THEORETICAL AND EMPIRICAL ANALYSIS
OF THE DEBT-ADJUSTED REAL EXCHANGE RATE
IN SELECTED TRANSITION ECONOMIES
DURING 1994-2001

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Theoretical and empirical analysis of the debt-adjusted real exchange rate in selected transition economies during 1994 - 2001

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Abstract

This paper aims to enrich the debate on the overvaluation/undervaluation of the Czech koruna and the currencies of other selected transition economies by applying the concept of the debt-adjusted real exchange rate (DARER), thereby offering monetary policy makers another indicator for more responsive management of this important economic variable. The motivation for constructing DARER is the fact that many transition economies finance their long-term current account deficits with capital flows, which often leads to real overvaluation of their currencies. DARER can signal to the authorities that the real exchange rate is becoming unsustainable in the medium term and that if this signal is ignored, a currency crisis may ensue. The paper is in seven parts. The first three parts contain the theoretical underpinning of the concept. Part four defines newly proposed indicators of exchange rate overvaluation. Part five contains empirical DARER results for the Czech Republic. Part six and annex 1 to this work contain empirical DARER results for selected transition countries, including a brief description of those countries' exchange rate histories. The final part examines the possibilities and limitations of the DARER concept in practice. The primary aim of this part, however, is to explain the information content of the real exchange rate as a very good warning signal of potential currency crisis.

Keywords:

Real exchange rate, under/overvaluation, transition

JEL Classification:

E50, F31, E47

Outline

1. EXCHANGE RATE DISEQUILIBRIUM AND CURRENCY CRISES

In 1997–1998, a broad group of new and emerging economies were exposed to speculative attacks on their fixed exchange rate parities. Some of these attacks developed into full-blown currency and banking crises. With the benefit of hindsight we can say that one of the main causes of these developments was the maintaining of overvalued currencies, leading to current account deficits and rising external debt.

1.1 The Risks of an Overvalued Currency

The risk of a speculative attack is not the only danger stemming from overvaluation of the currency. Overvaluation also has adverse effects on the long-term growth of the economy. There is a general belief that an overvalued currency leads to lower growth, but that an undervalued currency has an equivocal effect. The validity of this belief has been investigated by Razin and Collins (1997), for example. There exist two basic channels through which a misalignment (overvaluation or undervaluation) might influence growth. First, it could influence domestic and foreign investment, thereby influencing the capital accumulation process. Second, it could affect the competitiveness of the tradables sector, thereby affecting net exports, which are a significant component of growth. Another potential channel is misalignment volatility. Razin and Collins base their analysis on a simple model consisting of linear approximations of behavioural equations containing fundamental and shock variables. The model distinguishes between a real exchange rate that is affected by short-run rigidities and an equilibrium real exchange rate that would obtain in the absence of such rigidities. The deviation of the former from the latter functions as an indicator of misalignment. The fundamental determinants of the real exchange rate are output per worker; annual money growth in excess of real output growth; the terms of trade; long-term capital inflows as a share of GDP; and the annual resource balance also as a percentage of GDP. The shock variables proxy shocks to output, absorption and money supply.

Estimates were made for 93 countries over the period 1975–1992. The data for these countries were divided into two panels – one with 20 advanced countries, and a total of 322 observations; the other with 73 "developing" economies, and a total of 1190 observations. The first panel is for data in the period leading up to the debt crisis in developing countries, and the other for the crisis and its aftermath. The estimation method corresponds to standard growth regression, except that the real exchange rate is included on the right-hand side of the equation not in the form of volatility, but in the form of misalignment. The right-hand side includes three types of regressor: indicators for initial conditions, indicators of the external environment, and indicators of macroeconomic policy. Table 1 presents the results of the estimations. Apart from the real exchange rate, coefficients are not given for the variables. Regression 1 reveals that the average misalignments are negatively associated with growth. The same applies to the volatility of misalignment. Given that the results are only weakly significant, the possibility of non-linearity in the relationships needs further study.

Table 1: Real exchange rate misalignments and growth

VARIABLE	Regression 1	Regression 2
Average misalignment (%)	-0.0213 (-1.73)	
Undervaluation – absolute value of average misalignment (%)		-0.0143 (-0.65)
Overvaluation – absolute value of average misalignment (%)		-0.0647 (-2.56)
Standard deviation of the yearly misalignments	-0.0309 (-1.34)	-0.0206 (-0.87)
Number of observations	152	152
Dependent variable is growth in GDP per capita; figures in parentheses are t-statistics.		

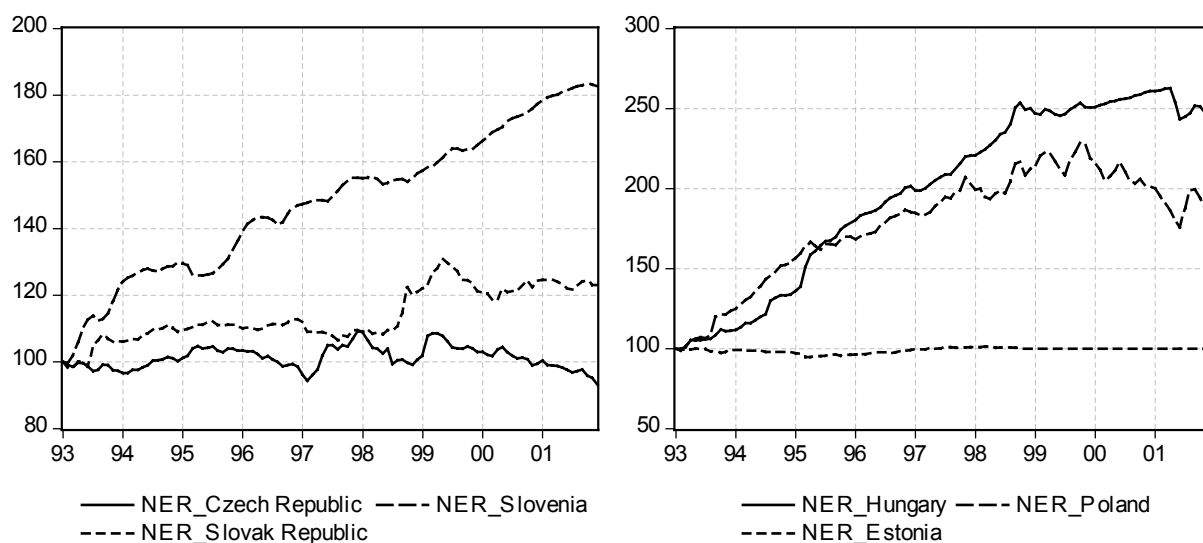*Source: Razin and Collins (1997, p. 27)*

The non-linearity consists in the fact that misalignments can have different growth effects depending on whether they reflect overvaluations or undervaluations. Regression 2 thus deals with the two cases separately. It shows that overvaluation has a negative, statistically significant and economically strong effect on growth. A 10% overvaluation of the real exchange rate is associated with a decline in growth of 1.6%. Interestingly, the estimation does not find a significant relationship between undervaluation and growth. The conclusion of the study is therefore clear – exchange rate policy makers should look out for the possibility of real overvaluation of the currency, as it has strong anti-growth effects.

Much of the subsequent empirical work aimed at identifying the main factors of an economy's vulnerability to currency crisis has concluded that overvaluation of the real exchange rate is indeed the most important indicator (see Goldfajn and Valdés (1997); Kaminski, Lizondo and Reinhart (1997); IMF (1998)). For example, the International Monetary Fund (IMF (1998), pp. 89-94) reports that, for a large sample of earlier crises, a real appreciation of the domestic currency relative to the average for the previous two years signalled the possibility of the outbreak of a crisis a year on average before it actually happened. This signal moreover persisted until the crisis erupted. Around 24 months before a crisis, the real exchange rate was, on average, about 7% higher than its normal level. But around three months before a crisis it began to decline (i.e. depreciate) towards its normal level. In the second year after a crisis, the real exchange rate was, on average, 7% below the average for the normal period.

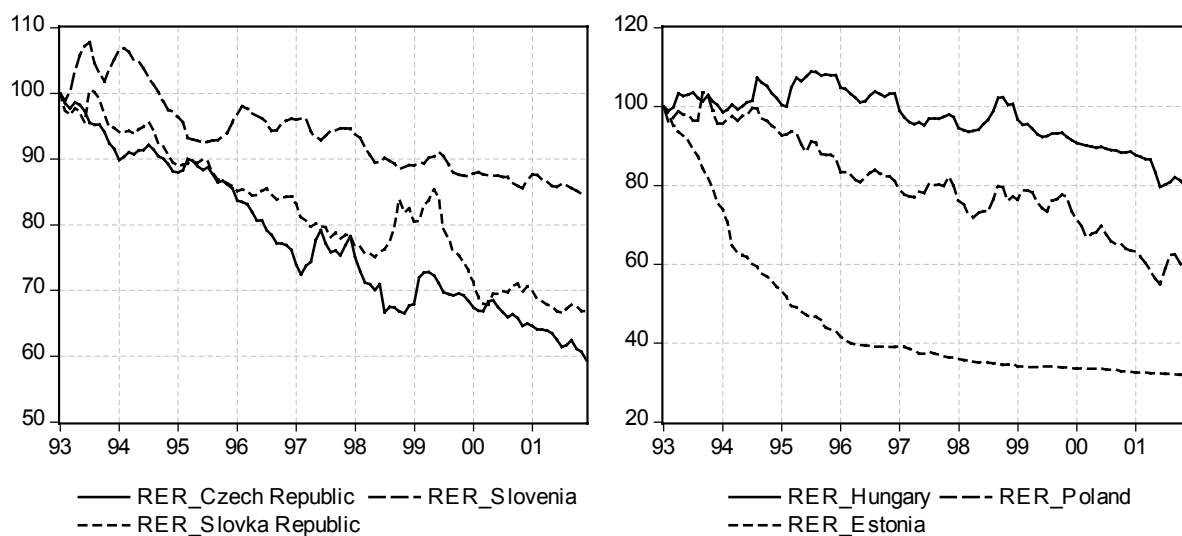## 1.2 Exchange Rate Development in Selected Transition Economies

For an assessment of the exchange rate developments in selected transition economies with the aforementioned theoretical and empirical information, quarterly nominal and real (CPI-based) exchange rate indices against the Deutsche mark and euro are given below.

Figure 1a: Nominal exchange rate in selected transition economies (January 1993= 100)

Legend (left chart): NER_Czech Republic, NER_Slovenia, NER_Slovak Republic

Legend (right chart): NER_Hungary, NER_Poland, NER_Estonia

Source: own calculations based on CNB data and IMF-IFS database

Figure 1b: Real exchange rate in selected transition economies (January 1993 = 100)

Legend (left chart): RER_Czech Republic, RER_Slovenia, RER_Slovka Republic

Legend (right chart): RER_Hungary, RER_Poland, RER_Estonia

Source: own calculations based on CNB data and IMF-IFS database

The above charts show (i) a clearly distinguishable continuous appreciation trend in the koruna's real exchange rate, and (ii) a widening gap between the nominal and real exchange rate.[1]

The reason that the real exchange rate is the most important indicator of a potential speculative attack is that, as a key relative price, it is a variable that summarises several other fundamental factors. Goldfajn and Valdés (1997) note that a medium to large overvaluation is

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[1] Komárek (1998) and Frait and Komárek (1998), for example, give an analysis of the factors underlying the real appreciation of the koruna against the DEM in the period under review and the conditions and assumptions for the sustainability of this trend, e.g. with regard to the Czech Republic's joining of European integration structures (in particular the EU).

rarely eliminated without a step devaluation. Investors are well aware of this and incorporate a the strong correlation between overvaluation and subsequent devaluation into their exchange rate expectations. The problem is, however, that although overvaluation is a systematic indicator of a possible crisis, the markets are entirely unable to anticipate the crisis, and in particular the timing of it. This is why it is very important that the authorities monitor whether their currency is becoming excessively overvalued and try to reduce any such overvaluation in a timely fashion. Countries whose statistics are underdeveloped or which do not have sufficiently long time series (i.e. the majority of the transition countries) have no option but to monitor the degree of overvaluation using very simple indicators. DARER could be one of these.

2. THE ESSENCE OF THE DARER CONCEPT

Borrowing from abroad allows the authorities of such countries to maintain the current (i.e. overvalued) exchange rate level despite mounting pressures on the domestic price level. This feeds through into *high domestic demand* and a subsequent *further widening of the external deficit* and a *worsening of the terms of trade* (i.e. the ratio of the dollar or mark prices obtained for exports to those paid for imports).

Provided the level of external debt does not exceed the maximum bearable limits, the existing exchange rate and the existing inflation rate can be sustained simultaneously. However, in such a situation the *actual domestic price level (P)* is repressed relative to the equilibrium price level at current account equilibrium. We can define precisely this *equilibrium price level (P_E)* as the price level that would occur if the economy were forced to settle its present and predicted future external liabilities. Thus the price level (P) repressed in this way causes the real exchange rate to appear less overvalued than it is in reality.

The aforementioned linkages are depicted in Figure 2, which is split into four quadrants. The first quadrant shows that not only does the real exchange rate path deviate downwards (overvaluation of the currency), but so does the actual nominal exchange rate path (E − for example the CZK/DEM rate) and the nominal exchange rate path corresponding to the profile of the inflation differential [E according to (π - π*)] and to purchasing power parity if R were a constant equal to unity. Our analysis will focus on a real exchange rate with appreciation tendencies as shown in the first quadrant of Figure 2. The distance between points C and B denotes overvaluation due to external debt[2] and the distance between C and A represents the total overvaluation relative to the fundamental equilibrium exchange rate (eq. R), which does not take into account external debt. And finally the distance between A and B illustrates the overvaluation excluding considerations of external debt.

The second quadrant in Figure 2 illustrates the equilibrium domestic price level (P_E), the foreign price level (P*) and the actual domestic price level (P). The third quadrant shows the equilibrium (π - π*)$_E$ and actual (π - π*) inflation differential tendencies. And the fourth quadrant shows debt service (DS) and the current account (CA) trend. In this last quadrant, it is possible to depict a variant in which the current account trend takes into account foreign direct investment (FDI). This is the variant we shall work with from now on, both theoretically and

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[2] See the index of debt "overvaluation (undervaluation) of the currency" (I_{DARER}) which we propose below.

empirically. It is represented by the (CA+FDI) curve, which lies above the CA curve, as it adds FDI to the current account deficit (surplus). The inclusion of FDI would reduce the absolute slope of individual curves in the other quadrants (and narrow the gaps between the curves depicting equilibrium and actual variables), i.e. the DARER curve and the curves denoted by the symbols [E according to $(\pi - \pi^*)$], [$(\pi - \pi^*)_E$] and [P_E].

