a more complex monetary policy game, in which such a behavior is (ex post) optimal.

7.1 InÆation and the interest rate

In this subsection we shall 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. The nominal exchange rate is measured in units of home currency per foreign currency , the initial exchange rate is normalized to 1. In this subsection it is simply assumed that in the "good" state there is no change in the exchange rate, whereas in the "bad" state the monetary policy maker devalues.[3] 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, p is the probability that there will be no devaluation, and e_b is the level of the exchange rate in the bad state,.then the following equality must hold:

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

One can express e_b as

$$e_b = \frac{(1-p)I}{I^* - pI}. \tag{3}$$

Since we consider only devaluations ($e_b > 1$) 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 (3) as expressing the fundamental constraint that unrestricted international capital markets impose on monetary policy.

Next we have to make assumptions about price formation. We assume that the second period price index (Π) can be expressed as a Cobb-Douglas function of the nominal exchange rate (e) and of the nominal wage (W).

$$\Pi = W^{\alpha} e^{1-\alpha} \tag{4}$$

where $\alpha \in (0.1)$.

As we normalize the initial price level to 1, Π is also the gross inflation rate. It is supposed 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

[3] In Appendix 1 we endogenize this assumption.

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[4]:

$$W = E(\Pi)C \tag{5}$$

where E is the expectation operator, and C is consumption. Let us suppose that consumption depends on the expected real interest rate[5].

$$C = \left(\frac{I}{E(\Pi)}\right)^{-\gamma} \tag{6}$$

where γ is the elasticity of consumption with respect to the expected real interest rate, a positive parameter.

One gets for expected inflation

$$E(\Pi) = \left(p + (1-p)e_b^{1-\alpha}\right)^{\frac{1}{1-\alpha\gamma-\alpha}} I^{\frac{-\alpha\gamma}{1-\alpha\gamma-\alpha}}. \tag{7}$$

Substituting 22 it holds that

$$E(\Pi) = \left(p + (1-p)\left[\frac{(1-p)I}{I^* - pI}\right]^{1-\alpha}\right)^{\frac{1}{1-\alpha\gamma-\alpha}} I^{\frac{-\alpha\gamma}{1-\alpha\gamma-\alpha}}. \tag{8}$$

One can see that $E(\Pi)$ has a finite value at $I = I^*$. The derivative $dE(\Pi)/dI$ at $I = I^*$ equals $(I^*)^{\frac{\alpha-1}{1-\alpha\gamma-\alpha}}$. Therefore raising the interest rate slightly over the foreign rate increases inflation locally. There are two subcases to consider, depending on the sign of $1-\alpha\gamma-\alpha$. If it is positive then $E(\Pi)$ approaches infinity as I approaches I^*/p. In this case expected inflation is a strictly increasing, convex function of the home nominal interest rate. In contrast, if $1-\alpha\gamma-\alpha$ is negative, then $E(\Pi)$ increases first then after reaching a maximum falls towards zero as the interest rate gets closer to its upper limit. The two subcases can distinguish between a small and a large open economy. In the first case the exchange rate has a dominating impact on inflation, whereas in the second case it is the expected real interest rate that is the more important.[6]

We can see that under our assumptions on price formation it can make sense to increase the home nominal interest rate above the exogenous I^* in order to

[4] 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.

[5] The expression for the real interest rate below is not entirely correct, because of Jensen's inequality. The numerical deviation is, however, rather small for 'plausible' values of the parameters, and subsequent derivations are very much facilitated by this sloppiness.

[6] Our model of inflation was not derived from first principles. This feature accounts for the irrealistic limiting behavior.

reduce expected inflation only in the large open economy case. However, as capital mobility implies that raising interest rates will result in higher devaluation, and therefore a higher burst of inflation, whenever it occurs, even in this case reduction in expected inflation is bought at the cost of increasing its variability.

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 shall motivate this behavior of occasionally devaluating via formulating a more complex game.

