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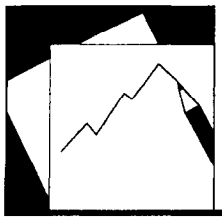

IMF Working Paper

Capital Flows to Transition Economies: Master or Servant?

Leslie Lipschitz, Timothy Lane and Alex Mourmouras

INTERNATIONAL MONETARY FUND

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Policy Development and Review Department

Capital Flows to Transition Economies: Master or Servant?

Prepared by Leslie Lipschitz, Timothy Lane and Alex Mourmouras[1]

January 2002

Abstract

This paper discusses the forces driving capital flows in transition countries of Central and Eastern Europe (CEE), factors limiting these inflows, their macroeconomic consequences, and policy issues they raise. Capital inflows in the CEE countries reflect real factors and can be a useful servant in the process of development, convergence, and catch up. But to the extent that inflows render CEE countries vulnerable to global capital market conditions, they can also be a cruel master, punishing perceived domestic policy weaknesses and responding to events beyond the control of domestic policymakers.

JEL Classification Numbers: E4, F3

Keywords: Central and Eastern Europe, capital flows, convergence, macroeconomic policy

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I. INTRODUCTION

Substantial private capital inflows have been a fact of life for many of Europe's transition economies over the past decade (Figure 1).[2] Capital flows to economies undergoing far-reaching structural change are to be expected, as they reflect investment opportunities in excess of those that can be financed by domestic savings.

But recent emerging market financial crises serve as a reminder that capital flows are a good servant but a bad master. In the countries affected by the Asian financial crisis, for example, the capital inflows that preceded the crisis were widely regarded as benign, particularly as they corresponded to high levels of domestic investment in economies that were growing rapidly and had strong fiscal positions and high domestic savings rates. Only in hindsight did it become evident that the capital inflows, together with rapid domestic credit expansion, were contributing to a highly vulnerable financial and corporate structure. This experience has underscored the need for countries receiving substantial capital inflows to consider carefully the reasons for these flows and the appropriate policy responses.

This paper is motivated and illustrated by data from the transition countries of central and eastern Europe (CEE).[3] It discusses the factors driving capital flows and the policy issues raised by these flows in the context of those CEE economies that are substantially open to private markets. The analysis has implications for other emerging market countries even though their circumstances may be different.[4]

Capital inflows to the CEE countries with market access have financed current account imbalances (Figure 2) associated, to varying degrees, with relatively high levels of investment spending and with consumption smoothing (as well as, in some cases, fiscal imbalances). Such deficits have been particularly large in the three Baltic countries as well as Hungary and Poland.[5]

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[2] For a general discussion of the determinants and systematic consequences of capital flows, see for instance Goldstein, Mathieson, and Lane (1989).

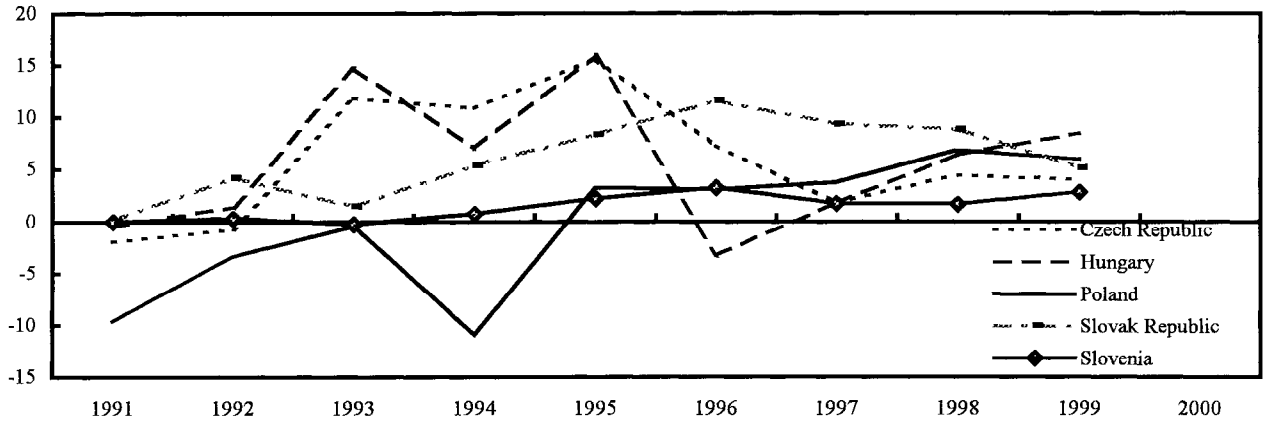
[3] Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia.

[4] The CIS countries are not included in this comparison, as they face a quite different set of issues: a greater role of government rather than private sector borrowing, greater reliance on official rather than private sector lending (except in some oil-producing countries); and a different stage of transition. See for instance McGettigan 2000 and EBRD 1997.

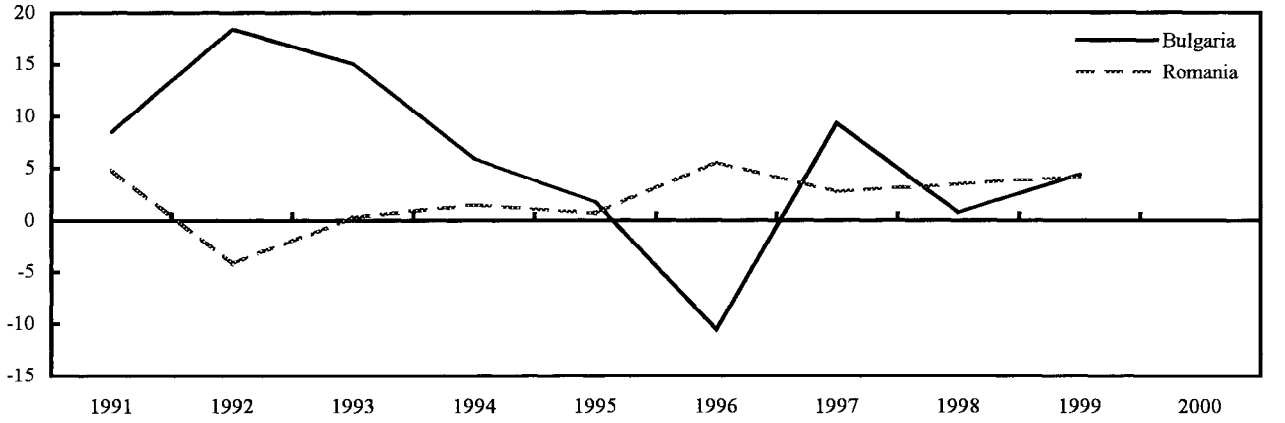
[5] Keller et al. (2000) analyzes various indicators of external vulnerability in the Baltic countries, arguing in particular that current account deficits may overstate the degree of external vulnerability.

Figure 1. Selected Countries: Net Private Capital Flows Excluding Change in Reserves
(As percent of GDP)

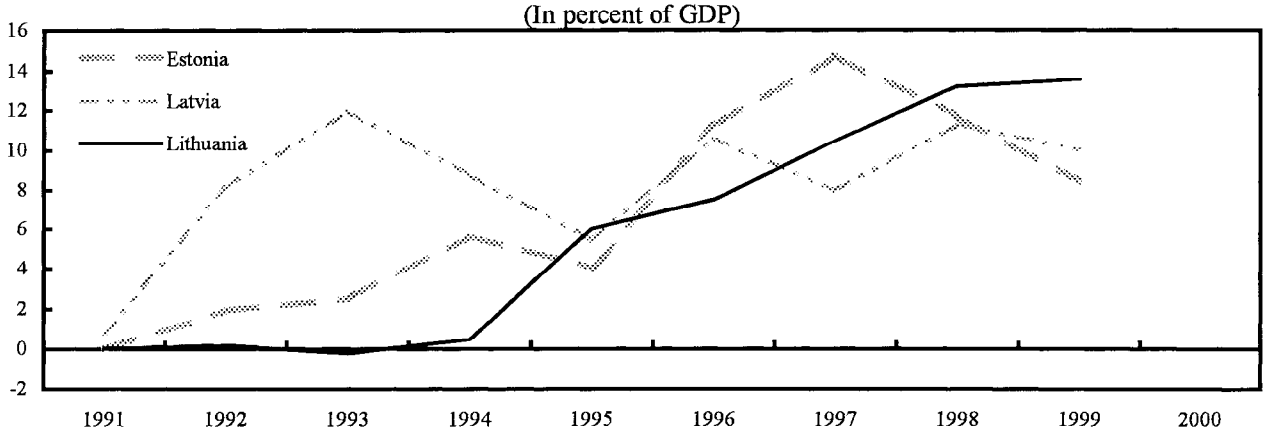
East Central Europe



Southeastern Europe



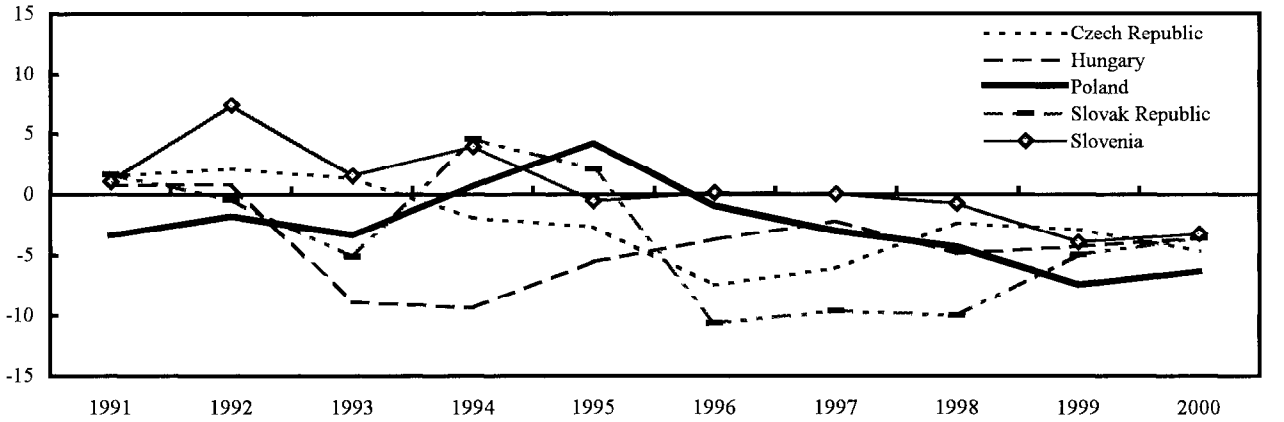
The Baltics
(In percent of GDP)