Figure 2: Deviations of exchange rate paths from equilibrium in indebted countries
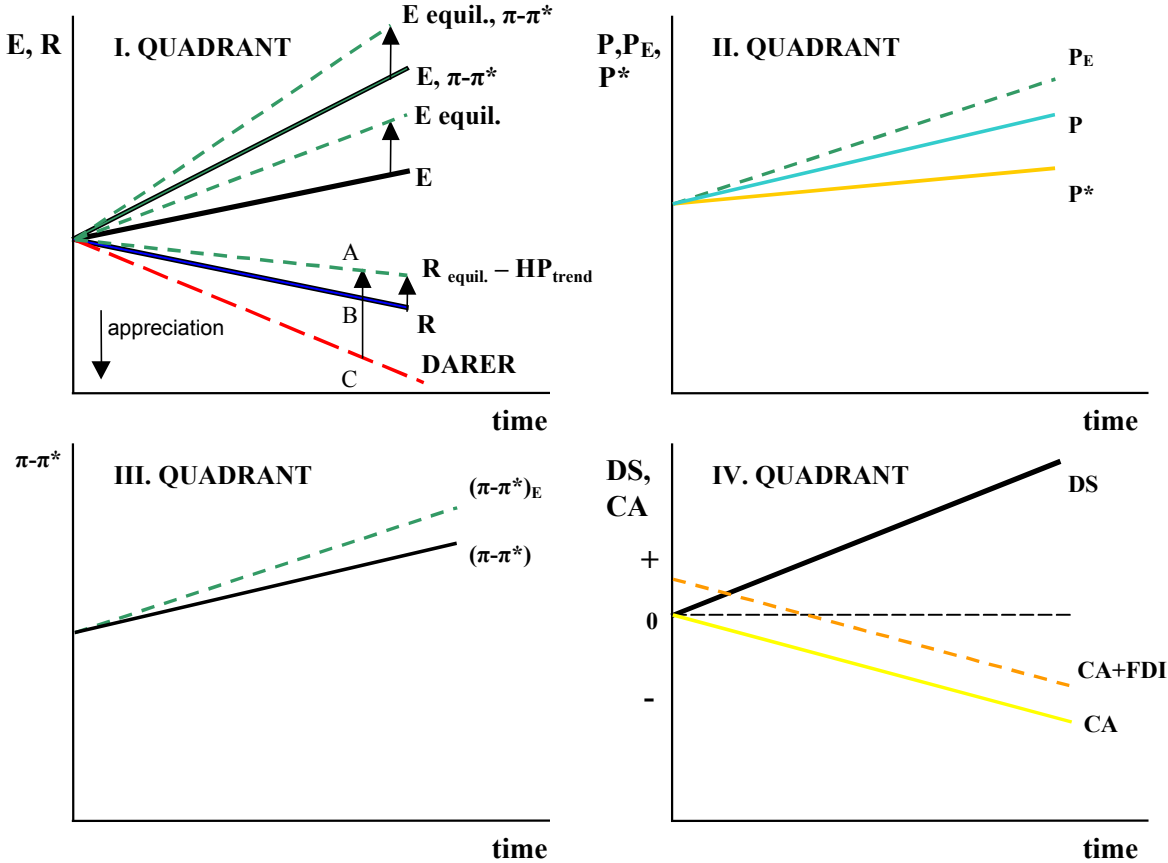
To sum up, if we want to realistically estimate the equilibrium real exchange rate and address in more depth the question of overvaluation or undervaluation of the Czech currency, we ought to take external debt, and also foreign direct investment, into account (see Frait and Komárek (1999c)). The DARER concept assumes that borrowing from abroad allows the current (i.e. overvalued) exchange rate level to be sustained via repression of the domestic price level. Provided that the level of foreign debt does not run into any budgetary constraints, the actual domestic price level (P) may be maintained below its equilibrium level (i.e. that at current account equilibrium – P_E). If the nation uses external debt to deal with its growing deficit, the DARER path falls below the path of the actual real exchange rate. The real appreciation is thus faster than would be suggested by the path of the normally calculated real exchange rate (R), where the nominal rate is deflated by foreign and domestic price indices (usually the PPI or CPI).

The advantage of DARER is that it explicitly takes into account the external debt of the economy. The Czech Republic is an example of an economy that is strongly dependent on foreign capital and which has accumulated a sizeable external debt. As the examples of several Latin American nations have shown, build-up of external debt can mask for some considerable time the need to adjust the economy with respect to prices (and the exchange rate in particular). DARER helps us to realise this fact. If we make pragmatic use of its information content it can serve as a warning signal for exchange rate policy. By "pragmatic use" we mean that DARER should be used not in isolation, but as part of a group of indicators targeted at identifying whether the currency is overvalued or undervalued.

We consider it appropriate to marry this concept with the concept of the fundamental equilibrium exchange rate, which is medium-term in nature and which does not take the external debt factor into account. Coupled with DARER, this would give us a better idea of the overvaluation or undervaluation of the currency. As a whole, such an approach could provide an alternative to the *FEER* (Fundamental Equilibrium Exchange Rate).[3] If DARER indicates rising overvaluation, the relatively strong currency is being maintained largely at the expense of growing external debt. For monetary policy this means that it is necessary to consider altering the parameters of that policy so as to reduce the motivation for the growth in debt (specifically by changing interest rate policy or capital mobility). It is then necessary to assess whether the relatively strong currency was really due solely to foreign capital inflow increasing the debt, or whether there were other fundamental causes. If capital inflow was really the cause, it does not make sense to prevent depreciation of the currency. On the contrary, depreciation should be encouraged.

3. CONSTRUCTION OF THE MODEL

The difference between the "standard" real exchange rate (R) and the DARER concept is apparent when we compare equations 1 and 2, where (E) expresses the nominal exchange rate, (P*) the foreign price level, (P) the domestic price level and (P_E) the domestic equilibrium price level.

$$R = E.P*/P \qquad\qquad (1)$$

$$DARER = E.P*/P_E \qquad\qquad (2)$$

Estimating DARER thus involves two steps: (i) estimating the equilibrium price level (P_E), which is then used for (ii) estimating the path of the debt-adjusted real exchange rate (DARER). We start by defining the current account deficit as the difference between aggregate supply and aggregate demand at the current price level in the domestic economy:

$$CA = S(P) - D(P) < 0 \qquad\qquad (3)$$

where *CA* is the current account, *S* is aggregate supply, *D* is aggregate demand and *P* is the theoretical product of the nominal exchange rate and the foreign price level [*E.P**]. However, the build-up of the current account deficit generates present and future external liabilities which

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[3] This term was coined by John Williamson in 1983. The FEER concept later entered into general use, where the equilibrium real exchange rate is calculated as the exchange rate consistent with medium-run simultaneous internal and external balance of the economy.

must later be repaid, i.e. excess aggregate supply will have to be created at the equilibrium price level. This is formally described by the following equation:

$$DS = S(P_E) - D(P_E) > 0 \qquad (4)$$

where DS is debt service and P_E is the price level that takes into account present and future debt service. By combining the two equations above we obtain a basic instrument for deriving the price repression (price pressures) implied by the growth in external debt ensuing from the current account deficit:

$$DS - CA = [S(PE) - S(P)] - [D(PE) - D(P)] > 0 \qquad (5)$$

The point of this analysis is to obtain an approximation of the price repression caused by the borrowing resulting from the current account deficit. For this purpose, we can modify supply and demand as follows:

$$S(P_E) = S(P) + S_P(P)(P_E - P) \qquad (5a)$$

$$D(P_E) = D(P) + D_P(P)(P_E - P), \qquad (5b)$$

where $[S_P(P) = dS/dP]$ and $[D_P(P) = dD/dP]$. We can now substitute both expressions into equation 5 and obtain:

$$DS - CA = (P_E - P) [S_P(P) - D_P(P)] \qquad (5c)$$

which rearranges to give:

$$(P_E - P) = (DS - CA)/[S_P(P) - D_P(P)] \qquad (5d)$$

This equation tells us that price repression always occurs when $[(P_E - P) > 0]$. We can make the following modifications:

$$S_P(P) = \varepsilon_s(S(P)/P) \qquad (5e)$$

$$D_P(P) = \varepsilon_D(D(P)/P), \qquad (5f)$$

where $[\varepsilon_s = S_P(P)/(P/S(P))]$ and $[\varepsilon_D = -D_P(P)/(P/D(P))]$, which are the elasticities of aggregate supply and demand respectively. Substituting these expressions into equation 5d we obtain:

$$(P_E - P) = \{[DS - CA)/S(P)]/(\varepsilon_s + \beta \, \varepsilon_d)\}P, \qquad (5g)$$

where $\beta = [1 + (DS - CA)/S(P)]$. By isolating P_E we obtain an equation for approximating the equilibrium price level:

$$P_E = P + \{[DS - CA)/S(P)]/(\varepsilon_s + \beta \, \varepsilon_d)\}.P, \qquad (6)$$

where ε_s and ε_d are the elasticities of aggregate supply and demand and $\beta = [1 + (DS - CA)/S(P)]$. The difference between P_E and P describes the extent of adjustment of prices (exchange ratios) needed if the country is to meet its present and future liabilities.

4. INDICATORS OF EXCHANGE RATE OVERVALUATION

Given below are three indicators of overvaluation of the currency that proceed from the DARER concept. The first indicator *(the debt overvaluation index)* identifies the currency overvaluation due to the very existence of the debt. The second indicator *(the trend overvaluation index)* applies the concept of the Hodrick-Prescott filter, which is used to determine the "trend overvaluation". The third indicator *(the total overvaluation index)* combines the two concepts to express, from a "broader" perspective, information on the overvaluation/undervaluation of the exchange rate. A detailed description of each indicator, together with its formal notation, is given below.

Debt overvaluation of the exchange rate

The overvaluation attributable to the debt is expressed in concrete form by the debt overvaluation index (I_{DO}). The proposed formalised notation for the calculation of this index can be stated in the following form:

$$I_{DO} = \{100/[100 + (DARER\text{-}R)]\text{-}1\}.100 \qquad (7)$$

The debt overvaluation index should say: *"By what percentage the real exchange rate is overvalued owing to the build-up of external debt"*. This overvaluation is expressed in per cent and captures only the part of the short-run to medium-run overvaluation made possible by deferring a current account reversal.

Trend overvaluation of the exchange rate

Trend overvaluation is a rather "imperfect" substitute for overvaluation comparing the current real exchange rate and the fundamental equilibrium exchange rate. The reason for this substitution is the continuing lack of a clear idea of the fundamental equilibrium exchange rate among economists modelling this variable in transition countries.[4] To calculate the trend overvaluation I propose, together with Frait (1999a), to use the Hodrick-Prescott filter.

In the case under review, the value of the parameter $\lambda = 1600$ recommended for quarterly data was used. Based on knowledge of the HP filter, a trend overvaluation index is defined below. The overvaluation relative to the real exchange rate trend is expressed in concrete form by the trend overvaluation index (I_{TrO}). The proposed formalised notation for the calculation of this index can be stated in the following form:

$$I_{TrO} = \{100/[100 + (HP_{TREND\_R} - R)]\text{-}1\}.100 \qquad (8)$$

The debt overvaluation index should say: *"By what percentage the real exchange rate is overvalued relative to its trend"*. This overvaluation is also expressed in per cent.

Total overvaluation of the exchange rate

The debt overvaluation only gives us an idea of the potential overvaluation of the currency due to the build-up of external debt, not of the total overvaluation. As noted above, for the latter we need to have an idea of the long-run fundamental equilibrium real exchange rate, which

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[4] Estimates of the fundamental equilibrium exchange rate can be found in the work of Šmídková (1998), Lazarová and Kreidl (1997) and, most recently, Frait and Komárek (1999b).

abstracts from the current account position. Owing to the shortness of the time series and other problems we do not have such an idea, so to obtain the equilibrium rate we have to use the aforementioned simple econometric method: the Hodrick-Prescott filter.[5] This method has its fundamental limitations, so we should emphasise that the calculated estimates must be interpreted as rough orientation indicators, which need to be reconciled with the other indicators of the external position of the economy.

The total overvaluation of the real exchange rate is expressed in concrete form by the total overvaluation index (I_{TO}). The proposed formalised notation for the calculation of this index can be stated in the following form:

$$I_{TO} = \{100 /[100+(DARER - HP_{TREND\_R})]- 1\} \cdot 100 \qquad (9)$$

The total overvaluation index should say: *"By what percentage the real exchange rate trend is overvalued due to the build-up of external debt"*. This overvaluation is also expressed in per cent.

Alternatively, we can also obtain the value of the total overvaluation by summing the debt overvaluation and the trend overvaluation (the deviations of the actual real exchange rate from the trend). This trend is calculated with a smoothing coefficient λ that ensures near-linearity.

5. DARER ESTIMATES FOR THE CZECH REPUBLIC

DARER has been applied empirically chiefly to newly industrialised nations. Estimations of DARER have been made, for example, for the Philippines and Thailand during the period 1980–1992 (Fabella, 1996).[6] An important aspect of applying DARER is how to interpret its estimated values. Originally DARER was devised on its own, without other indicators of currency overvaluation. Here, DARER must be interpreted solely as an indicator of the degree of currency overvaluation stemming from external debt accumulation. Consequently, I propose, together with Frait (1999c), to use it as a medium-run concept (i.e. for medium-run elasticities) for identifying currency overvaluation.

For empirical application to the Czech economy, 1994 was chosen as the base year for the calculation. In 1994 the current account was balanced, or switched from surplus to deficit, and the Czech Republic was more or less in a state of macroeconomic balance (neither overheated or undercooled in the macroeconomic sense). The simulation was performed for quarterly data (real data between 1994 Q1 and 2001 Q1, predictions obtained from CNB submodels, and the author's predictions up until the end of 2002). The German CPI was chosen as P* and the Czech CPI as P. Aggregate supply S(P) is proxied with gross domestic product, and aggregate demand is proxied with domestic absorption. As for exchange rates, only the bilateral nominal and real CZK/DEM (CZK/EUR) rates were used, as calculation of the effective exchange rate was surplus to the requirements of this work. The difference (DS-CA) can be approximated in

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[5] Calculation of overvaluation using the deviation of the real exchange rate from trend is routinely applied in the current empirical literature (see, for example, Milesi-Ferreti and Razin (1998); Kaminski, Lizondo and Reinhart (1997); and IMF (1998)).

[6] Both conceptions were elaborated both on the bilateral exchange rate principle and for the effective exchange rate, i.e. taking into account the allocation, within the real exchange rate, of weights to the major trading partners of each country.

two ways. The first boundary approximation (pessimistic) is the entire current account deficit. This case assumes that rapid attainment of a balanced current account would be desirable. The second boundary approximation (optimistic) is the current account deficit minus net inflow of foreign direct investment. This case assumes that an improvement in the current account is desirable only to the extent that the deficit is not financed by foreign direct investment.