7.2 InAation or debt or defaults

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. 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 set for the next period. 3. The state is realized and observed by the monetary authorities. 4. In the end 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 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-á-vis foreigners as beneficial for the policy maker. Concerning private debt we assume that private agents and the 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.

Let F be the exogenous total foreign financing requirement of the government, B the amount held in home currency denominated bonds, and D second period net foreign liabilities measured in foreign currency. Then by definition

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

Let B_p be the foreign currency value of private (net) foreign liabilities (including interest payable), and B_{hp} its domestic currency counterpart. Again by definition

$$B_{hp} = eB_p. \tag{10}$$

We assume that B_p is a nonnegative, nondecreasing function of $(I - I^*)$, and we will write $B_p(I - I^*)$, accordingly. 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.

We suppose that the monetary authority has a pair of loss functions of the following form.

$$U_i(\Pi, D, B_{hp}, J) = \varphi(\Pi) + \chi_i(D) + \varpi(B_{hp}) + JK \tag{11}$$

where $i = g$ or b, φ, χ_i, ϖ are nondecreasing, J is an indicator taking the value of 1 when $e_i \neq 1$, and 0 otherwise, whereas K is the opting-out cost, a positive number. It is assumed that $\chi_g < \chi_b$, i.e. the bad state is defined by the property that in a bad state having foreign debt is more onerous, than in a good state.

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 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 taking into account optimal behavior along the equilibrium path. Assuming specific preferences Appendix 1 demonstrates for the small open economy case that interior equilibria 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 $1 - \alpha\gamma - \gamma > 0$ 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. 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 helps in restraining the monetary authorities' appetite for aggressively using interest rates.

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, if the de_b/dI derivative is large, then a small shift in "fundamentals" can result in a substantial devaluation.

8 The models and the facts

We have tried to identify the causes why certain countries experienced a currency crisis, while others did not. 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 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 depreciations, 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 two distinct groups. One group introduced a very rigid system peg (currency board in Estonia and Lithuania, and a traditional peg in Latvia) in order to facilitate macroeconomic stabilization and to increase the credibility of the 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 strict anchor at a relatively early stage of the transition process, which in turn served as a crucial support to macroeconomic stabilization.

Slovenia and Poland in different ways tried to retain some flexibility in influencing the exchange rate as a means of support 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 adherence 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.

9 Concluding remarks

Section 4 described the multicolored financial crisis experience of 11 transition countries. As Section 6 pointed out the story is complex enough to request theoretical progress in the field. Section 7 arrived at the conclusion that there is no unique explanation for their behavior, and several existing models should be invoked to clarify it.

Moving from the vantage point of contemplation to that of action we can now ask what message our investigation bears on policy. As we have not focused on this aspect we can offer only a few tentative remarks on this topic.

First, it seems that crises were not a really devastating experience for most transition countries. Where they were, Russia being probably the most obvious example, they were associated with inconsistent macroeconomic policies and the weakness of structural (micro) reforms.

Second, the Czech and Slovak examples can show that macroeconomic stabilization can be an illusion without accomplishing the de facto market economy transformation.

Third, though capital controls may be useful for avoiding crises, there must be no doubt about that, one can argue on quite traditional grounds that they have clear disadvantages. In the case of Slovenia they may have inhibited growth, whereas the lack of capital market discipline may have been very instrumental to the developments in Hungary before 1995, in Bulgaria before 1997, in the Slovak Republic more recently, or in Romania during the whole period.

Fourth, having said that, we cannot deny that financial market liberalization may aggravate the vulnerability of these countries in the foreseeable future, and especially before they join the European Union. We believe that admitting this necessity and accepting some concomitant pains would be wiser than insisting on avoiding financial market turbulence at any cost.

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11 Appendix

11.1 The analysis of the model

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 monetary authority has a preference for low and stable inflation, and faces "perfect" capital mobility. 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 another negative effect by increasing the domestic currency value of foreign currency denominated private debt. 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.

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 set for the next period. 3. The state is realized and observed by the monetary authorities. 4. The new exchange rate is determined.