Source: IMF, World Economic Outlook

Figure 2. Selected Countries: Current Account Balance
(As percent of GDP)

East Central Europe



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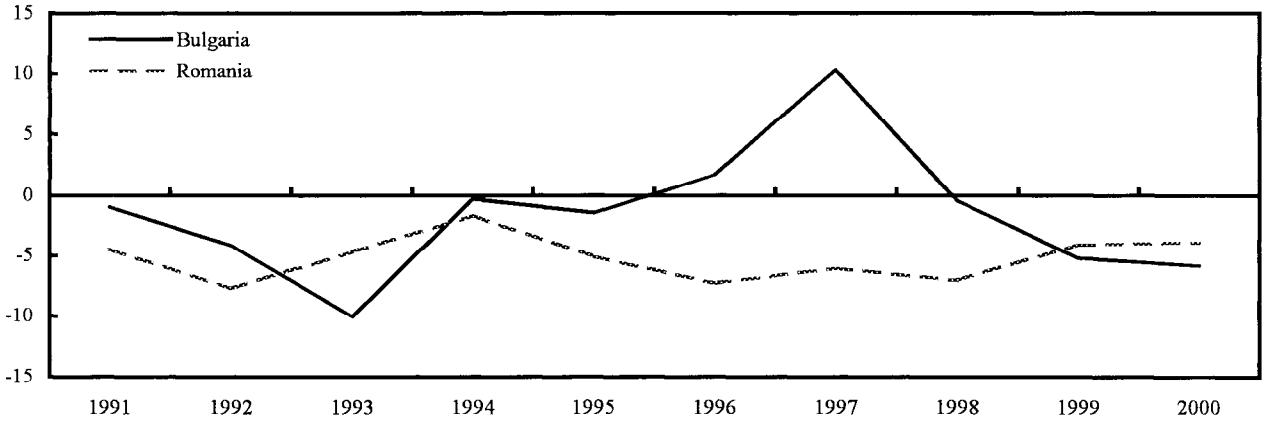
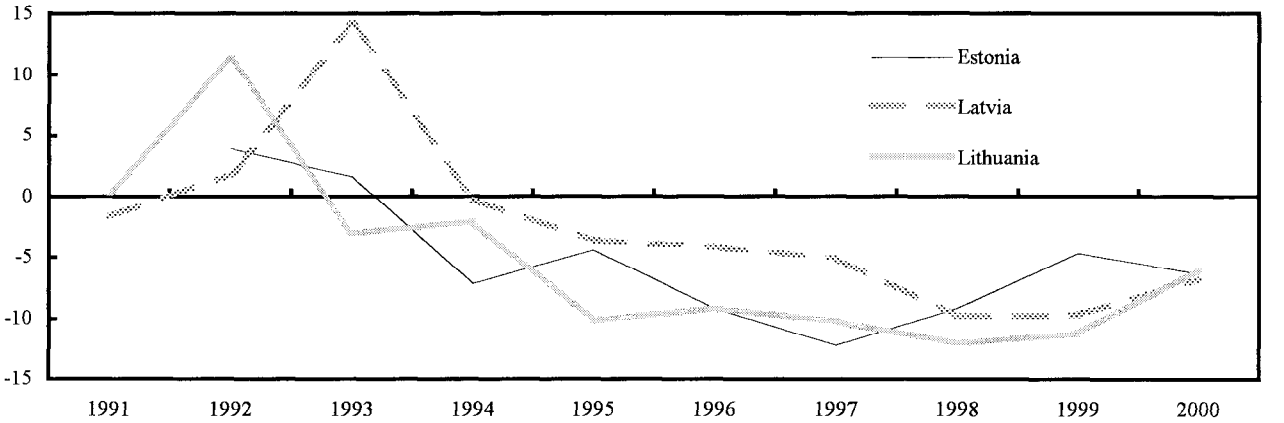


The Baltics



Source: IMF, World Economic Outlook.

Foreign direct investment (FDI) has been a major component of capital inflows (Figure 3). While its macroeconomic consequences are similar to those of other forms of capital inflow, FDI plays a role different from other flows at the microeconomic level, for instance by facilitating the transfer of technology and management techniques. Moreover, compared with other kinds of capital inflows, FDI is less likely to be unwound quickly in response to changes in market sentiment and some of the impact of such a change on the country's external position is absorbed by changes in market valuation.[6]

At the same time, several countries in the region have experienced substantial short-term capital inflows, including portfolio investment and bank claims (Figure 4). In the Czech Republic and Estonia, for instance, portfolio investment and other inflows amounted to around 5 percentage points of GDP in 1999. Such short-term inflows have in some cases been quite volatile; they played an important role in the buildup of vulnerabilities leading to the Russian crisis of 1998.

The remainder of the paper is structured as follows. Section II discusses the motivations for capital flows and their consequences. Section III discusses possible policy responses to capital inflows in light of international experience, and especially the recent global financial crises. In considering these issues, the note draws on the lessons from experience elsewhere in the world—especially the Asian crisis countries, Brazil, and Mexico. Section IV presents some concluding observations.

II. Motivation for Capital Flows

As a starting point, consider the massive increase in Central and Eastern European countries' GDP expressed in deutsche mark from 1992 through the end of the1990s (Table 1). These data imply that a hypothetical financial asset consisting of a representative share of these economies would have paid a handsome return—sufficient to repay the costs of financing such an investment many times over. Of course, this increase in deutsche mark GDP combines several factors: the accumulation of physical and human capital, the increase in factor productivity, and the substantial real appreciation of these countries currencies over this period —which in turn can also be related to Balassa-Samuelson effects reflecting productivity increases.

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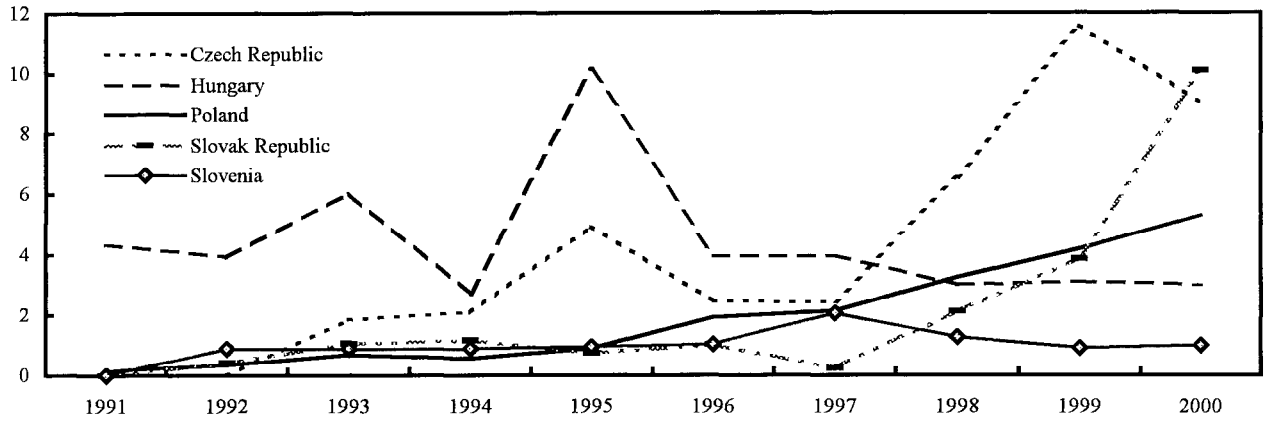
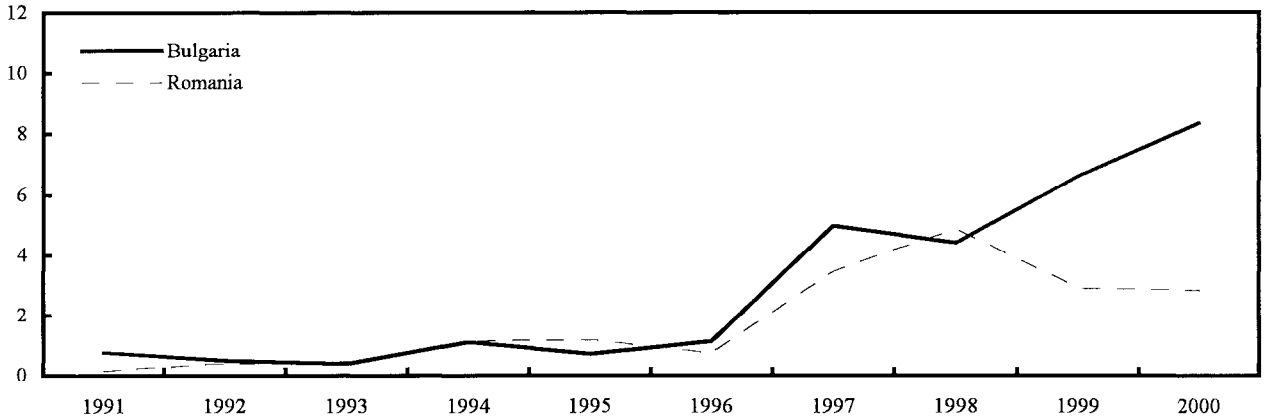
[6] There is nonetheless a range of views in the literature over the relative volatility of FDI and other forms of capital. The experience of recent crises suggests that FDI can be quite volatile as illustrated by the marked decline in FDI in Russia in the aftermath of its 1998 crisis; this view is supported by empirical work by Dooley, Fernandez-Arias, and Kletzer, 1994. But the prevailing view is that FDI is nonetheless less volatile than other forms of capital; see, for instance, Sarno and Taylor, 1999.