To solve the elasticities problem, two options present themselves de facto. The first is to try to estimate specific Czech elasticities from the structural macromodel. Given the problems in the data area, however, this is practically impossible for the time being. Hence typical elasticities for a small open economy as given by Medalla (Medalla, 1986) were chosen. One should also understand that DARER, like any other real exchange rate, is an abstract concept based on specific assumptions. The elasticities chosen reflect the well-known theoretical fact – supported by a wealth of empirical work – that elasticities increase with increasing time horizon. If we assume that it is currently desirable to eliminate the deficit fairly quickly (and with a predominantly non-income effect), it is appropriate to use DARER as a short- to medium-run concept. For these reasons, we opted for compromise elasticity levels ($\varepsilon_s = 0.2$ and $\varepsilon_d = 0.4$).[7]

The results of the DARER estimations (including and excluding the FDI effect) are given in Figure 3. All this estimations were prepared from official quarterly data (1994-2000, i.e. 28 observations) and CNB internal prediction of GDP, CA, FDI, CPI (in the Czech Republic and Germany) for 2001. The appendix 1 includes the current estimations for the Czech Republic, which were calculated from official quarterly data (1994-2001, i.e. 32 observations) as the same as for other candidate countries.

Figure 3: Real and nominal exchange rate indices, DARER for the CPI, and cumulative CA balances and CA+FDI balance
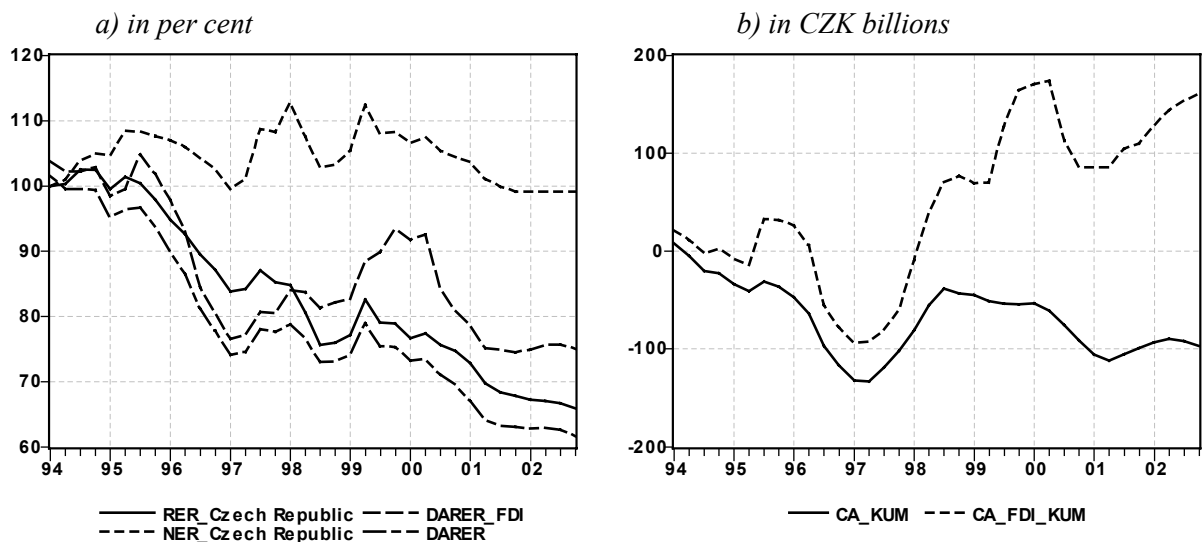
Source: own calculations based on CNB data.

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[7] The same elasticities ($\varepsilon_s = 0.2$ and $\varepsilon_d = 0.4$) were chosen in the work of Frait and Komárek (1999c). Fabella (1996) recommends separating the elasticities into short-run ($\varepsilon_s = 0.1$ and $\varepsilon_d = 0.4$) and medium-run ($\varepsilon_s = 0.3$ and $\varepsilon_d = 0.5$).

It follows from the logic of the model that the largest deviation of DARER from the real exchange rate occurred in 1996, when the current account deficit peaked. One of the problematic aspects of the model is also visible, namely its inability to differentiate between a narrowing of the deficit due to the income effect and a narrowing of the deficit due to the substitution effect.[8] In 1998, DARER rapid converged towards the real exchange rate, even though the narrowing of the deficit occurred amid a recession in the economy, which is not sustainable in the long term. The results for the calculations using the CPI are very similar to those for the PPI, although owing to the faster growth in consumer prices the speed of the appreciation is faster and the potential overvaluation greater in the CPI variant.

The fact that the koruna started to be overvalued in 1995 is illustrated in Figure 4. Here we can compare the total, debt and trend overvaluations. All indicators show broadly similar dynamics, except in the period between 1996 Q2 and 1997 Q3, which saw a large current account deficit and, simultaneously, swings in the real exchange rate. In many cases, the latter figures are expected outturns. Consequently, it is difficult to draw exact conclusions regarding the present overvaluation, undervaluation or equilibrium of the real exchange rate of the Czech currency. Nevertheless, I believe – and the recent exchange rate trend and the current account figures bear this out – that the koruna found its equilibrium level during 1999 (after a nominal depreciation in 1999 Q1). The final three quarters of 2000, however, suggest that the real exchange rate of the Czech currency is becoming modestly undervalued (according to the variant taking FDI into account the Czech currency is around 10% undervalued in real terms, but according to the FDI-excluding variant the koruna appears to be at equilibrium). This sizeable gap is due to the difference between the cumulative CA balance and the cumulative CA+FDI balance, as shown in Figure 4.

The right-hand part of Figure 3 shows us the cumulative CA balance and the balance adjusted for net FDI inflow. Looking at the two indicators, it is clear that FDI can be one of the main determinants of the actual overvaluation of the currency. In the Czech economy, the FDI trend was broadly stable until the first half of 1998 (the FDI level is illustrated by the distance between the CA curve and the CA+FDI curve). The only exceptions occurred at the start of the period under review, when FDI was relatively low, and in 1995 Q3, when it reached a local high of over CZK 44 billion. In the second half of 1998, however, two contrary tendencies emerged, causing the two indicators to diverge. The first was a massive inflow of FDI, which pushed the cumulative CA+FDI indicator to very high values. The second, opposing, tendency was a deterioration on the current account, which in 2000 Q4 reached a rather worrying CZK -43.4 billion, or an annually accumulated CZK 91.4 billion.[9]

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[8] However, the missing income effect in DARER in a way emphasises that the adjustment probably involves the substitution effect (expenditure switching) rather than a fall in domestic demand (expenditure reducing). This topic is addressed by Mandel (1998), for example.

[9] CA and CA+FDI profiles for selected transition countries (Hungary, Poland, Estonia and Slovakia) are given in Annex 2.

Figure 4: Total, debt and trend overvaluations for the CPI (percentages)

a) excluding FDI	b) including FDI
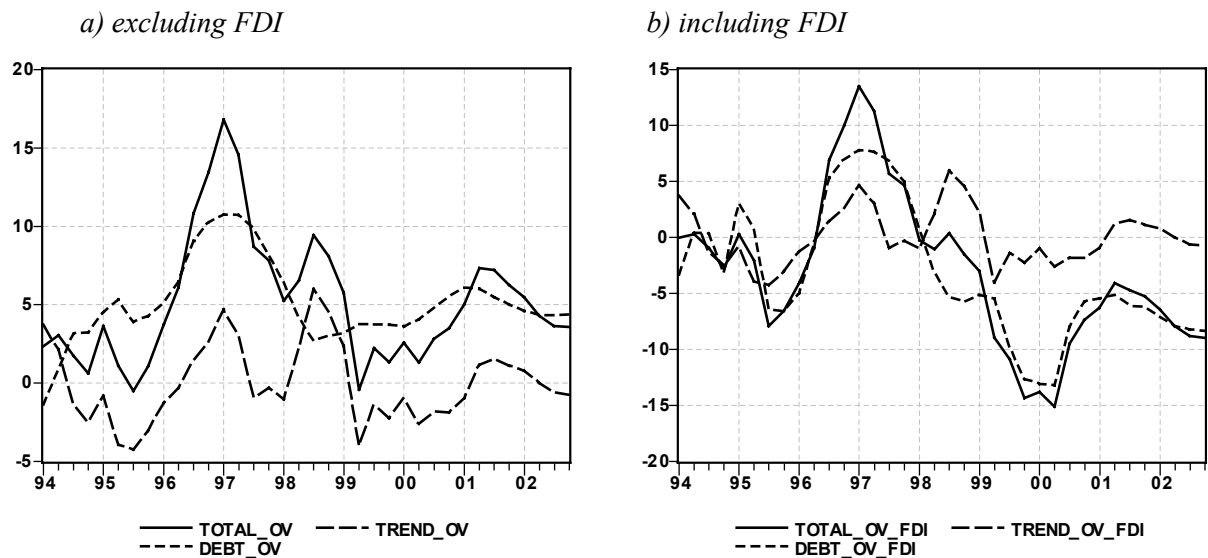
Source: own calculations based on CNB data

When applying the DARER method empirically to the Czech economy, it is also possible to take into account the forecast FDI profile in the estimate. In this variant, DARER can be adjusted for the current account (CA) and for the FDI effect. This gives us more estimates for the monitored variables, allowing us to further refine the assertion that the koruna is overvalued (undervalued). The logical effect of including FDI is a narrowing of the gap between DARER and the real exchange rate, which in turn reduces the debt overvaluation of the exchange rate. Here, the overvaluation of the koruna starts in mid-1996, and following the currency crisis the real exchange rate returns essentially to its long-run trend level. This variant shows clearly that from 1998 Q1 onwards the Czech currency appears undervalued in real terms. The degree of real undervaluation subsequently increases, reaching almost 15% in 1999 Q4 and remaining at this level for nine months. The latest figures for 2000 Q3 then show a rapid return to equilibrium values.

6. THE EXCHANGE RATE AREA AND EMPIRICAL DARER RESULTS FOR SELECTED TRANSITION ECONOMIES

The DARER concept and the indicators of exchange rate overvaluation proposed above were also applied to the time series of selected transition countries classed (alongside the Czech Republic) as "first wave" EU candidate countries by the European Commission. The results and success of real convergence for Slovakia, Estonia, Hungary and Poland are given in Annex 1 and the results of the DARER estimations are given in Annex 2. The calculation method and notation of variables are the same as those presented above for the Czech Republic.

This part contains a summary of the main features of the exchange rate area in these economies together with a basic analysis of the results obtained by applying the DARER method. From the global perspective, these suggest that the currencies of the transition economies were significantly overvalued in the "problem" period between the end of 1996 and

the end of 1997. Furthermore, the DARER results indicate overall that the currencies of Estonia, Slovakia and Hungary were at equilibrium in real terms at the end of Q3. The remaining two currencies (Czech and Polish) were meanwhile tending towards real exchange rate equilibrium – the Czech koruna from below (i.e. from a moderately undervalued real level) and the Polish zloty from above (i.e. from a moderately overvalued real level). However, these brief and general conclusions ought not to lull interested parties into a false sense of security, but should motivate them to examine the other microeconomic and macroeconomic relationships associated with these phenomena.

6.1 Slovakia

Brief description of the exchange rate area

Since the break-up of the Czech and Slovak Federal Republic (CSFR), the developments in Slovakia have in many respects been similar to those in the Czech Republic. Slovakia at first applied a fixed exchange rate system with a fluctuation band, and later also a currency basket structure. The currency basket of the Slovak koruna (SKK) comprised 60% DEM and 40% USD.[10] From the global perspective, the official SKK exchange rate depended chiefly on the DEM and USD cross rates on world markets and on the supply of and demand for foreign exchange. On 1 October 1998, however, the National Bank of Slovakia abolished both the fluctuation band and the currency basket and switched to a managed floating exchange rate system, which is still in force.

DARER results

From the start of 1994, the SKK was – according to the overvaluation indicators[11] – undervalued in real terms. But between 1996 Q1 and Q2 of last year, the SKK was an overvalued currency. The overvaluation peaked at around 20% in 1997 Q3. At the end of 2000, the probability of a moderate real undervaluation of the Slovak currency is starting to increase. The Czech koruna has shown similar real overvaluation (undervaluation) dynamics to the Slovak currency. This is not surprising, given the close links between these economies and their common past.[12]

6.2 Estonia

Brief description of the exchange rate area

After splitting from the Soviet Union, Estonia in June 1992 introduced a currency board. The primary reason for this was the need to stabilise the economy, and in particular to reduce inflation, which was running in excess of 100 per cent a year. A new currency – the Estonian kroon (EKK) – was established, fully replacing the Russian rouble. The kroon was pegged to

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[10] The absolute formulation for the SKK currency basket is: 1 IDX = 0.012817 USD + 0.029663 DEM, which corresponds to a 40% weight for the USD and a 60% weight for the DEM.
[11] Emphasis is placed in the total overvaluation indicator. The variants excluding and including FDI are taken as indicators of the imaginary overvaluation interval (result of variant including FDI = "minimum" overvaluation; result of variant excluding FDI = "maximum" overvaluation).
[12] Since the break-up of the CSFR, however, the degree of similarity between the two economies has been decreasing towards the level usually seen between two sovereign states.

the Deutsche mark at a ratio of eight EKK to one DEM. The currency board was intended chiefly to provide credibility for the stabilisation programmes in Estonia, a country with no central banking history and hence no central bank reputation.

In addition to lowering the costs of disinflation (by providing credibility for restrictive monetary policy and thereby creating expectations of low inflation), this exchange rate arrangement was intended to impose tough and credible budget constraints on banks and state finances. Central bank lending to the government, banks and state-owned enterprises was forbidden by law. So in Estonia's case, the currency board was intended not only to keep inflation in check (the usual reason for introducing it), but also to speed up and intensify the restructuring process.

Overall it can be said that the currency board in Estonia served its purpose. Inflation was reduced rapidly and the banking system and industry were both restructured, leading to high rates of GDP growth in 1995–1998. These benefits, however, entailed costs in the 1992–1994 period. I could be argued that the fall in GDP in 1992 and 1993 occurred because the currency board failed to engender low inflation expectations, meaning that there was no significant fall in the costs of disinflation stemming from the very tight monetary policy of the currency board. Given the EKK's nominal exchange rate profile during those years and the inflow of foreign capital, I do not believe that this was the case. The fall in GDP can instead be attributed to the structural changes in the economy and to curative restructuring, and is thus the result of the success, rather than failure, of the currency board in Estonia.

The disadvantage of this exchange rate regime (and of fixed rates and passive economic policy rules generally) was witnessed in 1998, when the Estonian central bank was unable to respond to the negative external shocks and thus contributed to the fall in GDP growth.

As for the future, Estonia is – according to available sources[13] – resolved to maintain the currency board at its present value. The benefits of the currency board may therefore continue. On the other hand, Estonia will have to face up to new risks. Its rapid economic growth may lead to rising domestic demand and a further widening of its current account deficit. Further real appreciation of the Estonian currency may reinforce such a trend. As the current account is only partially financed by foreign direct investment, Estonia may experience pressures in the future to abandon its present exchange rate regime.

DARER results

The Estonian kroon can be regarded as having been overvalued in real terms from the second half of 1994 to the present. This overvaluation peaked at around 15% in 1997 Q1, which is again similar to the tendencies in the other transition economies reviewed. From the end of 1999 till now, the Estonian currency appears to be near its real equilibrium.

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[13] See the website of the Estonian central bank: http://www.www.ee/epbe/.