Now let I denote the home (gross) interest rate set by the monetary authorities, and let I^* (≥ 1) be the gross return on foreign currency denominated bonds, which is assumed to be exogenous). Let p $(1-p)$ be the probability that the "good" ("bad") state will happen.[7] Then if $e_g(e_b)$ are the positive) levels of the nominal exchange rate, measured in units of home currency per foreign currency, in the two states of the world then the following equality represents perfect international capital markets

$$\frac{pI}{e_g} + \frac{(1-p)I}{e_b} = I^*. \tag{12}$$

This equality means that any expected deviation from uncovered interest parity leads to "infinite" capital flows, and thus is not feasible.

Next we have to make assumptions about price formation. We assume that the second period price index (Π) can be expressed as a Cobb-Douglas function of the nominal exchange rate (e) and of the nominal wage (W).

$$\Pi = W^{\alpha} e^{1-\alpha} \tag{13}$$

where $\alpha \in (0.1)$.

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:

$$W = E(\Pi)C \tag{14}$$

where E is the expectation operator, and C is consumption. Let us suppose that consumption depends on the expected real interest rate.[8]

$$C = \left(\frac{I}{E(\Pi)}\right)^{-\gamma} \tag{15}$$

where γ is the elasticity of consumption with respect to the expected real interest rate, a positive parameter.

Now let F be the exogenous total foreign financing requirement of the government, B the amount held in home currency denominated bonds, and D second period net foreign liabilities measured in foreign currency. Then by definition

[7] See the interpretation below.

[8] The - pardonable -sloppiness of this formula was noted above in the main text.

$$D = I^*(F - B) + \frac{IB}{e}. \tag{16}$$

Let B_p be the foreign currency value of private (net) foreign liabilities (including interest payable), and B_{hp} its domestic currency counterpart. Again by definition

$$B_{hp} = eB_p. \tag{17}$$

We assume that B_p is an increasing, convex function of I, which takes the specific functional form as

$$B_p = (H - I)^{-\varsigma}$$

where H is a "large enough" positive number, and ς is positive, too.

It is supposed that the monetary authority has a pair of (state-dependent) loss functions of the following form.

$$U_i(\Pi, D, B_{hp}, J) = \Pi + \chi_i D + B_{hp} + JK \tag{18}$$

where $i = g$ or b, J is an indicator taking the value of 1 when $e_i > 1$, 0 if $e_i = 1$, and $+\infty$ if $e_i < 1$.[9] K is the opting-out cost, a positive number, and $0 \leq \chi_g < \chi_b$, i.e. the bad state is defined by the property that in a bad state possessing foreign debt is more onerous, than in a good state.

We say that the public has rational expectations if

$$E(\Pi) = \left(pe_g^{1-\alpha} + (1-p)e_b^{1-\alpha}\right)^{\frac{1}{1-\alpha\gamma-\alpha}} I^{\frac{-\alpha\gamma}{1-\alpha\gamma-\alpha}} \tag{19}$$

where

$$\left(pe_g^{1-\alpha} + (1-p)e_b^{1-\alpha}\right) = E(e^{1-\alpha}).$$

From equations (13), (14), (15) one can derive that this is indeed what rational expectations imply in this model.

An exchange rate policy is said to be ex post rational if

$$e_i = \arg\min E(\Pi)^{\alpha+\alpha\gamma} I^{-\alpha\gamma} e_i^{1-\alpha} + \chi_i(I^*(F - B) + \frac{IB}{e_i}) + e_i(H - I) + JK \tag{20}$$

for $i = g, b$, by taking $E(\Pi), I, B$ as given.

[9] In other words we rule out the case of appreciation.

Ex post rationality is simply the requirement that the monetary authority must set the exchange rate so as to minimize actual loss at the beginning of period 2.