Figure 3. Selected Countries: Foreign Direct Investment
(As percent of GDP)

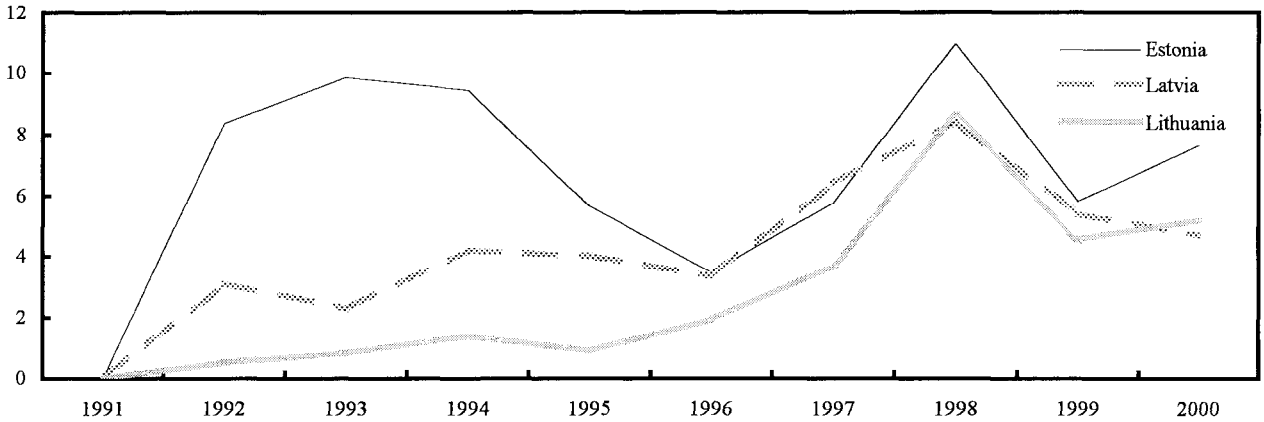
East Central Europe



Southeastern Europe



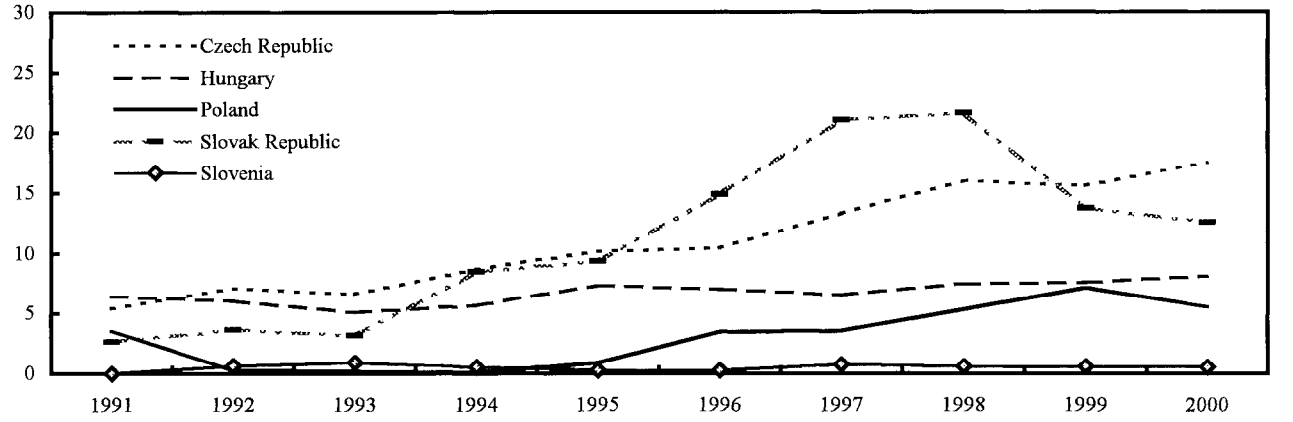
The Baltics



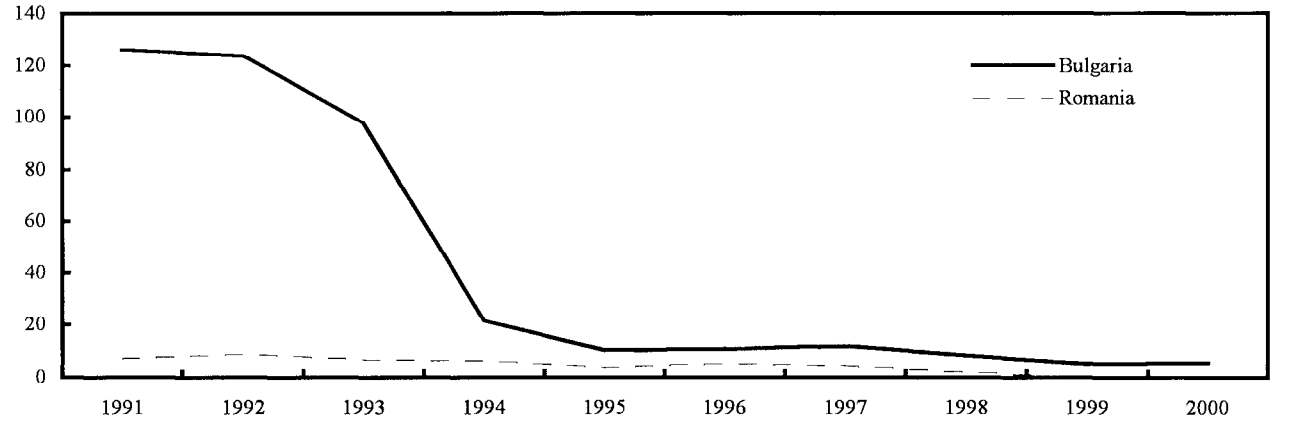
Source: IMF, World Economic Outlook

Figure 4. Selected Countries: Short Term Debt
(As percent of GDP)

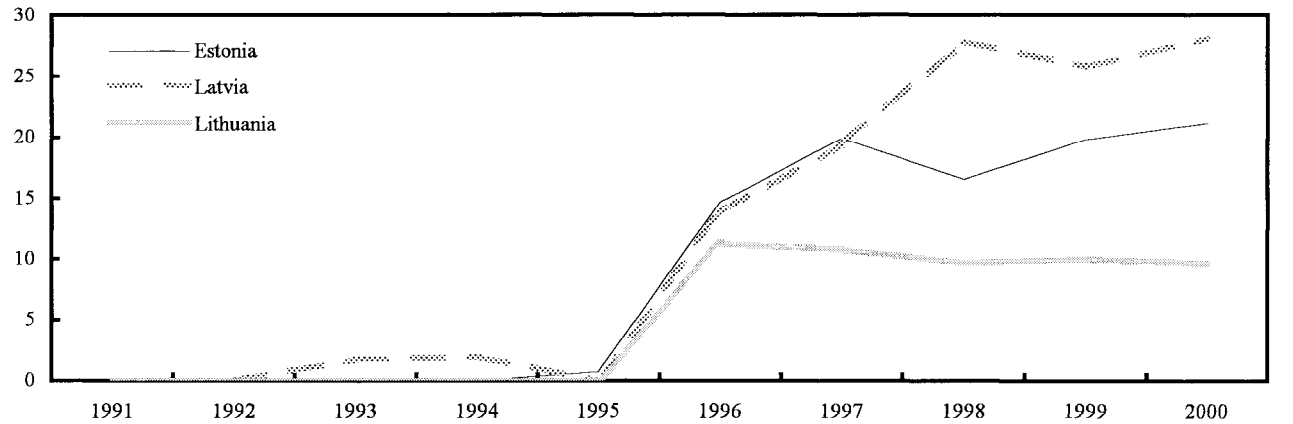
East Central Europe



Southeastern Europe



The Baltics



Source: IMF, World Economic Outlook

The rest of this section discusses two ways of thinking about the interrelation of capital flows, productivity growth, and real exchange rate appreciations. One can think, in portfolio terms, about interest differentials and arbitrage conditions, or in terms of different supply conditions, related to different capital-labor ratios and rates of return on capital.[7] Either way, one arrives at a compelling motivation for large capital inflows and some real dilemmas for policy.

Table 1. Real GDP and Real Exchange Rates: 10 CEE Countries 1/

(Cumulative Percentage Change)

	1992-1997 2/			1997-2002 2/		
	Real GDP	DM GDP	RER	Real GDP	DM GDP	RER
Total	7.0	177.7	147.3	18.6	66.9	34.5

Source : IMF, *World Economic Outlook.*

1/ Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia.

2/ RER are vis-à-vis DM; Figures for 2001-02 are WEO projections.

A. Real Interest Rate Differentials and Arbitrage Flows

Capital inflows are linked with the real appreciations of exchange rates that many transition countries in the region have undergone (Figure 5). On the one hand, inflows may be motivated by the anticipation of real appreciations. On the other, inflows support the real appreciation: huge starting disparities in capital/labor ratios and real rates of return are bound to elicit capital flows, large but uneven productivity gains, substantial increases in income, and significant Balassa-Samuelson effects (see sections II.B and II.C).

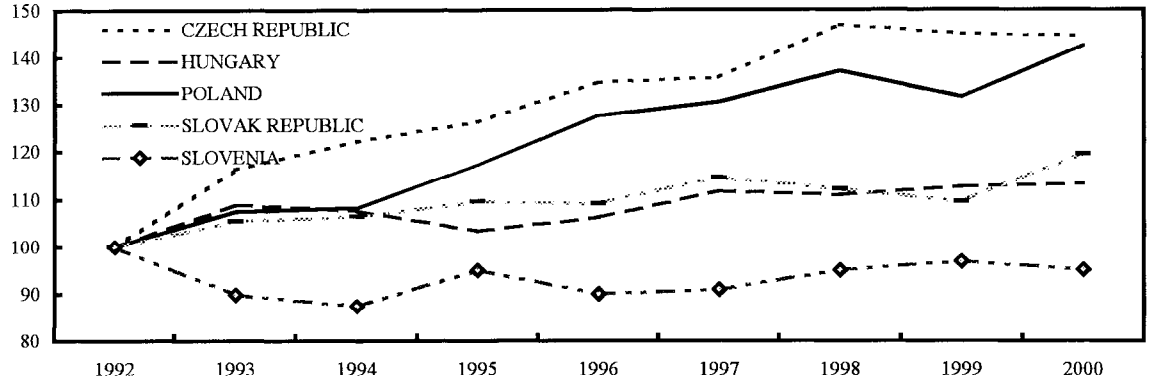
The first point can be made with reference to the basic uncovered interest parity relationship, linking nominal interest rates to the expected nominal depreciation of the transition country's currency:

$$i^C = i^G + \Delta e / e \,, \qquad (1)$$

[7] Capital inflows may also ease liquidity constraints on households and firms; this aspect is not analyzed in this paper.