6.3 Hungary

Brief description of the exchange rate area

After a relatively small initial devaluation in 1989 (of 5%, 6% and 10% successively), Hungarian monetary policy tried over the subsequent five years (1990–1994) to pursue two largely conflicting long-run objectives – disinflation and support for the current account – via two medium-run targets (the real exchange rate and domestic lending). In this period, the Hungarian forint (HUF) was pegged to a ECU/USD basket with a ±2.25% band and underwent several erratic and unforeseen devaluations aimed at preventing real appreciation.

A long-term public finance deficit (of up to 9.6% of GDP, or a primary deficit of 3.7% in 1994) and rapid wage growth, especially in 1993–1994, led to unsustainable growth in domestic demand (the inflation rate stayed within the 20%–30% range). In combination with discretionary exchange rate policy, which brought additional costs for foreign trade, the imbalance led to a widening trade deficit and overall current account deficit (7.0% of GDP in 1994). The confidence of foreign investors also gradually ebbed, as evidenced by a fall in foreign direct investment. The heightened risk on the financial markets was expressed by a relatively steeply sloped government bond yield curve (while securities with maturities longer than one year were illiquid). From around 1994 onwards there was talk of a "twin deficit problem". Solving this problem became a priority for the central bank, too, as it was a potential source of a future inflation spiral. The crisis culminated in a massive devaluation of the forint (of 8% in August 1994, followed by a series of smaller devaluations ending with a 9% fall in March 1995). In March 1995 a stabilisation programme was drawn up in collaboration with the government. This included the introduction of a crawling band.

This crawling peg system is still in effect. The forint is pegged to a ECU-USD basket with a band of ±2.25%. The initial monthly devaluation of 1.9% has been steadily reduced, reaching 0.78% in 1998.

The long-run monetary policy objective in Hungary is disinflation, and medium-run target is the nominal exchange rate. The rate of devaluation is adjusted so that it is always lower than the inflation differential vis-à-vis Hungary's major trading partners. The instruments of monetary policy are open market operations (chiefly repos and reverse repos); the pace of devaluation; remunerated minimum reserves as an automatic steriliser of capital inflow; and, from 1997, sterilising 6-month and 1-year non-callable deposit facilities. Hungary's long-run objective is to reduce inflation and raise the credibility of its financial markets. Like the Polish central bank, the National Bank of Hungary wants to achieve this objective using a crawling band. Unlike in Poland, though, Hungary has made no discretionary interventions in exchange rate policy. This has increased the credibility of the peg, leading to faster disinflation than in Poland. The credible crawling band has helped to stabilise the economy, fostering economic growth and a gradual improvement of the current account.

The Hungarian forint and the degree to which it has been overvalued differs somewhat from the other selected transition economies. The results of the overvaluation indicators suggest a significant, i.e. almost 50%, overvaluation at the start of the period under review. This has gradually declined, converging surprisingly well to the present real level, which can be said to be the Hungarian currency's equilibrium level according to all the monitored criteria. Despite this seemingly different trend, in the "crisis" period centred around the start of 1997 the Hungarian forint displayed a similar local rise in overvaluation to that observed in the Czech Republic, Slovakia and Estonia, and de facto in Poland too. At the end of 2001 the Hungarian forint was overvalued between 7,5% – 15%.

6.4 Poland

Brief description of the exchange rate area

Poland carried out an initial nominal devaluation (of 31.6% in 1990 and a further 14.4% in 1991). For a short period (up to October 1991) it introduced a fixed exchange rate against a basket of five currencies, but owing to the initial inflation environment (annual CPI inflation of 250% in 1990) it then opted for a crawling peg. This was in effect (with a modicum of discretion) from 1991 onwards. The crawling peg was effected vis-à-vis a basket of five currencies with a fluctuation band initially of ±0.9% and later of ±12.5%. The initial monthly devaluation of 1.8% was steadily reduced, reaching 0.5% in 1998. Poland abandoned the crawling peg system in April 2000, almost 10 years after its introduction.

The long-run monetary policy objective in Poland was, and still is, disinflation. The medium-run target is the nominal exchange rate. The instruments of monetary policy are repo operations on the open market, the pace of devaluation, and a reserve requirement.

At the start of the 1990s, Poland was suffering from three-figure inflation, hence steady disinflation was the Polish central bank's priority. This objective was to be achieved using the crawling peg, but because of a worsening balance of payments in 1992 and 1993, the central par value was devalued twice. These devaluations undermined the credibility of the crawling peg as a nominal anchor, leading to a lengthening of the disinflation process as the non-credible exchange rate regime failed to generate low inflation expectations.[14]

DARER results

The Polish zloty (PLZ) has shown moderately inverse tendencies to the real tendencies of the Hungarian forint. From the start of 1994, the Polish currency displayed a moderately upward overvaluation trend, but this overvaluation did not de facto exceed the 10% level. But relative to all the aforementioned currencies, it appears to be the most overvalued (around 10%). In the "crisis" period centred around 1997 Q1, the zloty, too, exhibited signs of rising overvaluation, although to a lesser extent than all the countries reviewed, reaching values of around 7.5%. On the other hand, the zloty shows largest differences between the individual indicators. At the end of 2001, the likelihood of a modest upward trend in the real overvaluation of the Polish currency, which DARER quantifies at around 5%.

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[14] The effect of the Polish exchange rate regime on the balance of trade and GDP growth is not entirely clear.

7. THE POTENTIAL AND LIMITATIONS OF DARER

A basic limitation of DARER is the assumption that every current account deficit is accumulated in external debt that will, sooner or later, have to be repaid, and that the key stimulus for the shift from deficit to surplus will be a real depreciation of the domestic currency. This ignores very important aspects of intertemporal optimisation and macroeconomic adjustment. The current account is too complex a variable to be regarded as a basic indicator of overvaluation of the currency. The current account position needs to be assessed from several angles. One needs to ask whether the debtor nation is solvent, whether the deficit is excessive and whether it is sustainable. Sustainability can be assessed in numerous ways. The first involves extrapolating current macroeconomic policy and household behaviour. In this case, sustainability is ensured if the resulting current account path is consistent with intertemporal solvency, i.e. if the economy optimises consumption and investment intertemporally so that in otherwise unchanged conditions the current account position will shift smoothly from deficit to surplus. If, conversely, an unchanged situation is eventually going to lead to a drastic current account reversal or balance of payments crisis, the current account is assumed to be unsustainable. This view traditionally relates the dynamics of debt accumulation to the current account, economic growth, real interest rates on the debt, and the real exchange rate. However, it does not take sufficient account of the different impacts of debt and non-debt financing of the accumulated deficits on the external position of the country. This is why it is appropriate to augment the DARER variant excluding the FDI effect with the DARER variant taking FDI into account.

By considering these DARER variants, we arrive de facto at a fictitious band of overvaluation (undervaluation) of the currency. The upper boundary of this band (the variant excluding the FDI effect) reflects the need to repay in the future all debts ensuing from the CA deficits. The lower boundary conversely means that no CA deficits will have to be repaid in the future. Intuitively it is clear that the "actual" real overvaluation will lie somewhere within this band, since the two scenarios given above are pretty extreme.

It is also clear that the ratio of external debt to GDP cannot grow without bound. Therefore, the current account position that will keep the ratio of external debt to GDP constant may be a basic measure of solvency. The problem is, though, that we do not know the optimal or appropriate boundary ratio of debt to GDP at steady state. Moreover, in transforming economies which are converging to steady state, this ratio would not be relevant. And in the case of a fast-growing economy with a low level of external debt, it would not make much sense to consider limiting the ratio of external debt to GDP. Another problem is that even if the solvency condition is adhered to, the economy may – in a world of high capital mobility – run into liquidity problems.

For these reasons, DARER must be viewed as one of a group of purely orientation indicators that can be applied in a situation where we have only a rudimentary idea about the economy. The indicators of overvaluation obtained using DARER cannot be viewed in relation to long-run fundamental equilibrium of the economy. On the other hand, though, I believe that the danger of overvaluation should not be underestimated, as it has well-known asymmetric

negative effects, for example, on the long-term growth of the economy or on the outbreak of financial crises.

References

EDWARDS, S. (ed.) (1989): *Real exchange rates, devaluation and adjustment*. Cambridge, MIT 1989.

FABELLA, R. V. (1996): The Debt-Adjusted Real Exchange Rate. *Journal of International Money and Finance*, 1996, vol. 3, pp. 475-484.

FEYZIOGLU, T. (1997): Estimating the equilibrium real exchange rate: an application to Finland. *IMF Working Paper*, September 1997, no. WP/97/109.

FRAIT, J. - KOMÁREK, L. (1997): Modelování reálného devizového kursu v podmínkách ČR. *Závěrečná zpráva projektu IGS/8*. Ekonomická fakulta VŠB-TU, Ostrava 1997.

FRAIT, J. - KOMÁREK, L. (1998): Je koruna skutečně nadhodnocená? *Bankovnictví,* 1998, č. 17, s. 12-13.

FRAIT, J. - KOMÁREK, L. (1999a): *Kapitálové toky a devizový kurs v transformující se ekonomice*, Praha, Nadace Josefa Hlávky a Ekonomický institut Josefa Hlávky 1999.

FRAIT, J. - KOMÁREK, L. (1999b): Dlouhodobé determinanty rovnovážného reálného kurzu koruny. *Výzkumná práce měnové sekce ČNB*, 1999, č. 4.

FRAIT, J. - KOMÁREK, L. (1999c): Zahraniční dluh, kapitálové toky a reálný měnový kurz. *Výzkumná práce měnové sekce ČNB*, 1999, č. 9.

FRAIT, J. - KOMÁREK, L. (2001): Na cestě do Evropské unie: nominální a reálná konvergence v tranzitivních ekonomikách, *Finance a úvěr,* 2001, č. 6.

FRAIT, J. - KOMÁREK, L. (2002): Odhady rovnovážného reálného měnového kurzu vybraných tranzitivních ekonomik, *mimeo* 2002.

GOLDFAJN, I. - VALDÉS, R. (1997): Are currency crises predictable. *IMF Working Paper*, Washington, D.C. IMF, December 1997, no. 97/159.

HALPERN, L. (1996): Real exchange rates and exchange rate policy in Hungary. *Economics of Transition*, 1996, no. 1.

HALPERN, L. - WYPLOSZ, CH. (1997): Equilibrium Exchange Rates in Transition Economies, *IMF Staff Papers,* 1997, 44(4), pp. 430-460.

IMF (1998): Financial crises: characteristics and indicators of vulnerability (ch. IV). In: *World Economic Outlook,* Washington, D.C. IMF, May 1998.

KAMIN, S. (1996): Real Exchange Rates and Inflation in Exchange-Rate Based Stabilizations: an Empirical Examination. Board of Governors of the Federal Reserve System, *International Finance Discussion Papers*, IMF, June 1996, no. 554.

KAMINSKI, G. - LIZONDO, S. - REINHART, C. (1997): Leading indicators of currency crises. *IMF Working Paper,* Washington, D.C. IMF, July 1997, no. 97/79.

KOMÁREK, L. (1998): *Dlouhodobý rovnovážný měnový kurz*. Česká společnost ekonomická, pátý seminář v řadě „Ekonomická teorie a česká ekonomika", Praha, listopad 1998.

LAZAROVÁ, Š. - KREIDL, V. (1997): Rovnovážný měnový kurz. *Výzkumná práce Institutu ekonomie ČNB,* 1997, č. 75.

LOTHIAN, J. - TAYLOR, M. (1996): Real exchange rate behavior: the recent float from the perspective of the past two centuries. *Journal of Political Economy*, June 1996.

MANDEL, M. (1998): Měnová restrikce, její efekty a příčiny. *Bankovnictví,* 1998, č . 24.

MEDALLA, E. (1986): Impact Effects of Tariff Reform Programm. *Tariff-Commission-PIDS Joint Research Project Staff Paper*, 1986, no. 86-05.

MILESI-FERRETI, G. M. - RAZIN, A. (1998): Current account reversals and currency crises: empirical regularities. Washington, D.C. IMF, *IMF Working Paper*, June 1998, no. 98/89.

RAZIN, O.-COLLINS, S. (1997): *Real exchange rate misalignments and growth*. In: Razin, A.-Sadka, E. (eds.): International Economic Integration: Public Economics Perspectives. Cambridge, Cambridge University Press,1997.

WILLIAMSON, J. (1994): *Estimating equilibrium exchange rates*. Washington, D.C., Institute for International Economics 1994.

Appendix 1: Empirical DARER Results for Selected Transition Economies

a) Czech Republic (excluding the effect of FDI)

Figure A1a.1: Real and nominal exchange rate indices of CZK/DEM and DARER for the CPI and PPI (in %)
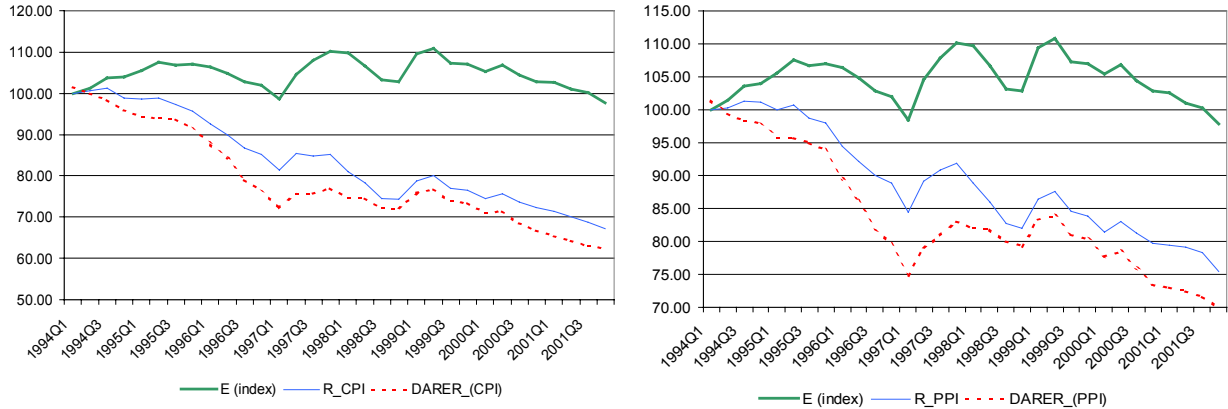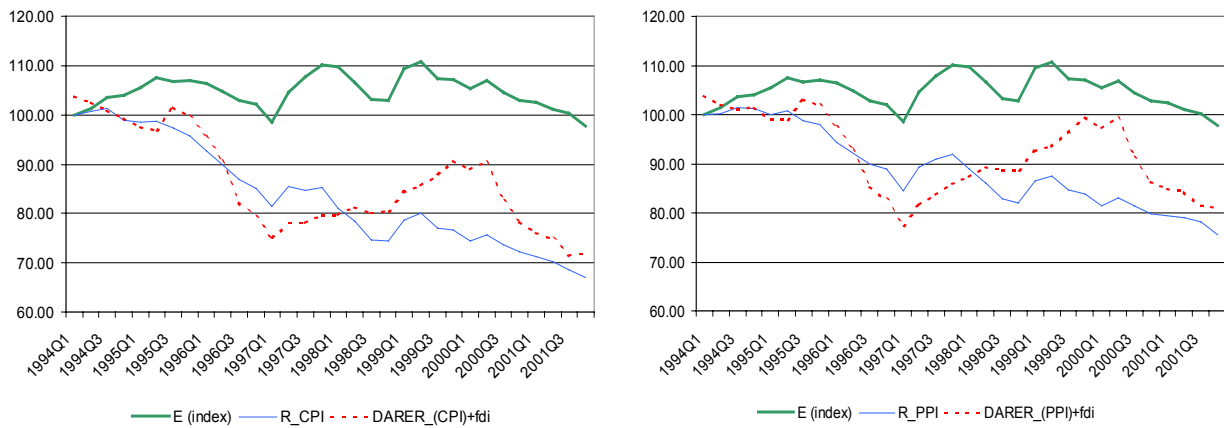