To complete the description of the model ex ante preferences for the policy maker must be specified. It is assumed that these are given by the expected value of L, plus a term expressing a dispreference for inflation variability. In effect this assumption is a deviation from Neumann-Morgenstern utility, implying some sort of time inconsistency in policy preferences.[10] Thus the expected ex ante loss function of the monetary poolicy maker is as follows:

$$L_x = E(L) + \phi var(L)^{\psi} \tag{21}$$

where ϕ and ψ are positive parameters.

Definition 1 *A vector $(I, e_g, e_b, B, E(\Pi))$ where $I \geq 1, e_g > 0, e_b > 0$ constitutes an equilibrium if I minimzes the value of L_x under conditions 12, 19,20. We say that an equilibrium is devaluationary if $e_g = 1, e_b > 1$, revaluationary if $e_g < 1, e_b = 1$, dirty pegging if $e_g < 1, e_b > 1$, successful pegging if $e_g = 1, e_b = 1$.*

In the following we will look for a devaluationary equilibrium.

(1) In a devaluationary equilibrium condition (12) takes the form

$$pI + \frac{(1-p)I}{e_b} = I^*. \tag{22}$$

From this one obtains a relationship between I and e_b

$$e_b = \frac{(1-p)I}{I^* - pI}. \tag{23}$$

It is easy to see that e_b is a convex, monotonically increasing function of I in the domain $[I^*, I^*/p)$,and it converges to infinity, having its range in $[1, \infty)$.

(2) We get for expected inflation

$$E(\Pi) = \left(p + (1-p)e_b^{1-\alpha}\right)^{\frac{1}{1-\alpha\gamma-\alpha}} I^{\frac{-\alpha\gamma}{1-\alpha\gamma-\alpha}}.$$

Substituring 22 one gets

$$E(\Pi) = \left(p + (1-p)\left[\frac{(1-p)I}{I^* - pI}\right]^{1-\alpha}\right)^{\frac{1}{1-\alpha\gamma-\alpha}} I^{\frac{-\alpha\gamma}{1-\alpha\gamma-\alpha}}.$$

[10] When faced with the possibility to devalue the policy maker is risk neutral with respect to inflation, whereas she is risk averse ex ante.

One can see that $E(\Pi)$ has a finite value at $I = I^*$. The derivative $dE(\Pi)/dI$ at $I = I^*$ equals $(I^*)^{\frac{\alpha-1}{1-\alpha\gamma-\alpha}}$. Therefore raising the interest rate slightly over the foreign rate inreases inflation locally. There are two subcases to consider, depending on the sign of $1-\alpha\gamma-\alpha$. If it is positive then $E(\Pi)$ approaches infinity as I approaches I^*/p. In this case expected inflation is a strictly increasing, convex function of the home nominal interest rate. In contrast, if $1-\alpha\gamma-\alpha$ is negative, then $E(\Pi)$ increases first then after reaching a maximum falls towards zero as the interest rate gets closer to its upper limit. The two subcases can distinguish between a small and a large open economy. In the first case the exchange rate has a dominating impact on inflation, whereas in the second case it is the expected real interest rate that is the more important. [11]

(3) Let us calculate the effect of changing the exchange rate at each state of the world, disregarding opting out costs. The derivative of the loss function equals

$$\frac{\partial L}{\partial e_i} = (1-\alpha)E(\Pi)^{\alpha+\alpha\gamma}I^{-\alpha\gamma}e_i^{-\alpha} - \chi_i BIe_i^{-2} + (H-I)^{-\varsigma}.$$

Assuming that in the good state there is no devaluation B can be uniquely expressed from the first-order condition relevant for the bad state as a function of $I, E(\Pi), e_b$.

$$B = \chi_b^{-1}(1-\alpha)E(\Pi)^{\alpha+\alpha\gamma}I^{-1-\alpha\gamma}e_b^{2-\alpha} + \chi_b^{-1}I^{-1}e_b^2(H-I)^{-\varsigma} \tag{24}$$

Then B is clearly an increasing, convex function in e_b.