Figure 5. Selected Countries: Real Effective Exchange Rate 1/
(Based on consumer prices, 1992=100)

East Central Europe



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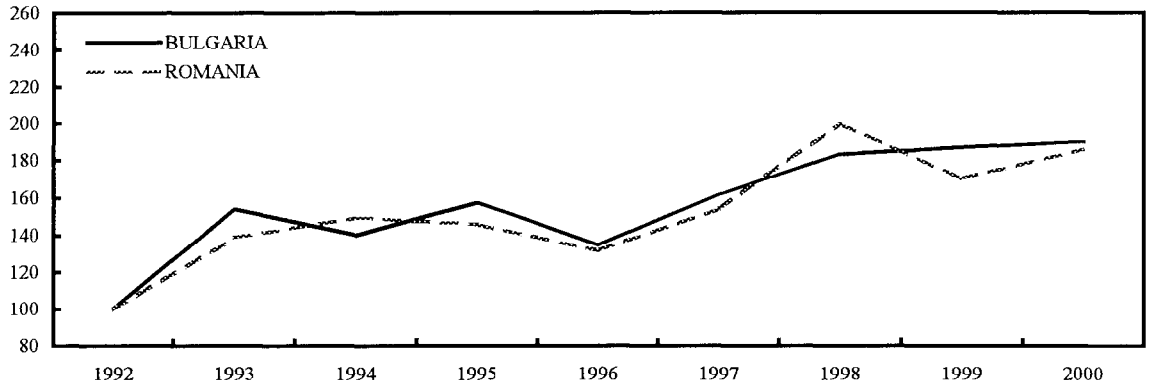
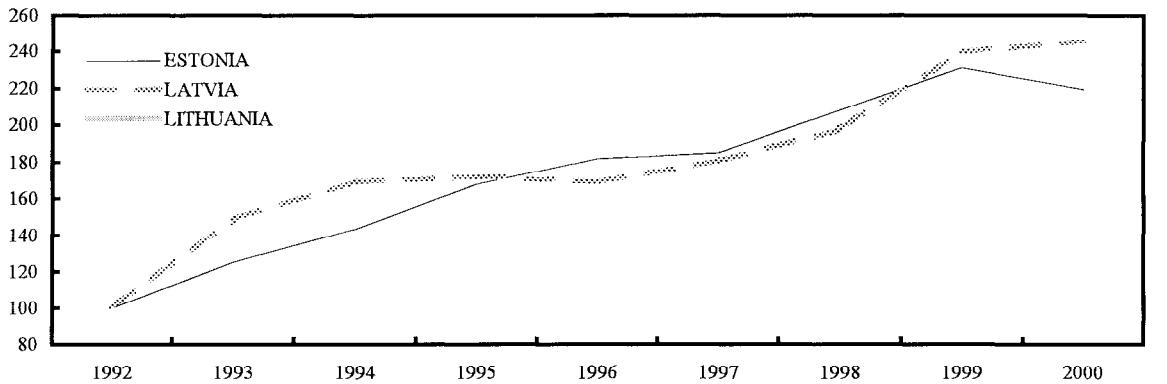


The Baltics



1/ Vis-à-vis US Dollar.

Source: IMF, Information Notice System

where superscripts refer to a transition country C and the industrial country G, i is the nominal interest rate, and e is the exchange rate expressed in units of currency C per unit of currency G. This implies the following relationship between real interest rates and the rate of real appreciation of the transition country currency:[8]

$$r^C = r^G - (\pi^C - \pi^G - \Delta e / e), \tag{2}$$

where the expression in parentheses on the right-hand side represents the rate of real appreciation of the currency of the transition country, expressed in terms of consumer price indices, and π^i is the rate of consumer price inflation in country i.

This relationship can be considered in light of the substantial real appreciations experienced by a number of transition economies. Table 2 presents illustrative calculations for the real interest rates for selected European transition economies implied by the right-hand side of (2), on the assumption of uncovered interest parity vis-à-vis Germany, and assuming that the average rates of real appreciation experienced since 1995 are expected to continue.[9]

[8] This derivation uses the usual approximation $(1 + a)/(1 + b) \approx (a - b)$ when a, b are small.

[9] The reader is cautioned regarding the limitations of comparability of data. For instance, in Latvia yields on Treasury Bills are lower than other interest rates, reflecting their value to banks as collateral. (This would of course amplify the difference between actual and implied real interest rates highlighted in the table.)

Table 2. Actual and Implied Real Interest Rates
Selected European Transition Countries, December, 1999

Countries	Actual real interest rate 1/	Real currency appreciation 2/	Implied real interest rate 3/
Bulgaria	-10.4	8.5	-5.8
Czech Republic	-2.0	4.9	-2.6
Estonia	-6.2	10.1	-7.2
Hungary	3.1	2.4	-0.3
Latvia	3.4	11.4	-8.3
Lithuania	8.8	14.5	-10.8
Poland	4.4	5.8	-3.4
Romania	21.7	4.1	-1.9
Slovak Republic	7.4	4.4	-2.1
Slovenia	-5.1	2.3	-0.1

1/ Short-term treasury bill rates are used except for Czech Republic, Estonia, and Slovak Republic for which we have the deposit rates.
2/ Average annual rate, December, 1994 to December, 1999.
3/ Implied real interest rate is calculated using the average German real interest rate for December, 1994 to December, 1999.

Source : IMF, *International Financial Statistics* and staff calculations.

These results indicate that, under the assumptions made, unfettered capital mobility would drive real interest rates well into negative territory. The substantial gaps between implied and actual interest rates need to be explained, as they would seem to imply a rather compelling incentive to import capital into these countries. These gaps suggest that, for several of the transition countries, what has to be explained is not the tendency for capital inflows, but rather what has limited these inflows.

These illustrative computations raise several questions:

- Why are the currencies of transition countries appreciating in real terms and is this appreciation likely to continue?

- Given differences in the capital structure between the transition countries and their more advanced western neighbors, what can we glean about the notional closed economy interest rates in these countries and the likely magnitude of capital inflows when the capital account is opened up?

- Why have capital inflows been insufficient to arbitrage out real interest rate differentials?

- To the extent that these differentials reflect risk premia, how rational has been the setting of these premia?[10]

B. Real Appreciation

Several alternative interpretations of these real appreciations are possible: [11]

a. The tradable-producing industries in the transition countries started the transition with depressed demand and new competition in their traditional markets, and little if any reputation or brand recognition in western markets. To the extent that current account flows influenced starting exchange rates, therefore, it is not surprising that these rates were very depreciated. As reputations were established and penetration of western markets progressed, some real appreciation was warranted solely on the basis of the changing conditions for trade. This process has been protracted and, indeed, is still far from complete.

b. A slightly more complex interpretation attributes the real appreciations to Balassa-Samuelson effects—i.e., rising *total factor productivity in tradable goods* relative to non-tradables. The gain in total factor productivity could reflect the efficiency gains of exposure to global markets, or the benefits of operating in an economy with increasingly more effective markets and institutions and a more stable macroeconomic setting. Rising output of traded goods and higher incomes are bound to put upward pressures on prices in the nontraded sectors—both through wage leadership and demand pressures.

The Balassa-Samuelson result can be illustrated using a model with two goods (tradables and nontradables) and two factors (labor and capital). Labor is immobile internationally but is fully mobile across sectors within a country. Capital is fully mobile internationally and the real interest rate (in terms of tradables) is determined exogenously in the world capital market. In this model, in which there is no capital scarcity by definition, domestic real interest rates in terms of tradables are always equal to world real interest rates. A country's relative price level will tend to rise if its TFP growth differential vis-à-vis the rest of the world is higher in the tradables sector than in the nontradables sector. The only requirement is that nontradables are not less labor-intensive than tradables (See the Annex for more details).

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[10] As a related issue, one could ask to what extent sterilized exchange market intervention may have affected interest differentials.

[11] See Halpern and Wyplosz (1996). In addition to the explanations discussed in this section, in some countries removal of consumer subsidies and price liberalization, as well as the introduction of VAT and excise taxes, also affected CPI real exchange rates without having any direct implications for competitiveness. These effects have been sizable for some countries, including the Baltics.

Suppose for instance, that growth in total factor productivity in the tradables sector of the transition country, denoted $\hat{A}_T^C$, exceeds that of the industrial country, $\hat{A}_T^G$, and that TFP is constant in non-tradables in both countries. Assume too that the price of traded goods is arbitraged internationally, and that there is wage leadership from the traded to the non-traded sector in the transition country. In these circumstances, the real appreciation of currency C in terms of relative CPIs would be equal to

$$\pi^C - \pi^G - \Delta e/e = (1-\gamma)(\hat{A}_T^C - \hat{A}_T^G), \tag{3}$$

where γ is the weight of tradables in the CPI, assumed the same in the transition country and in Germany. This result is derived for the more general case in the Annex.

c. An alternative case would be one in which the real appreciation results entirely from *capital accumulation in the tradables sector.* This will raise the marginal product of labor in tradables, raise wage rates in the sector, and, through wage leadership, increase wages too in the production of non-tradables—with much the same effect as in the previous example. It is worth noting that there is no real appreciation in this case in terms of relative unit labor costs in tradables—as productivity changes offset wage increases—but there is a real appreciation in terms of broader price indices such as the CPI.[12]

d. Of course, a real appreciation may be simply a monetary phenomenon, reflecting an unsustainable loss of competitiveness—e.g., because of excessive monetization of government deficits within a pegged exchange rate regime.

In cases a, b, and c the real appreciation reflects an ongoing equilibrating process. The capital inflow that puts downward pressure on real interest rates is a *real* phenomenon reflecting productivity trends; it is independent of the nominal exchange rate regime.