Figure A1a.2: Total, debt and trend overvaluations for the CPI and PPI (in %)
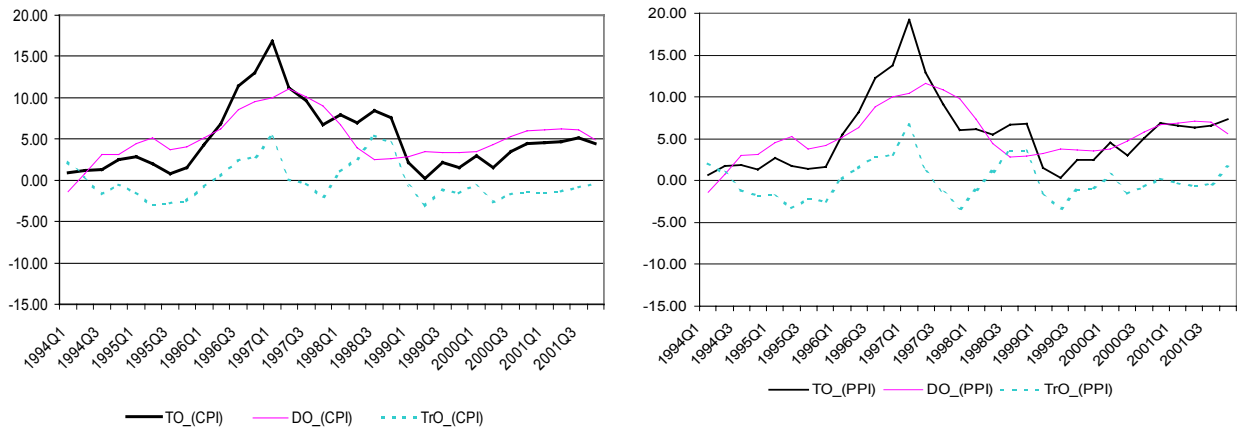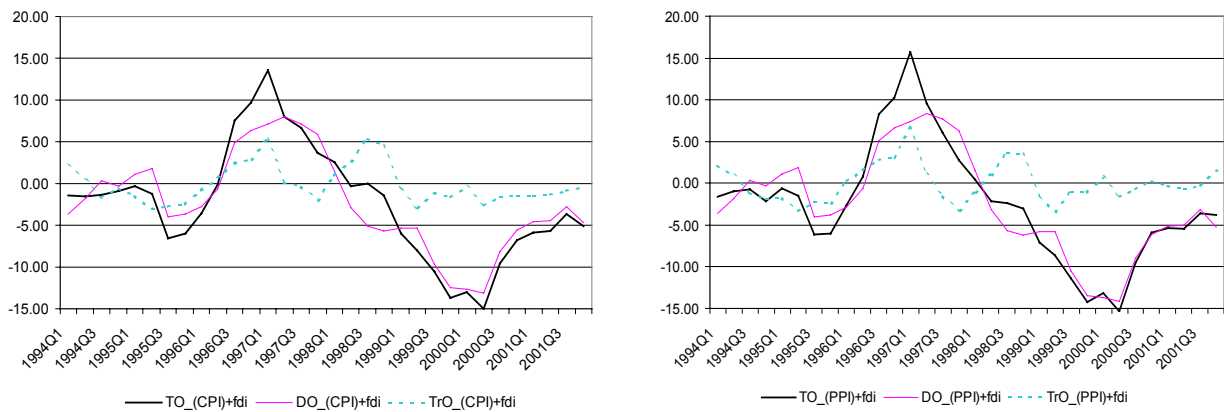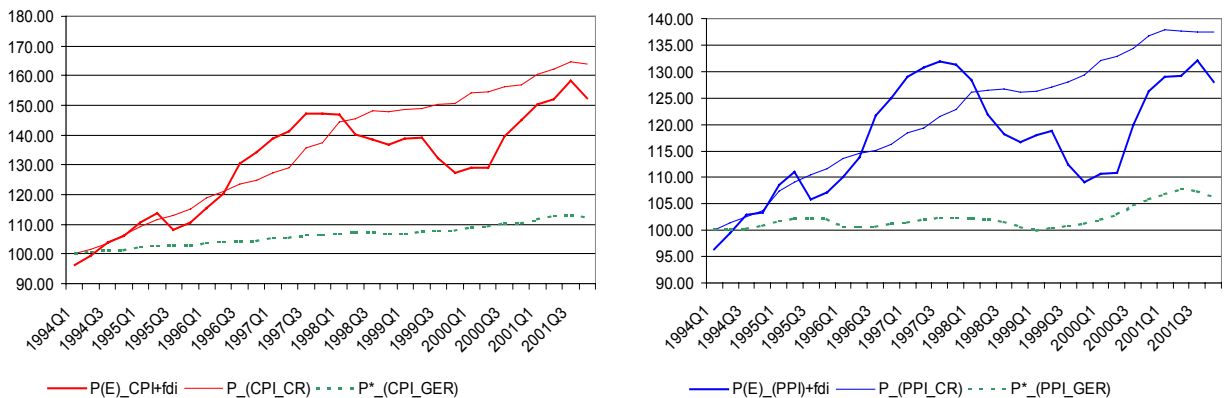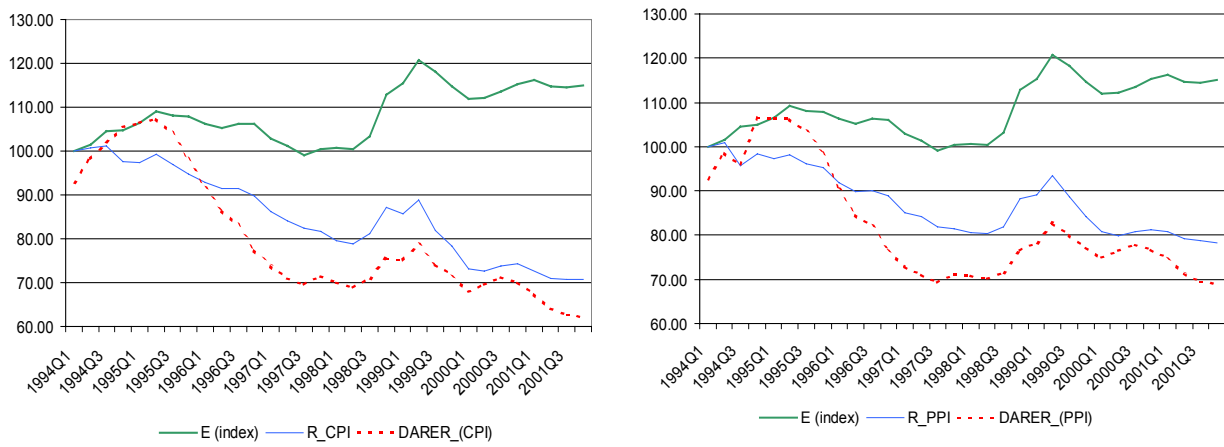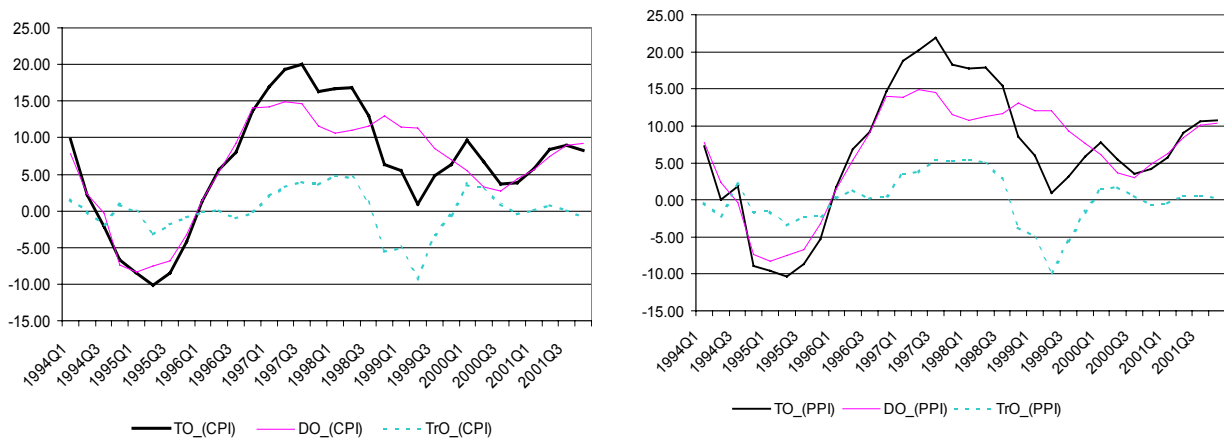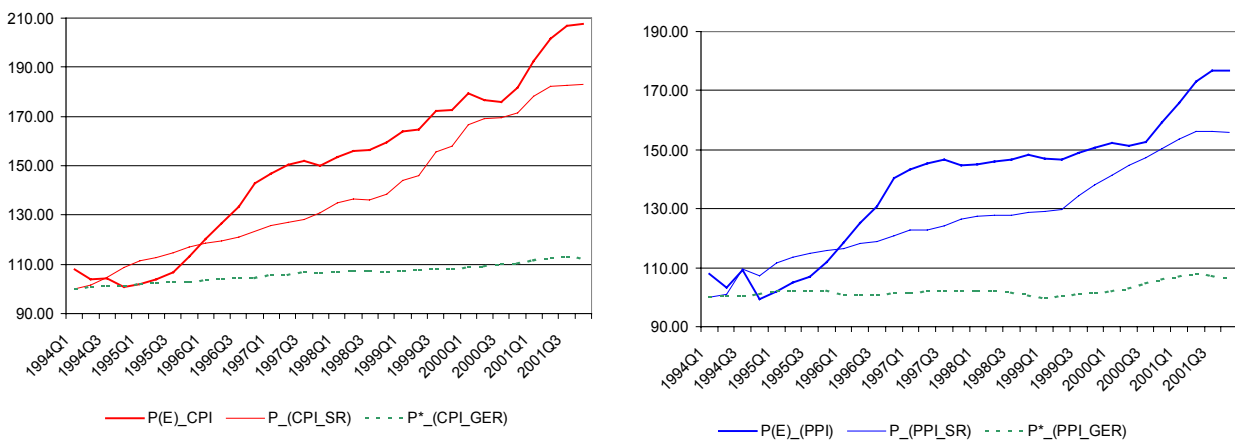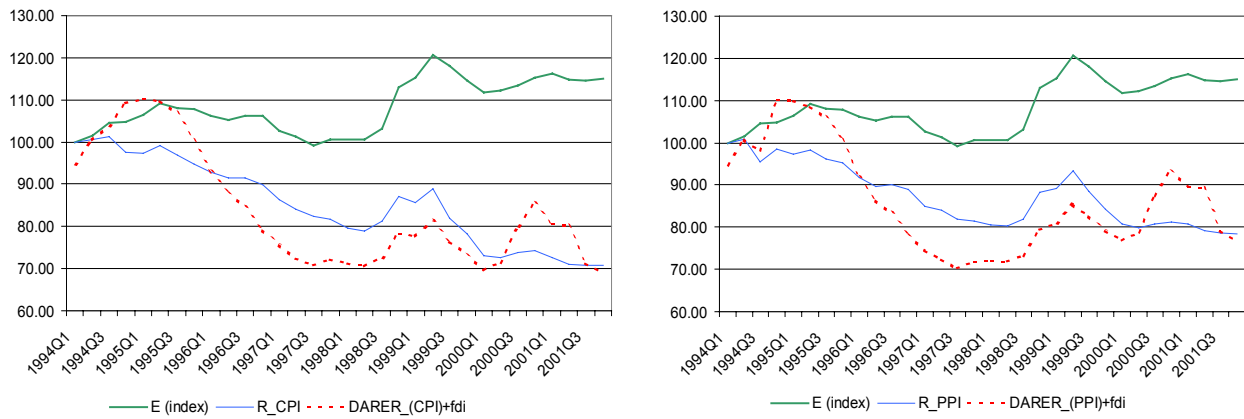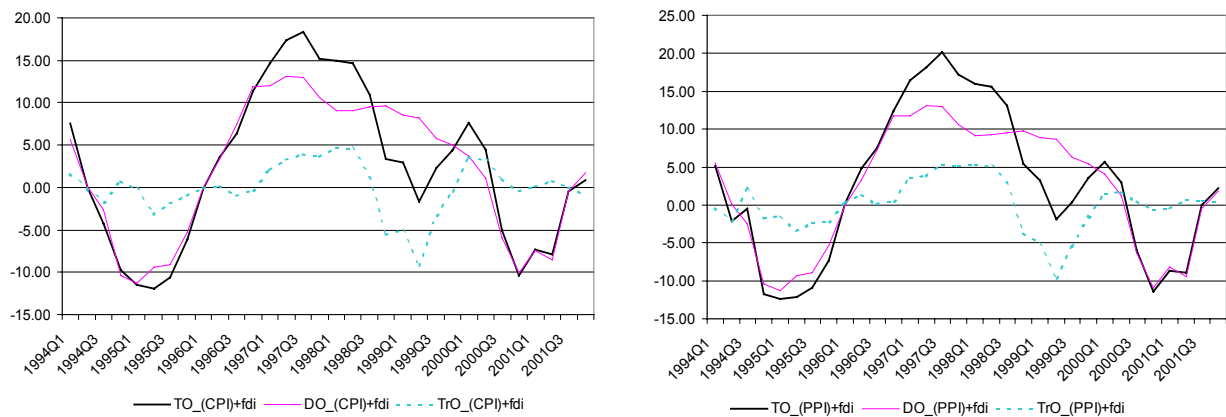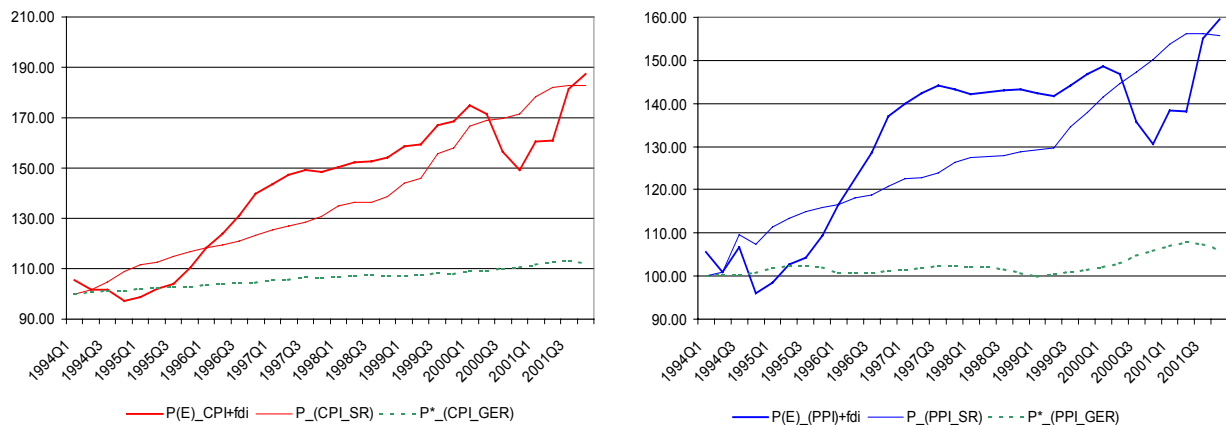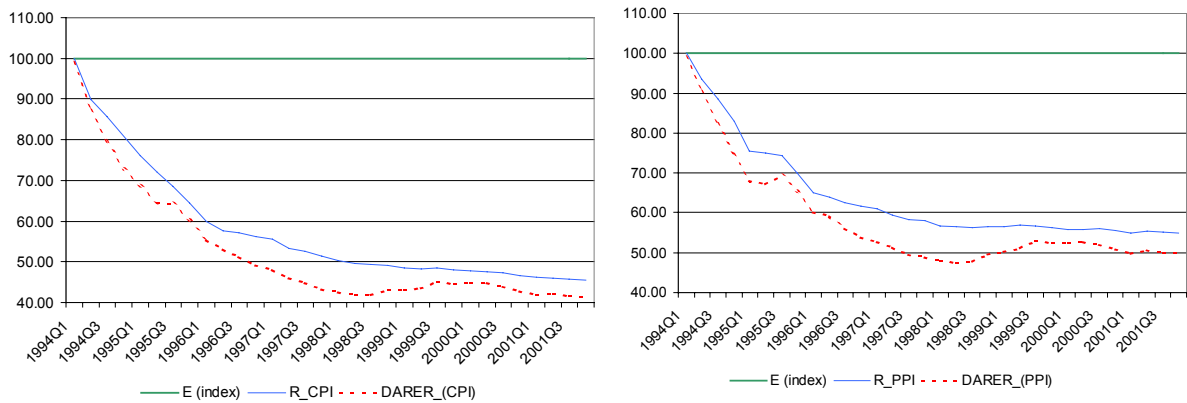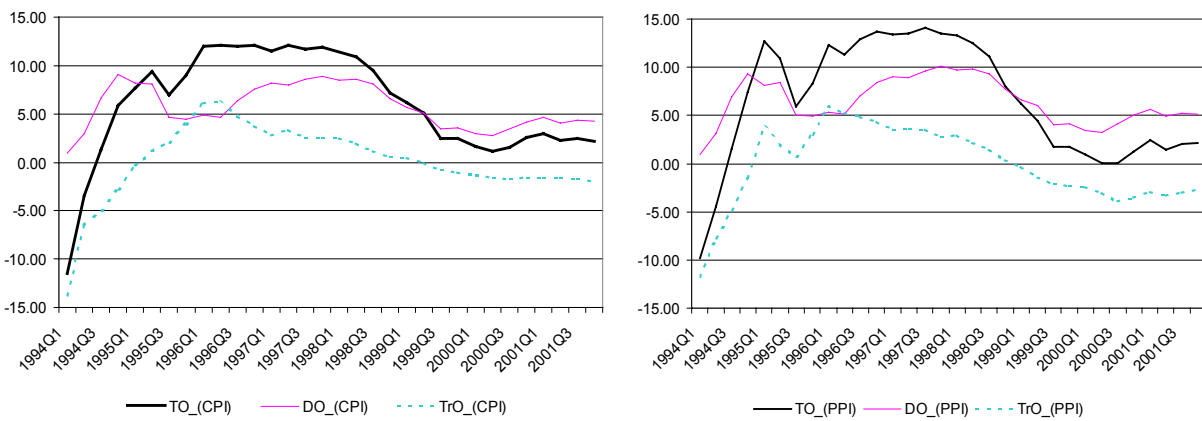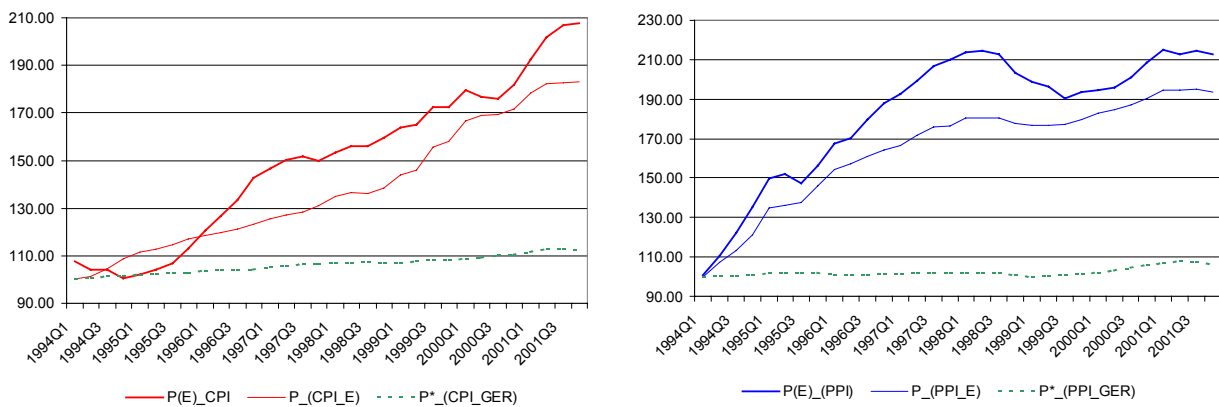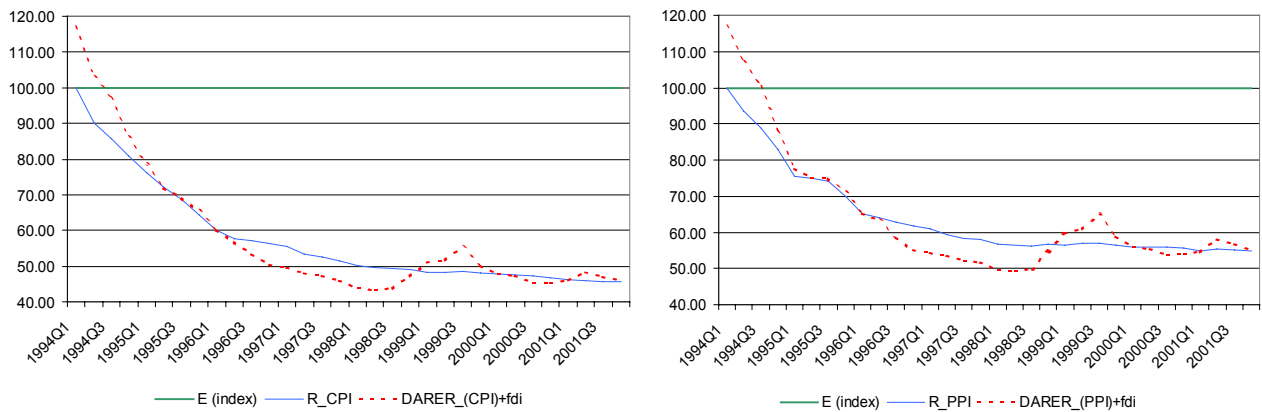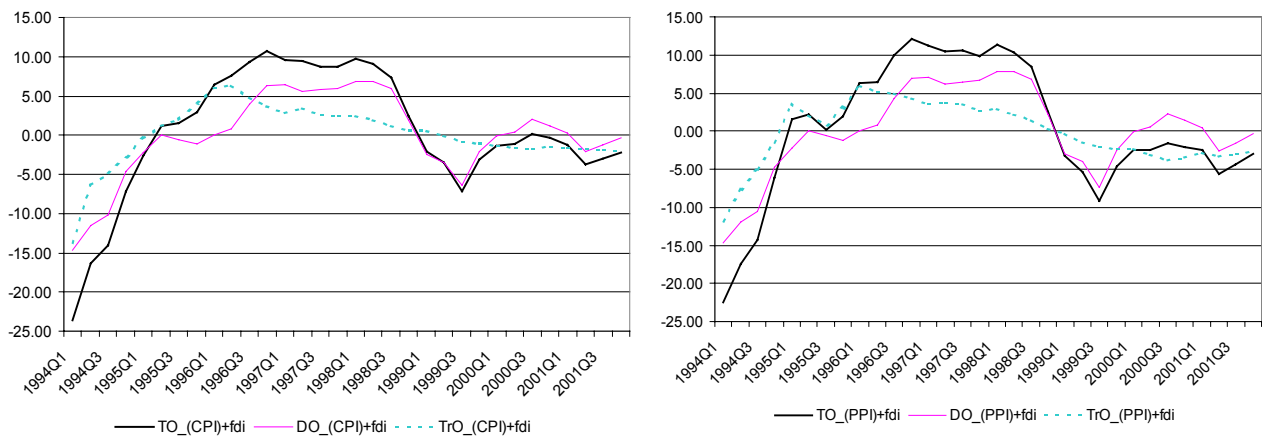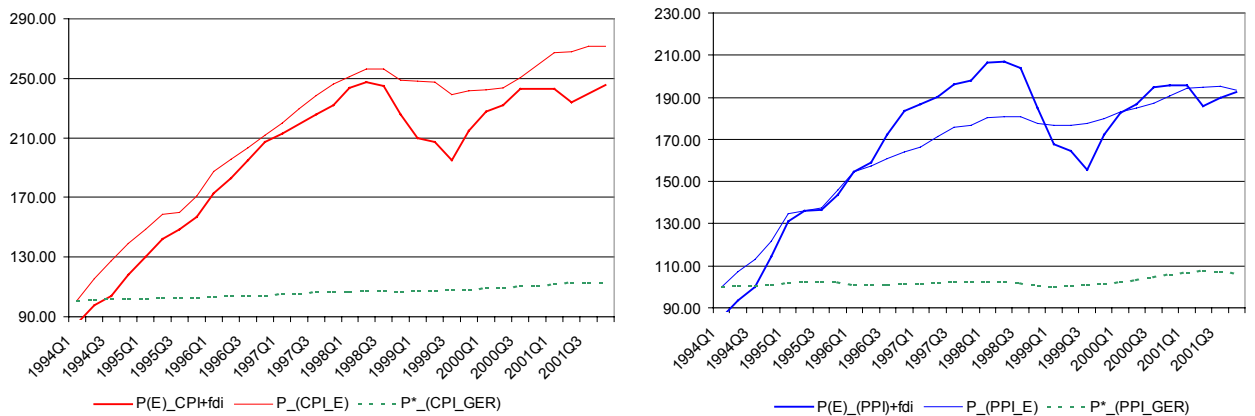

