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THE DEBT-ADJUSTED REAL EXCHANGE RATE FOR CHINA

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# The Debt-adjusted Real Exchange Rate for China

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## Abstract

The paper aims to enrich the debate on the overvaluation/undervaluation of China yuan Renminbi (CNY) against USD and JPY by applying the concept of the Debt-Adjusted Real Exchange Rate (DARER). This approach is offering to monetary policy makers another indicator for more responsive management of this important economic variable. The general motivation for constructing DARER is the fact that long-term current account surplus (deficits) is linked with capital outflows (inflows), which often leads to real undervaluation (overvaluation) of domestic currency. DARER can signal to the authorities that the real exchange rate is becoming unsustainable in the medium term. Based on the DARER approach we also introduce three indicators of exchange rate misalignment.

## Keywords:

Exchange rate, current account, misalignment, China, DARER

## JEL Classification:

E58, F31, F32, F37

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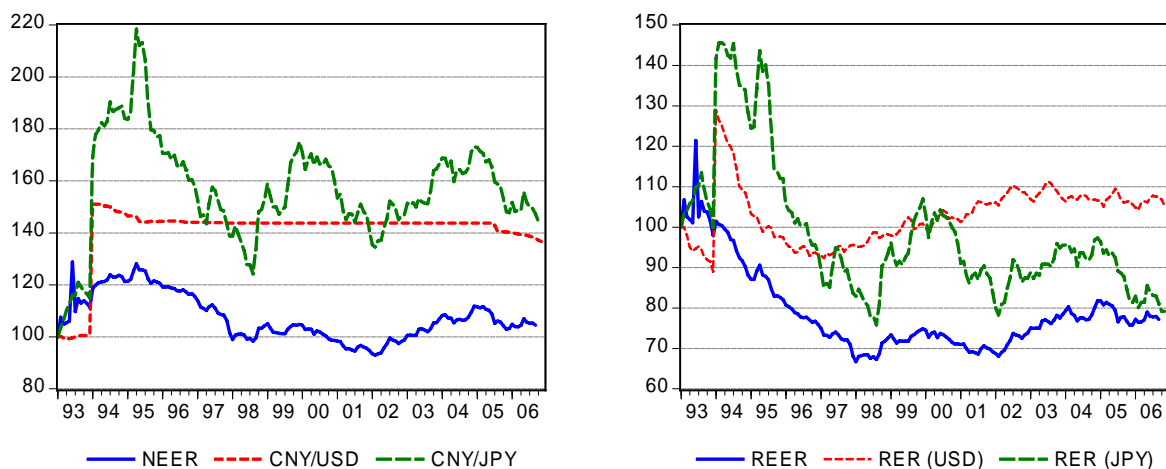
Jan Frait and Luboš Komárek note that everything contained in this paper represents their own views and should not be construed as representing those of the Czech National Bank. However, all errors and omissions remain entirely the fault of the authors. Research staying behind the paper has been supported by Grant Agency of the Czech Republic – grant no. 402/05/2758.

# 1. Introduction

The economic development of China has been the most outstanding phenomenon in the world economy over at least the last ten years. China has become the first holder of international official reserves, the second host-country for foreign direct investment and the world's third largest trading power. China's exports of final goods to the US and the EU have expanded rapidly and have given rise to large trade surpluses. All these factors are increasing suspicions about the potential misalignment of the Chinese currency – yuan Renminbi (CNY) – especially against the US dollar. Chinese authorities have maintained a fixed exchange rate regime against USD since 1994. This exchange rate policy has influenced the development of the nominal effective exchange rate, which has been on average relatively stable (see lhs of Figure 1), albeit the gradual period of appreciation was recorded from 1994 to 2002 and during the current period as well. This figure also shows the development of the bilateral nominal exchange rates CNY/USD and CNY/JPY.

The developments of the real exchange rates are shown on the rhs of Figure 1. The bilateral real exchange rate of the CNY against USD has also been rather stable, despite rapid productivity gains and the accumulation of net foreign assets. The effective real exchange rate initially sharply appreciates (1993-98), then behave in average steadily (1998-01) and consequently the moderate depreciation trend (2002-05).

Figure 1: The Nominal and Real Development of CNY



Note: NEER – nominal effective exchange rate, CNY - yuan Renminbi, USD – US dollar, JPY – Japanese Yen, REER – real effective exchange rate (deflated by CPI), RER – real exchange rate.

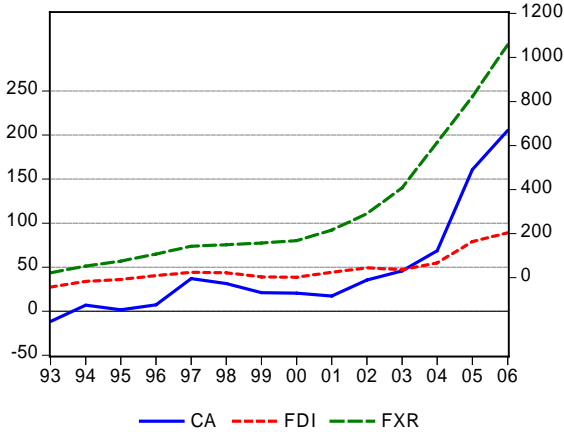
Source: own calculations based on IMF-IFS and EIB (The Economist) data.