Case d is less interesting for the purposes of the present analysis in that the historical appreciation is unlikely to continue—indeed, it is likely to be reversed sharply at some stage.

C. Capital Accumulation

To the extent that capital flows reflect imbalances in initial stocks of capital, the magnitude of potential capital flows to European transition economies can be estimated based on existing capital stocks.[13]

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[12] See Lipschitz and McDonald (1990).

[13] For a detailed analysis of supply conditions at the start of the transition see McDonald and Thumann (1990).

As a starting point, Table 3, column 1, highlights the large differences in output per worker between the European Union (EU) countries and the CEE countries. Insofar as the large differences in output per worker reflect differences in capital-labor ratios, the process of growth and development should have entailed huge capital inflows. The magnitude of these potential flows can be ascertained by the following calculations, which closely follow Lucas (1990). Suppose output in both the EU and CEE is produced by a single sector, with the *same* Cobb-Douglas production function in each country, $Y_i = AK_i^{\alpha} L_i^{1-\alpha}$. In intensive form, output per worker (y) is function of capital per worker (k), $y_i = Ak_i^{\alpha}$. The marginal product of capital is $r_i = A\alpha k_i^{-(1-\alpha)}$ or, in terms of output per worker,

$$r_i = \alpha A^{1/\alpha} y_i^{-\frac{1-\alpha}{\alpha}}. \tag{4}$$

If Germany is taken to represent the EU, and i denotes a representative CEE country, then from equation (4),

$$\frac{r_i}{r_{ger}} = \left(\frac{y_i}{y_{ger}} \right)^{-\frac{1-\alpha}{\alpha}}. \tag{5}$$

Equation (5), together with an estimate of the capital intensity of production, can be used to estimate the returns to capital in the CEE (Table 3, Column 3). Assuming a benchmark value of $\alpha = 1/3$, the marginal product in the transition economies in 1999 was between 8½ and 23 times the marginal product of capital in Germany.

Table 3. CEE: Potential Capital Inflows: Illustrative Calculations, 1999 1/

	y_i/y_{Ger} 2/	k_i/k_{Ger} 3/	MPK 4/	Potential Inflows 5/			
				η=1 6/	η=0.9 7/		
				Year following liberalization			
				1	1	2	3
Bulgaria	22.9	1.2	19.1	752.7	349.3	77.7	19.2
Czech Republic	53.6	15.4	3.5	275.1	109.0	29.9	2.8
Estonia 8/	31.1	3.0	10.3	542.7	249.2	61.8	14.1
Hungary 8/	55.7	17.2	3.2	258.9	100.5	27.5	1.9
Latvia 8/	20.9	0.9	22.9	824.7	385.7	82.5	20.6
Lithuania 8/	28.5	2.3	12.3	596.3	276.1	66.5	15.7
Poland 8/	38.6	5.8	6.7	424.5	188.4	49.7	10.0
Romania	26.9	1.9	13.8	634.3	296.4	69.8	16.7
Slovak Republic	42.2	7.5	5.6	381.1	165.8	44.3	8.0
Slovenia	72.8	38.6	1.9	146.8	40.3	7.6	-6.5
Median	34.9	4.4	8.5	483.6	218.8	55.8	12.1
Minimum	20.9	0.9	1.9	146.8	40.3	7.6	-6.5
Maximum	72.8	38.6	22.9	824.7	385.7	82.5	20.6

Sources: WEO; World Bank, World Development Indicators (WDI); and staff calculations.

1/ Common Cobb-Douglas production function, $y=k^{\alpha}$; $\alpha=1/3$; $r=0.04$; $\delta=0.15$.

2/ GDP per worker in percent of German GDP per worker (PPP basis).

3/ capital per worker (in percent of German capital per worker)

4/ Marginal product of capital (multiple of German product).

5/ Inflows in the period following liberalization of capital movements (in percent of GDP).

6/ With no adjustment costs, all inflows take place in the year following liberalization.

7/ $\eta=0.9$ is the specification of adjustment costs used in Kehoe-de Cordoba (2000).

8/ WDI labor force data were used for 1985 and 1989.

9/ WDI labor force data were used for 1985.

If the simple model were true and world capital markets were free and complete, these enormous rate of return differentials would induce rapid flows of investment goods from Germany and other capital-abundant countries to the transition economies of the CEE. Indeed, as observed by Lucas, *no* investment would occur in the wealthy countries in the face of rate of return differentials of this magnitude between mature and transition or developing countries.

Assuming that the European transition economies are small relative to global capital markets, equality of rates of return for capital would imply that capital per worker and output per worker in the transition economies would be equalized to world levels in a single period. If $\bar{k}_i = k_{ger}$ denotes capital per worker following financial liberalization, the capital flow in relation to pre-flow GDP would be

$$\frac{\bar{k}_i - k_i}{y_i} = \frac{k_{ger} - k_i}{y_i} = \frac{k_{ger}}{y_{ger}} \frac{y_{ger}}{y_i} \left(1 - \left(\frac{y_i}{y_{ger}} \right)^{\frac{1}{\alpha}} \right). \quad (6)$$

The potential capital flow in relation to GDP varies directly with German capital abundance (the German capital-labor ratio); the potential flow is also higher the greater is the difference in relative per-worker outputs y_{ger}/y_i. To estimate the size of these potential one-time flows predicted by this simple model, we used the Penn World Tables' estimate of 1.74 for the German capital-output ratio in the late 1980s-early 1990s (Table 4). An economy with per worker output equal to ½ of Germany's would experience a one-time income-equalizing flow of over 300 percent of GDP. Even if output per worker is 80 percent of Germany's, this flow would still be over 100 percent of GDP.

Turning to the CEE countries, the magnitude of the one-time capital flows predicted by the simple model, in the absence of adjustment costs ($\eta = 1$ in Table 3), ranges from about 150 to 825 percent of GDP in 1989 (Table 3, Column 4). To put this in perspective, in a similar exercise for Spain's experience with capital flows following financial liberalization in 1986, Fernandez de Cordoba and Kehoe (2000) found that the capital flow required to equalize German and Spanish interest rates would be of the order of 86 percent of GDP.

Table 4. Potential Capital Inflows

y_i/y_{ger} (In percent)	Capital Inflow (In percent of GDP)
10	1738
20	863
30	564
40	407
50	305
60	227
70	163
80	106
90	52
100	0

Source: staff calculations.

A more realistic case is one in which it is assumed that *immobile or slowly adjusting factors of production* such as suitable land or particular types of human or physical capital may create bottlenecks that delay the adjustment of labor, capital and other factors. Limits to the intersectoral mobility of physical factors within the transition economies are a closely related friction which may be particularly relevant in the CEE countries. Substantial quantities of labor and capital need to be reallocated away from the sectors of the economy formerly under

the control of the state and into the newly privatized economy, but this reallocation is bound to be costly given the sector-specific nature of some of the factors. The role of adjustment costs is illustrated in the Annex, which calibrates a simple neoclassical model of investment subject to adjustment costs for the CEE economies. This model produces gradual convergence of the transition economies' capital-labor and per capita incomes to Western European levels. Illustrative results, for adjustment costs similar to those reported in the literature for other countries ($\eta = 0.9$) are shown in Table 3, Columns 5-7. These results indicate that physical adjustment costs can account for capital inflows that are much smaller than those that would be predicted in the absence of such costs—but even in the presence of such costs, capital flows are predicted to be much larger than those actually observed.

D. What Limits Capital Flows to Transition Economies?

While the European transition countries have received substantial amount of foreign financing in the decade following the transition, the current account deficits shown in Figure 2 above have not been anywhere close to those predicted by the simple model, as shown in Table 4. This raises the question of why capital flows have been so small, compared with the predictions of the model.[14] Several factors generating frictions in the pace of factor mobility may be mentioned briefly, although each of these could be analyzed in more detail.

a. *Differences in technology* may result in differences in the productivity of capital across countries. This could reduce the incentive for capital to move to the transition economies, especially to the extent that these gaps are not expected to close over the lifespan of the capital. Broadly interpreted, these technological differences reflect not just the state of knowledge but also aspects of the way production is organized. For instance, there may be inefficiencies in production even in advanced transition countries—corresponding to the observation that there is room for further progress in industrial restructuring (for instance, in the Czech Republic, Poland, and Slovenia) and in agriculture (e.g. in Poland).

b. *Externalities*, particularly those associated with human capital accumulation. Such externalities have been used, in particular by Lucas (1988, 1990), to analyze persistent cross-country differences in income per capita. They would also tend to imply a higher marginal product of capital in industrialized countries and thus a diminished incentive for capital to flow to developing and transition countries.

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[14] For a group of 23 industrialized countries during the 1960s and 1970sa, Feldstein and Horioka (1980) found that domestic rates of investment and saving tended to be closely correlated. Feldstein and Horioka originally interpreted this puzzling finding as indicating the presence of substantial barriers to capital flows among industrialized countries. With the move to capital account liberalization in many industrial countries in the 1970s and 1980s, the correlations between S and I appear to have weakened when data for the 1980s are also considered. See Rivera-Batiz and Rivera-Batiz (1994), page 273.

c. *Institutional factors* may play an important role in limiting capital inflows. Foreign investors may be concerned that the rules of the game are uncertain, or may change—owing, in some cases, to concerns about the possibility of confiscatory taxation or exchange controls, as well as insecure property rights and uneven application of laws and contracts.[15] (Such concerns are not confined to transition countries, of course, but are among the factors that limit the extent to which we operate in a truly global capital market.)

d. Investors may be uncertain about the ability of the *financial system* to channel capital flows efficiently, and this would affect the risks and prospective returns on their investments. As a related point, there may be *credit market constraints* as access to credit may be limited by the availability of suitable domestic assets to serve as collateral. The basic reason why capital inflows remain larger than those observed in reality in the adjustment cost model presented in the Annex has to do with consumer behavior. Rational, forward-looking consumers react to the open capital market regime and to the higher future incomes that capital accumulation will bring about by raising their consumption through foreign borrowing. Taking into account the limits which credit markets impose on consumer borrowing further reduces the magnitude of desired capital inflows, bringing them closer to those observed.[16]

e. *Macroeconomic instability* may reduce the profitability of investment by making rational investment planning more difficult; uncertain or turbulent macroeconomic prospects tend to limit capital inflows and in some cases lead to capital flight. (The latter has been particularly important in the case of Russia.[17])

f. Finally, capital flows much larger than those actually witnessed would result in *increasing concerns about repayment*. Such concerns are reflected in the fact that current account deficits are regarded as warning indicators of a crisis.[18] Underlying market concerns

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[15] Tornell and Velasco (1992) attribute capital flows from poor to rich countries to weak property rights which induce a "tragedy of the commons". Groups representing special interests in poor countries are able to appropriate other groups' capital stocks, either directly or indirectly through their influence on the budgetary process. By contrast, investments citizens of poor countries make in rich countries are safe from expropriation risk. Recent findings by Garibaldi et al. (1999) that the distribution of FDI flows across countries is significantly influenced by investor perceptions of country risk as well as survey-based indicators of the legal and political climate are consistent with the view that such factors are important limitations to capital flows.