Figure A1a.3: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)
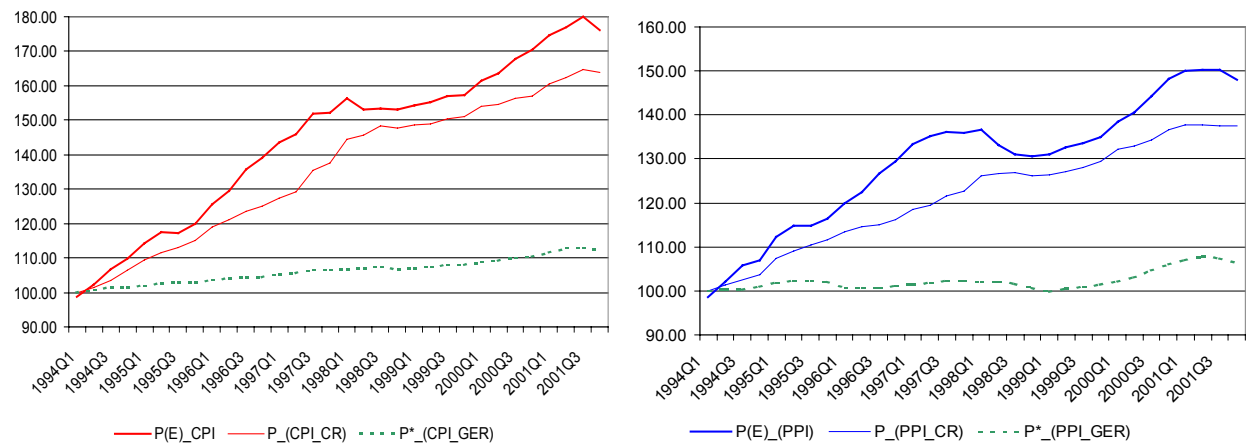
Czech Republic (including the effect of FDI)

Figure A1a.4: Real and nominal exchange rate indices of CZK/DEM and DARER for the CPI and PPI (in %)
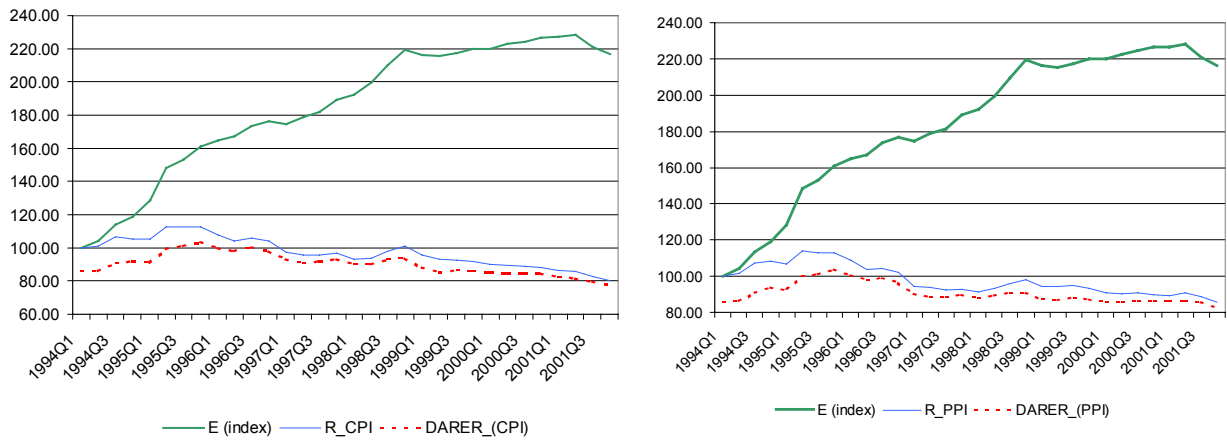