(4) Again assuming no devaluation in the good state actual inflation rates can be expressed as

$$\Pi_g = E(\Pi)^{\alpha+\alpha\gamma}I^{-\alpha\gamma} \tag{25}$$

and

$$\Pi_b = E(\Pi)^{\alpha+\alpha\gamma}I^{-\alpha\gamma}e_b^{\alpha} \tag{26}$$

(5) Let us derive the expected loss from external government debt.

$$E(\chi D) = I^*(F-B)E(\chi) + p\chi_g IB + (1-p)\chi_b\frac{IB}{e}$$

which can be rewritten as

$$E(\chi D) = I^*(F-B)E(\chi) + p\chi_g IB + \chi_b B(I^* - pI)$$

[11] Our model of inflation was not derived form first principles. This feature accounts for the irrealistic limiting behavior.

by using (23).Then its derivative with respect to the interest rate is

$$\frac{dE(\chi D)}{dI} = \left(p\chi_g I - \chi_b pI + \chi_b I^* - I^* E(\chi)\right)\frac{dB}{dI} + (p\chi_g - p\chi_b)B.$$

It is clear that as long as B and $\frac{dB}{dI}$ are positive, increasing the interest rate reduces expected costs coming from external government debt. Our results on expected inflation, and inspecting (24) imply that in the small economy case we have these two positivity conditions unambiguously.

(6) Now let us express the expected cost coming from unhedged foreign lending by the corporate sector.

$$E(B_{hp}) = p(H-I)^{-\varsigma} + (1-p)e_b(H-I)^{-\varsigma}$$

By our assumptions $E(B_{hp})$ is monotonically increasing, and convex in I.

(7) Next we demonstrate numerically that there are sets of parameters implying the existence of an interior equilibrium.First we assign parameters in the following way.

$\alpha = 0.5$ $\gamma = 0.2$ $p = 0.875$ $I^* = 1.05$ $F = 0$ $\varkappa_g = 0$ $\varkappa_b = 10$ $\varsigma = -0.1$ $H = 3$ $\phi = 2$ $\psi = 10$

First we compute the value of L_x, disregarding opting out costs, on the assumption that there is no devaluation in the good state, but there is devaluation in the bad state. It turns out that L_x attains its minimum at $I = 1.1756$. The loss increases slightly as the domestic interest rate goes above the foreign rate, then it starts to decrease at $I = 1.084$, and after reaching its minimum increases again rather sharply. The implied optimal devaluation is large ($e_b = 7.3759$). We have to check that it is indeed the ex post optimum. The first derivative of L_b vanishes at e_b by construction, thus we have to establish only that it is a global optimum. This is true, however, since calculations show that the second derivative is positive at e_b and monotonically decreasing in e. It is easy to see that because of the $\varkappa_g = 0$ parameter assignment it is never worthwile for the monetary authorities to devalue in the good state. Simple calculation show that devaluation is optimal if the fixed cost is smaller than 47.2039. The difference between the values of L_x, when there is no devaluation in either case, and when $I = 1.1756$, without opting out costs, is 1.9046. Then for $K < 15.2368$ the devaluationary policy is better than holding to the peg even in the bad state.

To summarize our arguments we get the following proposition.

Proposition 2 *There exists a (non-trivial) range of parameters for which devaluationary equilibria exist in the small open economy case.*

In a small open economy increasing the nominal interest rate above the foreign rate always increases expected inflation and inflation variability, but reduces the expected burden of government foreign debt. If one has a strong reason for

not increasing unhedged private foreign liabilities, then this motive can counteract the debt renunciation effect and can lead to moderation in devaluation, thus to lower interest rates, lower expected inflation, and lower inflation variability.

It must be emphasised that this analysis is based on certain assumption concerning price formation, which come from a reduced form model, and from the UIP assumpion that can be too extreme with respect to the behavior of international capital markets. Also our results refer to a devaluationary equilibrium of an adjustable peg regime. Thus it is implicitly assumed that maintaining the peg is so attractive that there is no chance for a revaluation. Considering this possibility would make the already complicated analysis intractable.

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