[16] See Barro, Mankiw, and Sala-i-Martin, 1992; and Barro and Sala-i-Martin, 1995, p. 101.

[17] See for instance Abalkin and Whalley, 1999.

[18] Warning indicators have been discussed, for instance, by Berg and Patillo (1999). See also Keller et al. (2000), and McGettigan (2000).

over current account deficits—even if they, in fact, reflect real factors such as capital scarcity and productivity growth—are the institutional and financial considerations mentioned in the previous two points, together with the difficulty market participants face in ascertaining that capital inflows are in fact based on these real factors. For these reasons, larger current account deficits would tend to be associated with higher required risk premia and would serve to limit the capital flows in response to any given differential in returns.

E. The Dilemma for Policy and the Role of Risk Premia

From the above analysis, two points of reference emerge. First, from the analysis related to equation (2), it is clear that, given a trend real appreciation, the real interest rate in the transition country required for interest parity is substantially below that in the industrial countries. Second, from the analysis of domestic supply conditions it is clear that capital scarcity should make the rate of return on capital in European transition countries higher than that in advanced industrial countries. In many circumstances, these two phenomena may be intimately related. Rapid capital accumulation in areas of relative capital scarcity is often accompanied by rapid growth in total factor productivity in tradables. Such growth in TFP in countries catching up is the result of exposure to modern technology incorporated in imported, latest-vintage capital goods, assuming that there are no serious locational disadvantages to production in these areas associated with poor infrastructure, imperfect property and legal rights, corruption, and the like.

If the authorities seek to set real interest rates low enough to limit ex ante arbitrage inflows, there will almost certainly be a massive ex post imbalance between investment and saving—that is, a huge capital inflow. If, on the other hand, the authorities seek to set real interest rates at a rate reflective of the relatively high returns to capital, there will be very large arbitraging inflows. While various fundamental and institutional factors may impart some friction to the process—thereby limiting the size of capital flows—it is not likely that these will be sufficient to afford the transition country any significant interest rate independence.

It is conceivable that movements in risk premia could help contain the size of capital inflows and allow for some natural speed limits on the pace of capital accumulation and the size of current account imbalances. The simplest ideal would be the case where the risk premium on the currency of the transition country was related in a smooth monotonic fashion to the size of the current account deficit. This would facilitate a smooth increase in domestic interest rates to the point where, at a certain level of the current account deficit, domestic interest rates would be high enough to balance real intertemporal forces—decisions on saving and consumption and the timing of investment—without eliciting overwhelming portfolio inflows. In practice, however, risk premia are unlikely to be so well behaved. They will be a function not only of the current account deficits, but also of a broad array of other variables—including political developments, bandwagon effects, and various elements of contagion from other emerging market countries—that may well be highly erratic and will certainly be beyond the control of the domestic policymakers.

The problem for policy, therefore, is that macroeconomic developments will turn on capital account developments which will be highly sensitive to a vector of possibly erratic exogenous variables. There may thus be times when policymakers are trying to cope with overwhelming inflows that undermine any semblance of financial restraint. At other times, a sudden exogenous jump in risk premia may reverse capital flows and force a financing crisis and/or a major compression of demand.

The problem is a real one, and different nominal exchange rate regimes will not alter it fundamentally. It is true that floating exchange rates may be able to absorb shifting risk premia more smoothly. But they will not help stabilize the influence on domestic demand. Consider, for example, the case of a sudden drop in the risk premium from a seemingly settled domestic situation. Under a pegged exchange rate regime, the transition country may be overwhelmed with capital inflows resulting in inflation and a sharp deterioration in the competitiveness of the traded goods sector. Under a floating exchange rate regime where the domestic monetary authorities retain interest rate independence, the value of the domestic currency will jump to an overappreciated level where some interest-equalizing depreciation is expected; and this appreciation could well be devastating for the traded goods sector of the economy. It is unlikely that countries would be willing to accept the large movements in exchange rates that would be likely to result (see Calvo and Reinhart, 2000).

As is clear from the experience of the Asian crisis, the Lawson Doctrine does not provide much comfort: even if the government accounts are balanced and capital flows reflect private investment decisions, government policy will have to confront the instability imparted by a volatile capital account.

III. Policy Responses to Capital Inflows

The previous section has stressed that in the absence of frictions, *real* factors, notably capital scarcity and productivity growth differentials, would account for capital flows to transition economies much larger than those actually observed. While these capital flows are limited by a variety of factors that were enumerated—and in particular by volatile risk premia associated with information and other frictions—they may nonetheless be huge. Certainly these capital flows are large enough to pose a challenge for economic policy and to lead to a buildup of vulnerabilities of the kind reflected in recent capital account crises.[19] The question is then what kinds of policy may be useful in tackling this challenge.

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[19] A useful reference is Schadler et al., 1993, which considered the experience of 6 countries faced with surges of capital inflows: within the five years following the publication of this study, three of these countries had undergone major crises. The countries experiencing crises were Spain (1993), Mexico (1994-95), and Thailand (1997-98); Chile and Colombia weathered international financial crises; while in Egypt, the episode of capital inflows proved short-lived.

A. Exchange Rate Regime

The choice of exchange rate regime affects the channels through which capital inflows affect the economy, but no regime would by itself be sufficient to neutralize these effects. A flexible exchange rate is likely to be the regime of choice for countries experiencing large capital inflows. But, if capital inflows have real origins, the authorities cannot look to their choice of nominal exchange rate regime alone to resolve their dilemma.

Under a fixed exchange rate—either a conventional peg or a currency board—inflows are associated with an increase in foreign exchange reserves and thence in the domestic money supply. Initially, the monetary authorities are likely to try to address this situation through sterilization, while maintaining a tight domestic monetary policy to restrain domestic monetary expansion and inflation. But where real forces are driving the real exchange rate to appreciate, a policy of restraining inflation and retaining the peg through sterilized intervention is not sustainable, as such a policy would require a substantial and progressive contraction of domestic credit as reserves accumulate. At some point, sterilization is likely to break down, leading to a monetary expansion and domestic inflation. The end result is that an exchange appreciation eventually takes place through an inflation differential, if it does not take place first through nominal currency appreciation.

Under floating exchange rates, capital inflows typically result in a nominal (and real) appreciation that generates a current account deficit validating the capital inflow. This appreciation enables the country to adjust to the inflows. But to the extent that the capital inflows are in the nature of a stock adjustment, there will almost certainly be some overshooting in the real exchange rate, which is likely to subject the tradable goods sector to difficult competitive circumstances. Moreover, as mentioned above, even if the capital inflows are based on real productivity gains and capital scarcity, a very large current account deficit will make the country vulnerable to changes in market sentiment; in the event that capital inflows are suddenly reversed, this may dry up financing for producers, with adverse consequences for the supply side.

Thus, since the mechanisms motivating capital flows are real rather than monetary, they cannot be influenced decisively by monetary policy or the nominal exchange rate regime: the main difference is with regard to whether a real appreciation takes place through nominal appreciation or through inflation.

Moreover, if a fixed exchange rate is sustained for some time, it may create other vulnerabilities: as confidence in the nominal exchange rate grows, it is likely that more and more private foreign exchange positions will go unhedged, and that the vulnerability to—and the potential cost of—a change in market sentiment will increase. This is illustrated by the experience of the Asian crisis countries in the run up to the 1997-98 crisis.[20] Given such

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[20] See for instance Boorman and others, 2001. In contrast, the relatively benign reaction of Australia and New Zealand to the same crisis may, in part, serve to illustrate that such

(continued...)

vulnerabilities, the authorities are likely to try to resist any downward pressure on the currency that may result from a sudden increase in the risk premium. However, to the extent that the market sees this resistance as ultimately futile, the central bank may be seen as a sitting duck thereby eliciting huge flows of opportunistic speculation. Flows of this magnitude will probably prove overwhelming and depreciation will become inevitable. Thus, whatever the underlying fundamentals, a fixed exchange rate regime may serve to exacerbate volatility.[21]

B. Fiscal Policy

In theory, contractionary fiscal policy can offset the expansionary influence of capital inflows.[22] In practice it makes sense to pursue contractionary fiscal policies during periods of large inflows. Moreover, a strong fiscal position should make it possible to adopt an expansionary stance in response to a sharp turnaround in the capital account.[23] But there are practical limits to what should be expected of fiscal policy: it is highly unlikely that any government will be able to change the stance of fiscal policy in the magnitudes and with the rapidity required to offset shifts in the capital account. Fiscal policy—which is constrained by multi-year governmental obligations and programs, and is subject to parliamentary debate and approval—is simply not a sufficiently flexible instrument.

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vulnerabilities are avoided with a floating exchange rate, as private agents eschew unhedged financial exposure and hedge the risks in export earnings and import costs.

[21] There is a role for exchange rate based stabilizations, and in particular hard pegs—through currency boards or dollarization—and considerable evidence that they can deliver credibility benefits that translate into lower inflation without sacrificing growth performance (see Ghosh et al. (1998); Hamann (1999); Masson (1999); and Corker et al. (2000)). Nevertheless, the foregoing analysis suggests that the authorities would be wise to consider and embark on exit strategies before the onset of crisis.