Figure A1a.5: Total, debt and trend overvaluations for the CPI and PPI (in %)
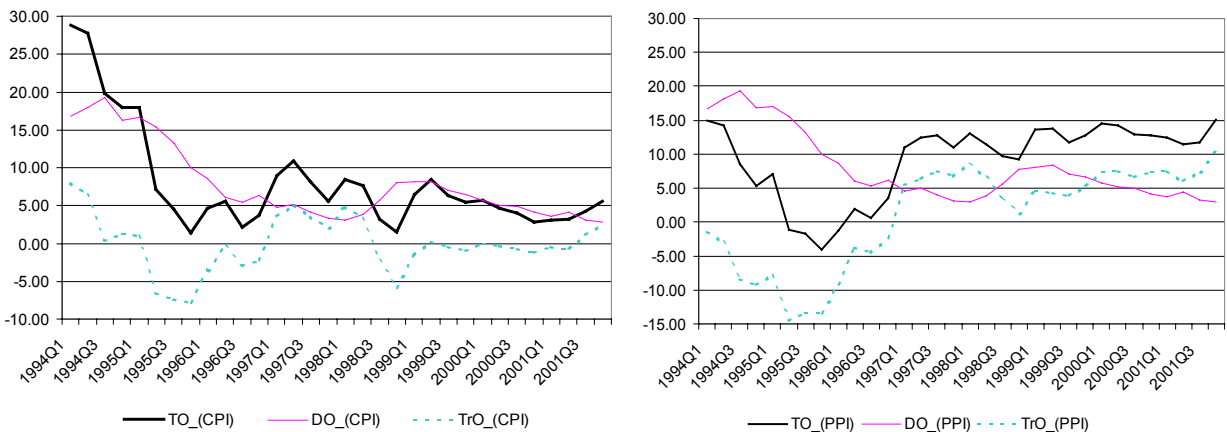

Figure A1a.6: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

b) Slovak Republic (excluding the effect of FDI)

Figure A1b.1: Real and nominal exchange rate indices of SKK/DEM and DARER for the CPI and PPI (in %)

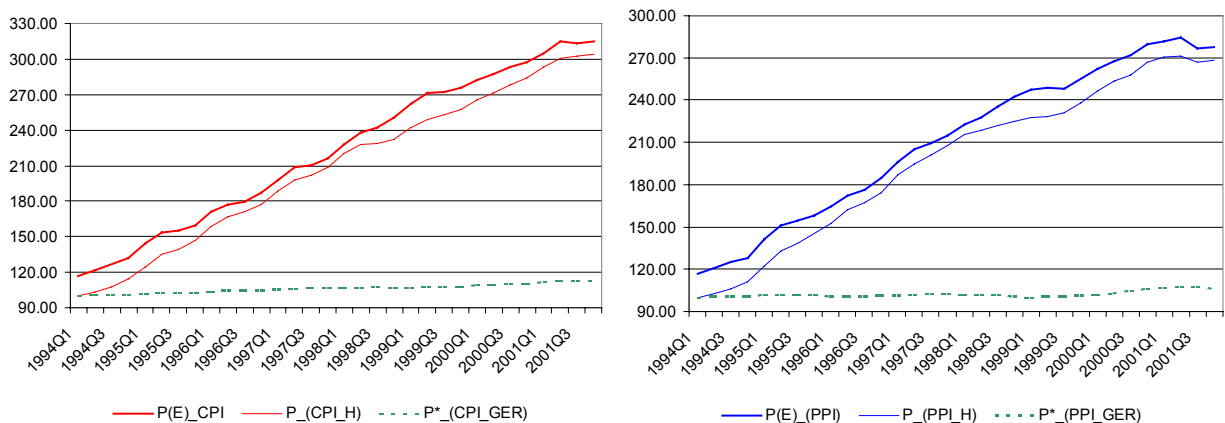*Figure A1b.2: Total, debt and trend overvaluations for the CPI and PPI (in %)*

Figure A1b.3: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

Slovak Republic (including the effect of FDI)

Figure A1b.4: Real and nominal exchange rate indices of SKK/DEM and DARER for the CPI and PPI (in %)
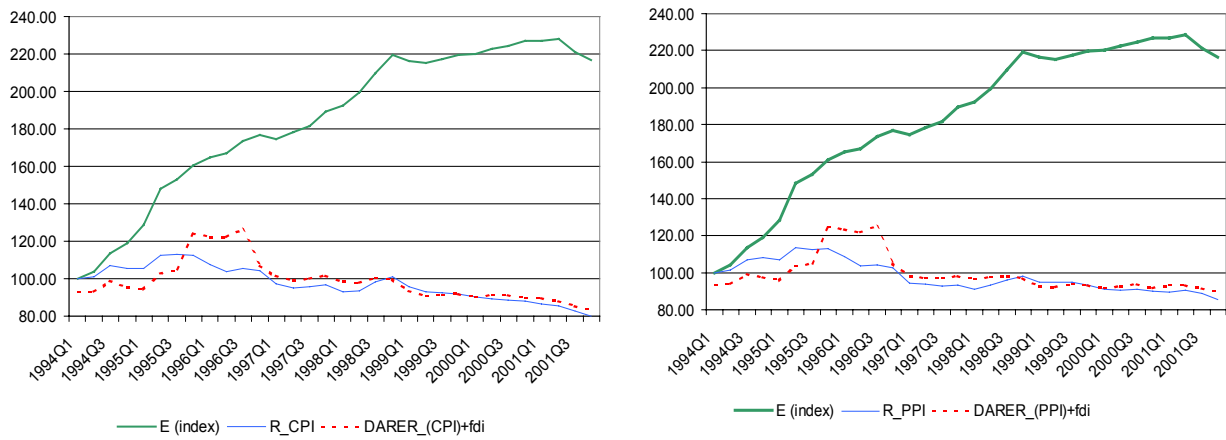

Figure A1b.5: Total, debt and trend overvaluations for the CPI and PPI (in %)

Figure A1b.6: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

c) Estonia (excluding the effect of FDI)

Figure A1c.1: Real and nominal exchange rate indices of EKK/DEM and DARER for the CPI and PPI (in %)

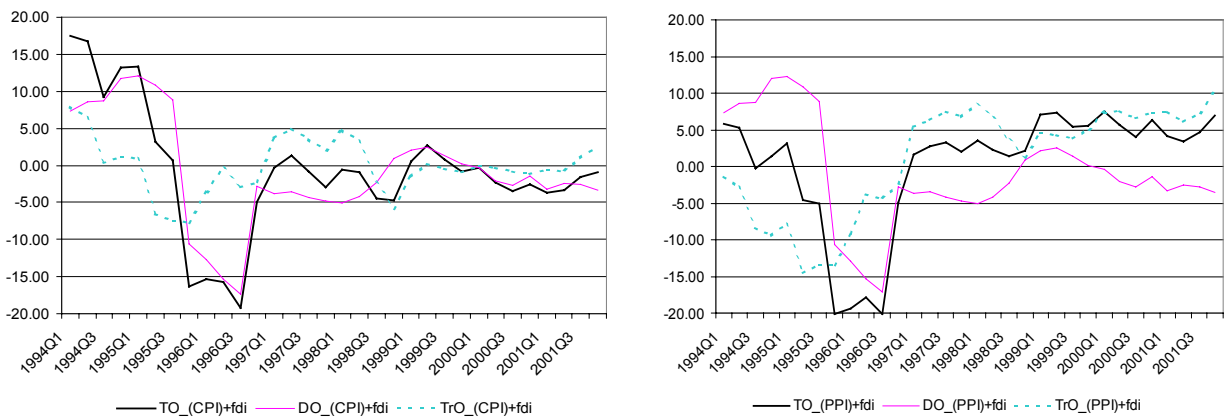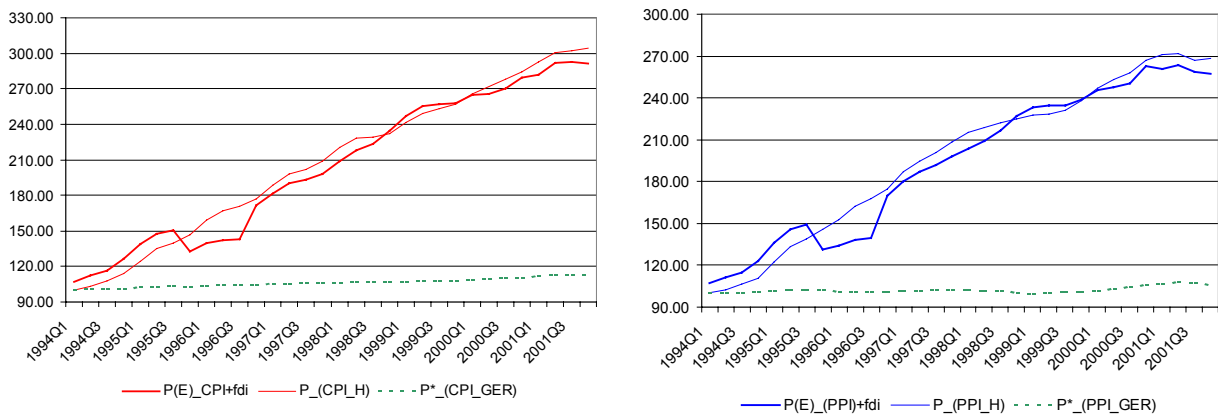*Figure A1c.2: Total, debt and trend overvaluations for the CPI and PPI (in %)*

Figure A1c.3: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

Estonia (including the effect of FDI)

Figure A1c.4: Real and nominal exchange rate indices of EKK/DEM and DARER for the CPI and PPI (in %)
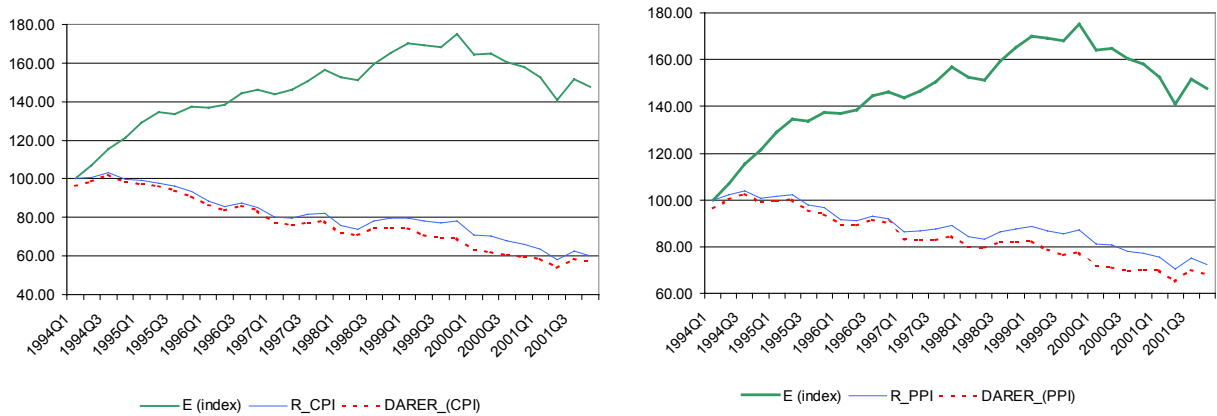

Figure A1c.5: Total, debt and trend overvaluations for the CPI and PPI (in %)

Figure A1c.6: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

d) Hungary (excluding the effect of FDI)

Figure A1d.1: Real and nominal exchange rate indices of HUF/DEM and DARER for the CPI and PPI (in %)

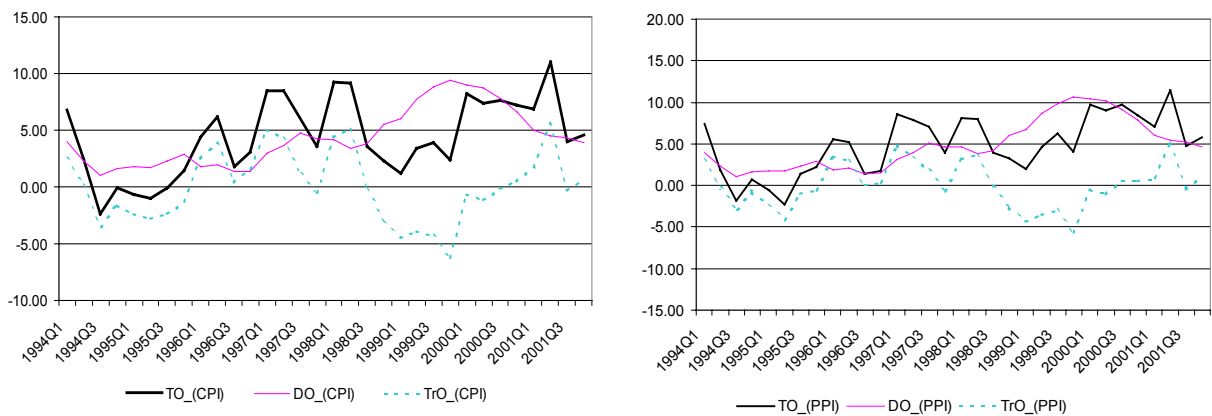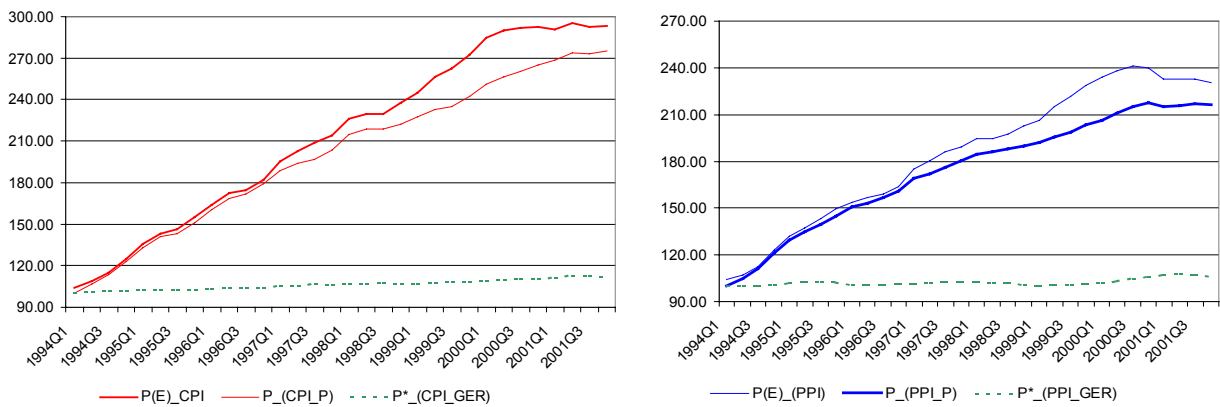*Figure A1d.2: Total, debt and trend overvaluations for the CPI and PPI (in %)*

Figure A1d.3: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

Hungary (including the effect of FDI)