[22] In a simple Mundell-Fleming model with fixed exchange rates and capital mobility monetary policy is irrelevant and only fiscal adjustment can be used to prevent overheating and reduce the current account deficit associated with capital inflows. In the same model with floating exchange rates, a combination of fiscal tightening and monetary easing can be used to reduce the current account deficit.

[23] The experience of the 1997-98 Asian crisis illustrates the importance of a sound fiscal position in providing room for the authorities to respond to a crisis in a way that served to cushion the macroeconomic consequences of a sharp reversal in the capital account. Once it became evident that the crisis was leading to a precipitous drop in private domestic demand, fiscal deficits were allowed to expand substantially (Lane et al. (1999)).

C. Capital Controls

Controls on capital inflows are another tool that may be considered in resolving the dilemma posed by capital inflows that occur in responses to real forces reflecting capital scarcity and productivity gains. Such controls constitute an interference with market forces and, presumably, slow down the convergence of capital-labor ratios, productivity, and per capita income. But clearly, very large capital inflows increase current account imbalances, dependence on foreign capital, and thus vulnerabilities to international financial market conditions. To the extent that risk premia increase smoothly with current account deficits and other measures of vulnerability, there would probably be little justification for capital controls. However, to the extent that risk premia are erratic, or at least subject to influences unrelated to domestic economic developments, capital flows may impose enormous instability on an economy and overwhelm stabilization policy. Even though capital controls distort the intertemporal allocation of resources, are subject to evasion, and could be used as a pretext to relax macroeconomic discipline, they could provide emerging market countries a temporary shield from volatile short-term capital flows like interbank lending and portfolio investment. This view of controls is consistent with evidence indicating that controls on capital inflows have typically been more successful in altering the composition of capital inflows than in reducing their total amount (Montiel and Reinhart, 1999).

The situation is different for a country with a history of an open capital account than for countries in which flows have not yet been liberalized. In the former case, it may prove difficult to reintroduce capital controls successfully, particularly where there are numerous closely-held corporations and substantial intracorporate flows, requiring the authorities to run a race with the markets to keep up with the markets' ability to circumvent them. In contrast, countries that do not yet have liberal capital accounts must consider the appropriate pace and sequencing of capital account liberalization. It is now conventional wisdom that that long-term and more stable flows such as direct investment should be liberalized before shorter-term and less stable flows; and that liberalization should proceed cautiously taking account of the ability of the financial sector and the macroeconomy to withstand the additional stresses that will result.[24] Indeed, some countries in Central and Eastern Europe—including Hungary, Poland, Slovenia, and Croatia—have retained some controls on short-term capital.[25]

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[24] If resorting to capital controls, price-based controls à la Chile are better than quantitative restrictions and may well manage to lengthen the maturity structure of liabilities. See for instance Johnston et al. (1999).

[25] In the case of Hungary, these controls were lifted in mid-June 2001 in conjunction with the adoption of inflation targets for monetary policy.

D. Structural Reforms

Another category of policies that can be considered is broadly categorized as structural reform. Here, one may think of two general categories: reforms to the financial sector, and reforms aimed at increasing the efficiency of the economy more generally.

Strengthening the governance of the financial sector is particularly important in helping reduce the vulnerabilities associated with capital inflows. While developing a sound financial system has been a priority for transition economies since the early days of transition,[26] the crises in Asia and elsewhere have underscored that liberalized capital flows place particularly stringent requirements on financial system soundness. This is an area of reform in which many CEE countries have made substantial progress—in some instances prompted by crises—while in others evident weaknesses remain. Strong financial supervision and regulation in line with the Basel Core Principles, [27] action to address any weak institutions, and ancillary reforms in other areas such as the legal system are important in this regard.

As a related factor, reforms that bring about increased transparency—an increased flow of accurate information to the markets—may help reduce the economy's vulnerability to capital flows. With better information, the resources provided by the capital inflows can be put to better use. Moreover, incompleteness or asymmetry of information may result in herding or bandwagon behavior, and, in extreme circumstances, to panics—driven by investors' fear that others may have more complete information. Contagion too is exacerbated by an insufficiency of information that makes it difficult for lenders to differentiate among borrowers on the basis of credit-worthiness.[28] In contrast, when information is provided to more continuously, it can be priced into the markets more smoothly.[29]

Other structural reforms, aimed at increasing the efficiency of the economy more broadly—for instance, through competition policy, labor market flexibility, public sector reform, privatization, and so on—however desirable from the standpoint of the economy more generally—do nothing to resolve the dilemma facing the authorities with massive capital

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[26] See for instance the volume edited by Caprio, Folkerts-Landau, and Lane (1994).

[27] See Folkerts-Landau et al. (1998).

[28] Only some of the several alternative explanations of contagion are based on informational imperfections. See for instance Masson et al., 1999.

[29] The benefits of transparency—or rather, the costs of opaqueness—were highlighted by some episodes in the Mexican and later the Asian financial crises as unpleasant information, particularly regarding the countries' usable reserve positions, became known to markets at the worst possible time, in the midst of a crisis. See for instance Lane and others, 1999.

inflows. They may, however, improve the supply response to capital inflows by helping to allocate the resources associated with the inflows more efficiently.

IV. Conclusion

Freed from controls, the development of the transition economies should be accompanied by very large capital inflows. The incentives for these flows are embedded in the initial conditions and the process of development. Such flows can be a useful servant—serving the purposes of development: financing investment, raising productivity, and increasing per capita incomes. But global capital markets can also be a cruel master: capital inflows and the corresponding current account deficits render countries vulnerable to global capital market conditions, and these can be both punishing of perceived domestic policy weaknesses and highly erratic (or at least highly responsive to events beyond the control of domestic policymakers). This state of the world requires that stabilization policy be cognizant of some nontraditional considerations related to exchange rate regimes, fiscal policy, structural and institutional factors, the rules governing capital flows, and the transparency of economic data and policy.

Illustrating Balassa-Samuelson Effects and Investment Subject to Adjustment Costs

A. Balassa-Samuelson Effects

The Annex provides more details on the derivation of equation (3) on page 4, based on Obstfeld and Rogoff (1996). This analysis takes tradables as numeraire and normalizes the price of nontradables to 1 in both countries. (This is a real model which ignores the split between nominal currency appreciation and inflation).

The transition country's price index, P, is given by $P = 1^{\gamma} p^{1-\gamma}$, where the price of tradables is normalized to unity and p is the relative price of nontradables in terms of tradables in the transition country and γ is the weight of tradables in consumer price index in the transition country. Likewise, the price level, P^*, in the industrial country (Germany), is given by $P^* = 1^{\gamma}\left(p^*\right)^{1-\gamma}$, where it is assumed that the share of tradables is the same in both countries. Dividing P by P^*, taking logarithmic derivatives with respect to time and indicating instantaneous percentage changes by a ^ yields

$$\frac{d\log P}{dt} - \frac{d\log P^*}{dt} \equiv \hat{P} - \hat{P}^* = (1-\gamma)(\hat{p} - \hat{p}^*). \qquad (7)$$

Equation (7) is the key expression linking cross-country differences in inflation to real appreciation differentials. If we assume for the sake of simplicity that the industrial country had a constant price of nontradables, then its price level would be constant. The inflation differential between the transition country and Germany would then be equal to $(1-\gamma)\hat{p}$, the product of the share of nontradables in the transition country's price index times the percentage increase in its nontradables price. If the price of nontradables rose by 15 percent during a given year and their share in the price index were 50 percent, then the transition country's real appreciation rate would be 7 ½ percent, and so on.

According to Balassa-Samuelson, appreciation in the relative price of nontradables is driven by technological change in the tradables sector. Let $Y_i = A_i F_i(K_i, L_i)$ be the CRS production function in the tradables and nontradables sectors, i=T,N, and $\mu_{LT} \equiv \frac{wL_T}{Y_T}$ denote labor's income share in the tradables sector (μ_{LN} is defined similarly). Also let $\hat{A}_T \equiv \frac{\dot{A}_T}{A_T} > 0$ denote the rate of growth of TFP in tradables is (a dot over a variable indicates differentiation with respect to time). It can be shown (see Rogoff and Obstfeld, page 212) that the rate of real appreciation in the transition country is given by

$$\hat{P} - \hat{P}^* = (1-\gamma)\left[\frac{\mu_{LN}}{\mu_{LT}}(\hat{A}_T - \hat{A}_T^*) - (\hat{A}_N - \hat{A}_N^*)\right]. \quad (8)$$

Higher productivity growth in tradables in the transition country pushes up the relative price of nontraded goods over time provided that $\mu_{LN} \geq \mu_{LT}$, that is provided that labor is used relatively intensively in the nontraded goods sector. If the production function for nontraded goods is Cobb-Douglas, $Y_N = A_N K_N^{\alpha} L_N^{1-\alpha}$, the factor shares are constant: $\mu_{LN} = 1-\alpha_N$, and $\mu_{KN} = \alpha_N$. In the Cobb-Douglas case, the condition $\mu_{LN} \geq \mu_{LT}$ boils down to the requirement that $\alpha_N < \alpha_T$ which is likely to be satisfied given that in practice traded goods have a larger content of imported capital inputs.

Equation (8) is the key link between TFP growth in tradables and real appreciation. Assume in addition that (1) tradables and nontradables have the same labor intensity ($\mu_{LT} = \mu_{LN}$); and (2) Equal rates of technical progress in the nontradables sector in the transition country and Germany). Then the inflation differential between the transition country and the west will be equal to the share of nontradables in the CPI times the differential in the growth rate of TFP in the tradables sector between the transition country:

$$\hat{P} - \hat{P}^* = (1-\gamma)(\hat{A}_T - \hat{A}_T^*). \quad (9)$$

This is equation (3) in the main text. Presumably the TFP growth differential between the transition countries and Germany was very high in the aftermath of these economies' opening up in the late 1980s and early 1990s as these countries adopted readily available western technology and management. The TFP differential would presumably taper off gradually as these "technological arbitrage" opportunities available to the transition countries are exhausted. Further growth in TFP in the transition countries would then come from local or western research and development efforts.