Figure A1d.4: Real and nominal exchange rate indices of HUF/DEM and DARER for the CPI and PPI (in %)
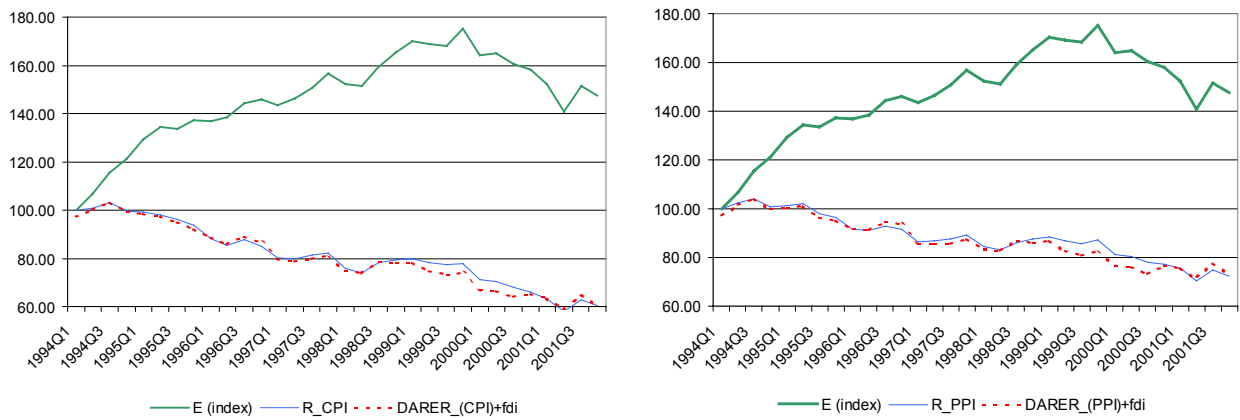

Figure A1d.5: Total, debt and trend overvaluations for the CPI and PPI (in %)

Figure A1d.6: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

e) Poland (excluding the effect of FDI)

Figure A1e.1: Real and nominal exchange rate indices of PLN/DEM and DARER for the CPI and PPI (in %)

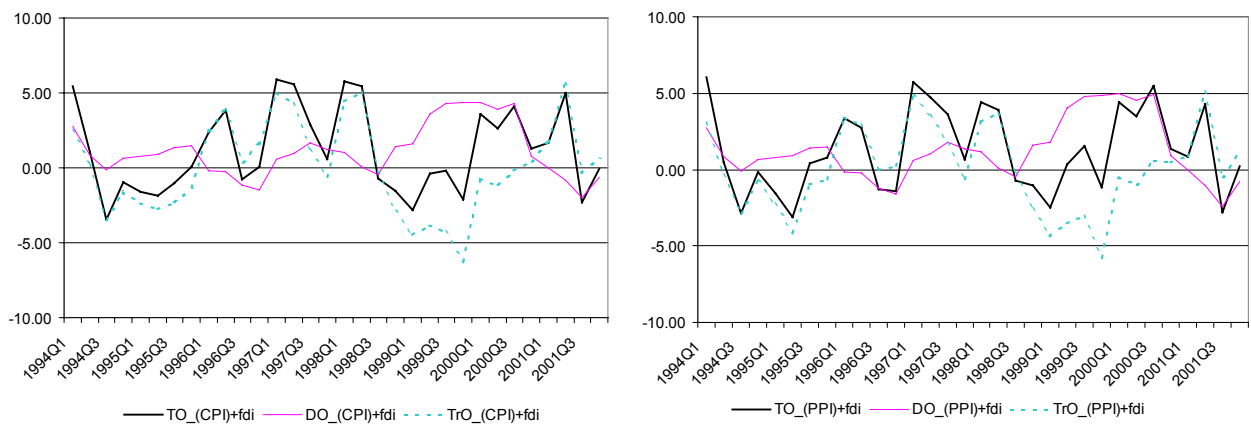*Figure A1e.2: Total, debt and trend overvaluations for the CPI and PPI (in %)*

Figure A1e.3: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

Poland (including the effect of FDI)

Figure A1e.4: Real and nominal exchange rate indices of PLN/DEM and DARER for the CPI and PPI (in %)

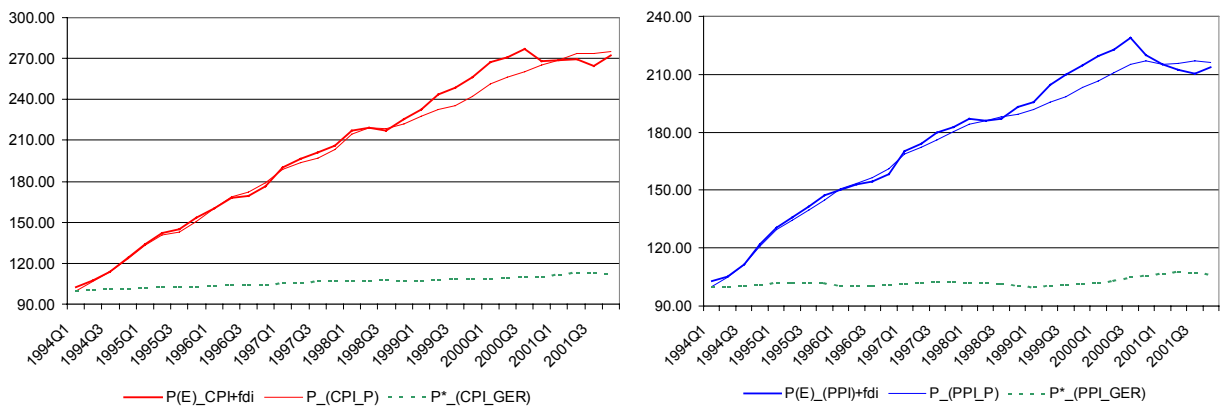*Figure A1e.5: Total, debt and trend overvaluations for the CPI and PPI (in %)*

Figure A1e.6: Equilibrium domestic, current domestic and current foreign price level for the CPI and PPI (in %)

Appendix 2: Development of Cumulative Balances of CA and CA+FDI for Selected Transition Countries
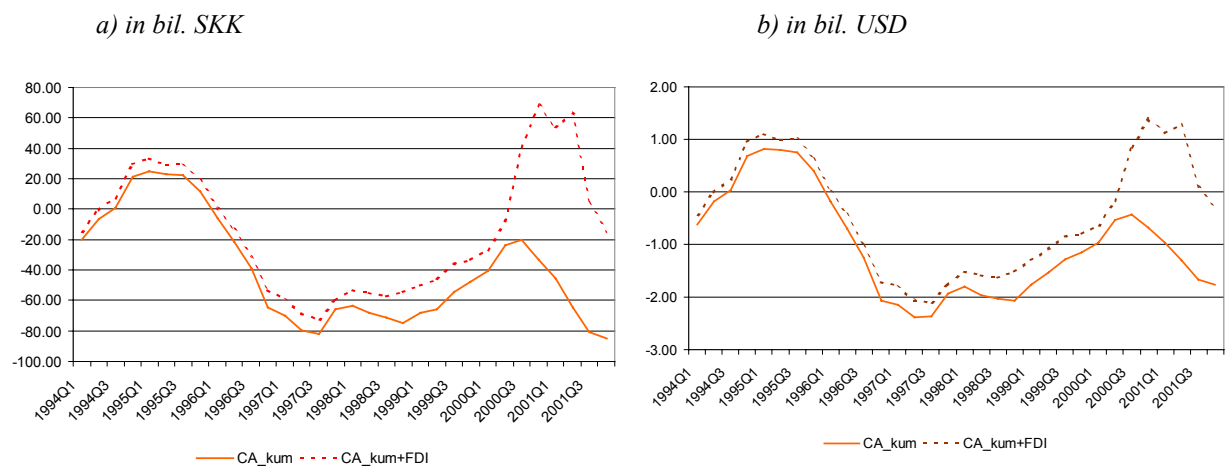
Czech Republic

Figure A2.1: Cumulative balance of CA and balance of CA+ FDI

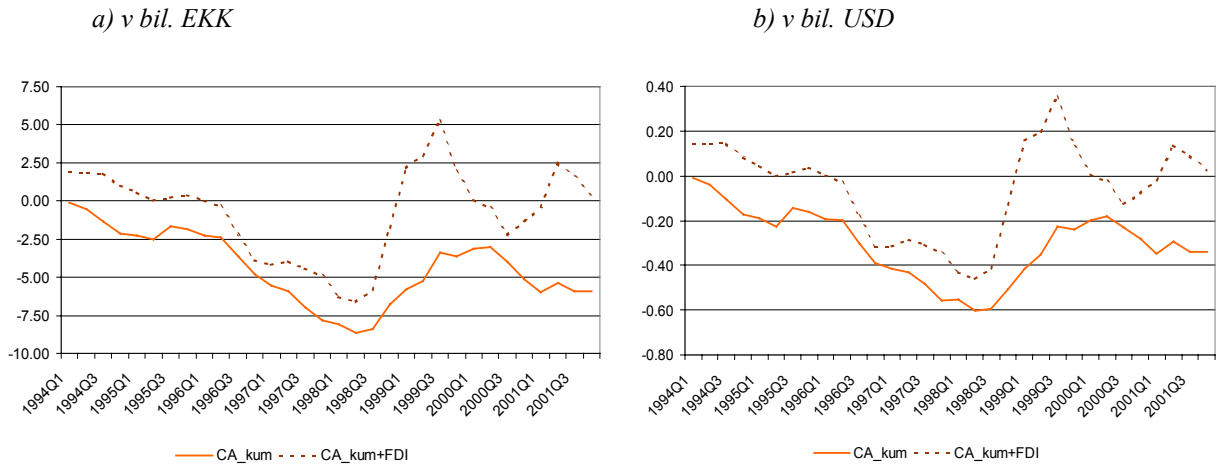*a) in bil. CZK*   *b) in bil. USD*
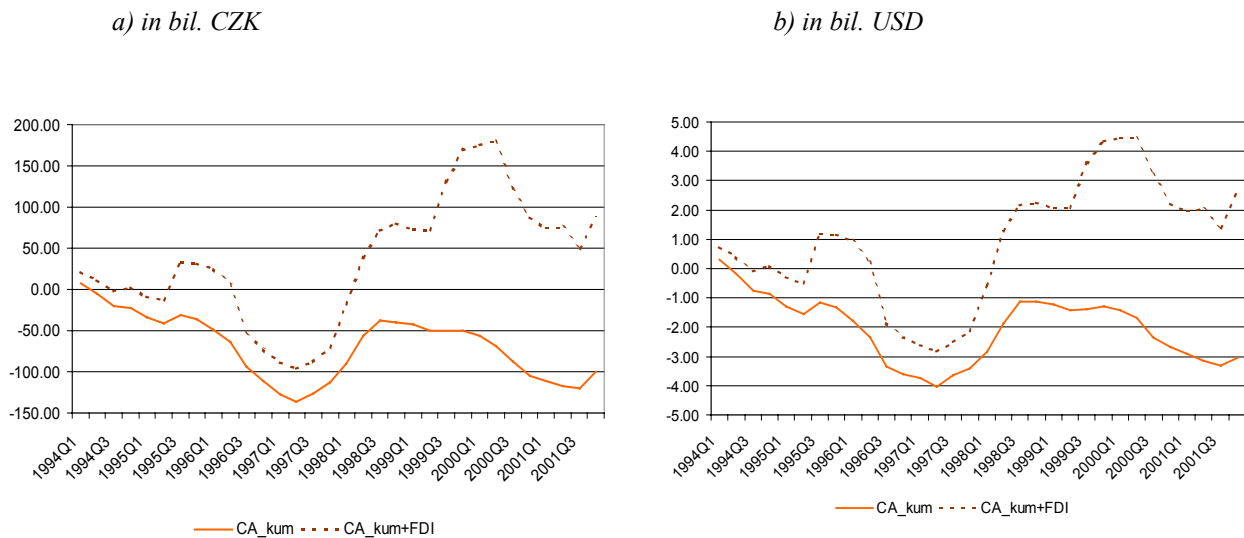
Slovak Republic

Figure A2.2: Cumulative balance of CA and balance of CA+ FDI

a) in bil. SKK   *b) in bil. USD*

Estonia

Figure A2.3: Cumulative balance of CA and balance of CA+ FDI

a) v bil. EKK   b) v bil. USD

Hungary

Figure A2.4: Cumulative balance of CA and balance of CA+ FDI

a) v bil. HUF   b) v bil. USD
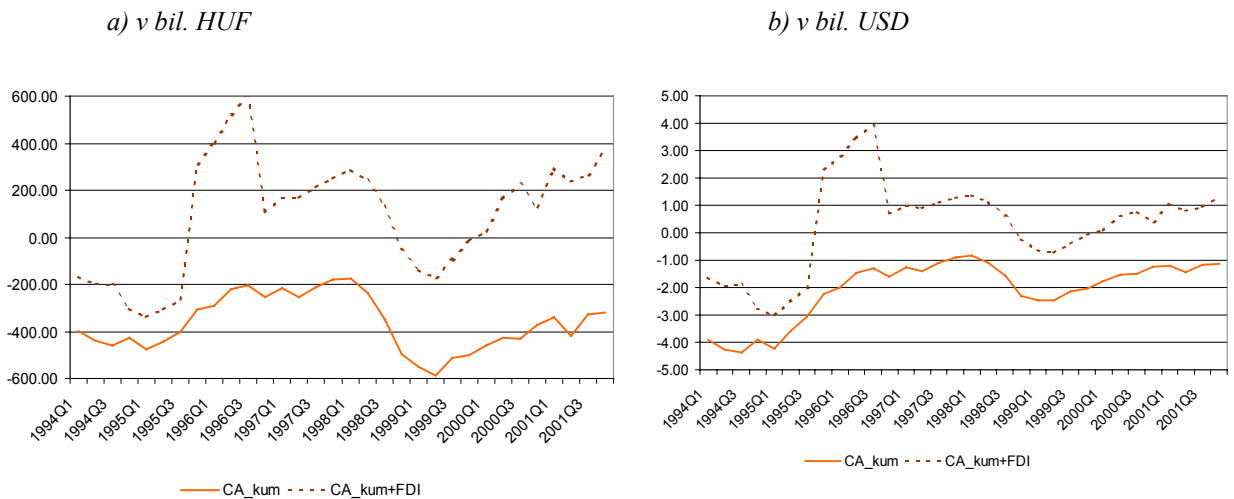
Poland

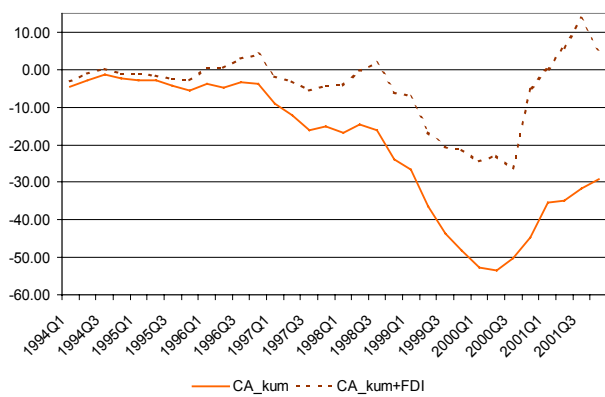*Figure A2.5: Cumulative balance of CA and balance of CA+ FDI*

        a) v bil. PLN   *b) v bil. USD*