B. Neoclassical Model of Investment Subject to Adjustment Costs

Adjustment costs in the installation of new capital are an important friction that can partly account for the difference between the large flows predicted by the benchmark model and those observed in reality. This section uses a simple model of investment in the presence of adjustment costs in the spirit of Lucas (1967) to provide a quantitative illustration of how capital inflows in the transition economies might slow down relative to the benchmark frictionless model.

Consumers

Consider a small open economy inhabited by a large number of identical, infinitely lived households, each maximizing $U = \sum_{t=0}^{\infty} \beta^t u(c_t)$, where $0<\beta<1$ is the subjective time discount

factor and the period utility function belongs to the CRRA family $u(c) = (c^{\rho} - 1)/\rho$. The intertemporal elasticity of substitution is $\sigma=1/(1-\rho)$. The representative household owns a unit of labor each period which he supplies inelastically to domestic firms. The representative household's assets at the beginning of period $t=0$ are denoted a_0. They consist of the initial domestic stock of physical capital, $k_0>0$, and initial foreign assets l_0 (which may be positive, zero, or negative). The market price of a unit of installed capital at date t is denoted q_t. We consider two regimes of intertemporal trade. Under *portfolio autarky*, domestic residents do not have access to the international capital market. In this case, domestic households' assets consist exclusively of claims on domestic firms, k_{t+1}. Under *perfect financial capital mobility*, on the other hand, the economy is open to asset trades with foreign residents. Domestic households' portfolios then consist of claims on domestic capital, k_{t+1}, and bonds purchased (or issued) in the international capital market, l_{t+1}, where

$$a_{t+1} = q_t k_{t+1} + l_{t+1}. \tag{10}$$

These internationally traded bond are one-period, risk-free securities issued at t and maturing at $t+1$. They are denominated in terms of the aggregative consumption good and bear the world rate of interest (r_t^*), which residents of our small open economy treat parametrically. In the absence of uncertainty and country risk premia, claims to domestic capital and international bonds are perfect substitutes in domestic residents' portfolios. The budget constraint of the household is

$$c_t + a_{t+1} \le w_t + (1 + r_t^*)a_t, \tag{11}$$

$t=0,1,\ldots$ .The first order conditions for the problem yield the standard Euler equation

$$1 + r_{t+1}^* = \frac{u'(c_t)}{\beta u'(c_{t+1})} \tag{12}$$

At a consumer optimum, the marginal rate of substitution between present and future consumption must equal the real interest the consumer faces in the world capital market. The shape of the time path of consumption depends on the relative sizes of the subjective rate of time preference and the real interest rate. If $\beta(1 + r_{t+1}^*) = 1$, consumption is constant over time; if $\beta(1 + r_{t+1}^*) > 1$ then consumption is rising; otherwise it is falling. In addition, the equilibrium consumption path must satisfy a transversality condition ensuring that its present value equals the present value form of the household's wealth (no Ponzi games are possible).

Firms

There is any number of perfectly competitive domestic firms, each operating a Cobb-Douglas constant returns to scale technology. The representative firm produces output using hired labor and the capital stock it owns. Capital depreciates at rate δ per period. Following Lucas,

the installation of new capital goods is subject to adjustment costs. Denoting *net* real domestic investment by z_t, the representative firm's capital stock evolves according to

$$k_{t+1} \leq \varphi(z_t / k_t)k_t + (1-\delta)k_t, \tag{13}$$

where the adjustment cost function φ satisfies $\varphi' > 0$, $\varphi'' \leq 0$, $\varphi(\delta) = \delta$ *and* $\varphi'(\delta) = 1$. The advantage of this specification relative to, say, a quadratic form is that adjustment costs are independent of the scale of the firm. For the sake of simplicity, we adopt the parameterization used by Fernandez de Cordoba and Kehoe (2000):

$$\varphi(z/k) = \frac{1}{\eta}\left(\delta^{1-\eta}(z/k)^{\eta} - (1-\eta)\delta\right), \tag{14}$$

for $0<\eta \leq 1$. If $\eta=1$, there are no adjustment costs: $\varphi(z/k) = z/k$ and $k_{t+1}=z_t+(1-\delta)k_t$. Assuming the world rate of interest is constant and equal to r^*, the representative firm's problem at date $t=0$ is to select a sequence of labor hires, investment plans and capital per worker that maximize its discounted stream of profits

$$\sum_{t=0}^{\infty}\left(\frac{1}{1+r^*}\right)^t\left[Ak_t^{\alpha}N_t^{1-\alpha} - w_tN_t - z_t\right] \tag{15}$$

subject to (13). Since labor utilization can be adjusted costlessly, firms' labor demand schedules are derived from the first order conditions $w_t = (1-\alpha)Ak_t^{\alpha}$. However, firms' investment plans no longer correspond to the desired capital stock level satisfying $r_{t+1}^* + \delta = \alpha Ak_{t+1}^{\alpha-1}$. The adjustment cost slows down the pace of firms' capital accumulation, as demonstrated by the first order condition for investment. Letting q_t denote the multiplier corresponding to (13), the Lagrangian is

$$\sum_{t=0}^{\infty}\left(\frac{1}{1+r^*}\right)^t\left[Ak_t^{\alpha}N_t^{1-\alpha} - w_tN_t - z_t + q_t\left(\varphi(z_t/k_t)k_t + (1-\delta)k_t - k_{t+1}\right)\right] \tag{16}$$

The FONC with respect to z_t is

$$\varphi'(z_t/k_t) = \frac{1}{q_t}. \tag{17}$$

Investment is positive only if the shadow price of installed capital (q_t) exceeds unity, the market price of new capital goods (For a related analysis of Tobin's q, see Rogoff and Obstfeld, 1996, page 107). With k_t predetermined at t, $\phi'>0$ and $q_t>1$, equation (17) can be inverted to derive firms' investment demand schedules as an increasing function of q_t. For the specific functional form (14), the firm's investment demand schedule reduces to

$$z_t = \delta k_t q_t^{\frac{1}{1-\eta}}. \tag{18}$$

The FONC for k_{t+1} is

$$q_t = \frac{1}{1+r^*}\left[A\alpha k_{t+1}^{\alpha-1} + q_{t+1}\left(1-\delta+\varphi_{t+1}-\varphi'_{t+1}\frac{z_{t+1}}{k_{t+1}}\right)\right] \tag{19}$$

In light of equation (18), equation (19) simplifies to

$$q_t = \frac{1}{1+r^*}\left[A\alpha k_{t+1}^{\alpha-1} + (1-\delta)q_{t+1} + q_{t+1}\varphi_{t+1} - \frac{z_{t+1}}{k_{t+1}}\right]. \tag{20}$$

Along the optimum path of capital accumulation, the shadow price of an extra unit of capital, q_t, is the discounted sum of three components: (1) the marginal product of capital next period; (2) the shadow price of the undepreciated portion of the unit of capital next period; and (3) the capital unit's marginal contribution to lower adjustment costs next period.

Equilibrium

The feasibility constraint for the economy expressed in per worker terms is

$$c_t + z_t + l_{t+1} \le Ak_t^{\alpha} + (1+r_t)l_t. \tag{21}$$

Given the economy's initial capital stock and ownership of foreign assets, denoted $k_0 > 0$ and l_0, a *perfect foresight equilibrium* is a set of sequences for the shadow value of capital and quantities, $\{q_t, k_t, z_t, c_t, l_t\}$, with q, k, z and c positive, that are consistent with utility and profit maximization and clear the goods market. An equilibrium must satisfy (10), (12), (18), (20), and (21) with equality, for t=0,1,.... A *steady state* is an equilibrium with k_t=k_{t+1}=k^* and $z_t = z^* = \delta k^*$. In a steady state, $z^*/k^* = \delta$, $\varphi\left(z^*/k^*\right) = \delta$, $\varphi'\left(z^*/k^*\right) = 1$, and $q^* = 1$. The steady state capital- and output-labor ratios are pinned down by the world interest rate r^*, the marginal productivity condition $r^* + \delta = \alpha \mathrm{A}(k^*)^{\alpha-1}$ and $y^* = \mathrm{A}(k^*)^{\alpha}$. In the calibration we assume that the world interest rate satisfies $1+r^* = \beta$. The representative CEE consumer's rate of per capita consumption is then constant. From the present value budget constraint, we have $c^* = \frac{r^*}{1+r^*}W$, where $W \equiv (1+r^*)a_0 + \sum_{t=0}^{\infty}(1+r^*)^{-t}(1-\alpha)k_t^{1-\alpha}$ is the present value of the consumer's wealth.

Discussion

At the beginning of the transition, the shadow value of installed capital is high, reflecting the initial economy-wide shortages of usable capital goods. The rate of physical capital accumulation is correspondingly high but, unlike in the frictionless model, capital inflows is gradual (Table 3). Over time, the shadow price of capital declines, and the economy approaches the steady state in which the shadow price of capital is unity and investment merely replaces units of capital made obsolete by physical wear and tear.

Investment and consumer demand both drive capital inflows into the early phase of the transition. The opening up of the economy to international capital flows leads to a consumption and investment boom as domestic households and firms take advantage of new opportunities to smooth consumption or augment their plant and equipment. While firms respond to adjustment costs by reducing their rate of investment (compared to a frictionless world), capital inflows are quite high, fueled by buoyant consumer demand. Correctly anticipating higher future incomes, households finance the shortfall between their permanent income and their disposable income through foreign borrowing (intermediated by the banking system). In the absence of liquidity constraints, borrowed funds allow consumers to maintain a constant optimal rate of consumption. The resulting current account deficits are reversed only later as consumer incomes rise and loans are serviced.

A model featuring traded and non-traded goods, limited intersectoral factor mobility, and liquidity constraints can better mimic observed capital inflows. Fernandez de Cordoba and Kehoe have calibrated such a model for the case of Spain, although without allowing for liquidity constraints. Combining their specification with a model of credit constraints, such as the one developed by Barro, Mankiw and Sala-I-Martin, could shed light into the relative importance of consumer and corporate foreign borrowing in driving capital inflows. Elaborating and calibrating such a model for the CEE is a useful direction for future research.

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