The monitored exchange rate history was affected by the Chinese plan on joining the WTO. The dual exchange rate system was replacing by a unified scheme based on a basket of currencies. This regime only exists for 18 months. In the beginning of 1995 it was replaced by a peg to the US dollar at a rate of 8.277 CNY/USD with the narrow fluctuation margin ( $\pm 0.18\%$ ). This helps to cut galloping inflation (28% y-o-y) at that time and to stabilize Chinese economy. Since 1996, CNY has been convertible for commercial operations on the current account. On the other hand, the regulations are still applied to financial transactions by

individuals and companies from the SAFE (State Administration of Foreign Exchange).<sup>1</sup> The Chinese exchange rate policy is currently under pressure, as both official and business constituencies put forward different arguments: overheating of the economy, ongoing catching-up that calls for real exchange-rate appreciation, “unfair” cost advantages benefiting the country, or capital controls that artificially back-up the exchange rate regime. The complex diagnosis of the misalignment of CNY is therefore not a simple task.

The proposition of the undervaluation of CNY is based largely on three main arguments – (i) the high dynamics of the Chinese’s export and growing of the current account surplus, (ii) the accumulation of foreign exchange reserves by the People’s Bank of China and (iii) massive foreign direct investment inflows to the Chinese economy– see Figure 2. All these factors together with the growing productivity of the Chinese industry are the main sources of the exchange rate pressures on the CNY.

Figure 2: The Current account balance, FDI inflow and Foreign Exchange Reserves (billions of USD)



Note: CA – current account balance, FDI – net foreign direct investment, FXR – foreign exchange reserves (rhs).  
 Source: own calculations based on IMF-IFS and EIB (The Economist) data.

However, we could also formulate significant arguments to defend the currently applied fixed exchange rate regime. Firstly, the peg on the dollar has served the country well regarding its economic performance over the last few years. China has achieved strong growth with moderate inflation, and a modest current account surplus. Furthermore, it does not suffer from overall pent-up demand. Secondly, it is the weakness of Chinese banking system, especially to the structure of its forex balance sheets. A prior condition to introduce more flexibility in the exchange rate would be the improvement of the banking sector’s balance sheet in order to cope with the opening of the financial account. Thirdly, for the time being, it has not been possible to detect Balassa-Samuelson effects in China, probably because of the structural segmentation of the labour market. Fourthly, while Chinese exports are rising, import growth is very dynamic too. The entry of China to WTO at the end of 2001 has led to the progressive fall in customs duties and other trade barriers, which could have the similar effect to import as the revaluation of CNY. Similarly, the Chinese trade surplus especially with the United States and European Union is more than off-set by the deficits with main Asian trade partners<sup>2</sup>. Finally, China’s

<sup>1</sup> see for example Xiaopu (2003)  
<sup>2</sup> excluded from the effect of Hong Kong economy

competitiveness stems mainly from structural factors. The level of wages is low and wages are flexible downward given the massive labour supply, which could lead to the elimination of the CNY revaluation.<sup>3</sup>

There are many ways in which greater flexibility could be introduced to the Chinese exchange rate policy: (i) gradual revaluation of the CNY, which is consistent with the current fixed but adjustable regime, (ii) a currency peg on a more diversified basket of world “reserve” currencies (USD, EUR, JPY, GBP) according to the denomination of payments in the Chinese foreign trade, (iii) a widening of the fluctuation margin, (iv) moving to the floating exchange rate regime. The final decision would also depend on the size of the exchange rate misalignment.

## 2. The Essence of the DARER Concept

Misalignment currency 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 – see Razin and Collins (1997), for example. Either overvalued or undervalued currency also leads to the risk of a speculative attack, especially in the case of applied fixed exchange rate regimes. With the benefit of hindsight we can say that one of the main causes of these developments was the maintaining of misaligned currencies, leading to current account imbalance.

Consequently, if we want to evaluate the misalignment of the CNY, we ought to take current account and foreign direct investment into account. The DARER<sup>4</sup> concept originally assumes that borrowing from abroad allows the current exchange rate level to be sustained via repression of the domestic price level and vice versa. 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). Similarly these effects hold for the current account surpluses.

The advantage of DARER is that it explicitly takes into account the development of current account of the economy. China is an example of an economy that is strongly affected by foreign capital and which has accumulated a sizeable current account surplus – see Figure 2. DARER helps us to realize 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. If DARER indicates rising overvaluation (undervaluation), the relatively strong (weak) currency is being maintained largely at the expense of growing (falling) external debt<sup>5</sup> and vice versa. It is then necessary to assess whether the relatively strong (weak) currency was really due solely to foreign capital flows influencing the debt, or whether there were other fundamental causes. If capital inflow was really the cause,

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<sup>3</sup> The sensitivity of exports to exchange rate movements is also limited because of approximately half of China’s export come from foreign subsidiaries set up in China.

<sup>4</sup> For the application of the DARER to selected new EU Member States see Frait and Komárek (2002).

<sup>5</sup> 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 does not make sense to prevent devaluation (revaluation) of the currency. On the contrary, this action should be encouraged.

Furthermore, we consider the concept of DARER appropriate to marry with the concepts of the fundamental equilibrium exchange rate, which are medium-term in nature and which does not take the external debt or surplus 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 a supplement to main partial equilibrium approaches to estimating the medium-term real equilibrium exchange rate, i.e. – BEER (*Behavioural Equilibrium Exchange Rate*), CHEER (*Capital-Enhanced Equilibrium Exchange Rate*), FEER (*Fundamental Equilibrium Exchange Rate*), ITMEER (*Intermediate-Term Model-Based Equilibrium Exchange Rate*), NATREX (*Natural Real Exchange Rate*), PEER (*Permanent Equilibrium Exchange Rate*) and so called Monetary Model. A detailed description of these variants of equilibrium exchange rate models could be found in MacDonald (2001), Égert (2003), Driver and Westaway (2005) or Horváth and Komárek (2007).

### 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.

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

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

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 balance (deficit or surplus) as the difference between aggregate supply and aggregate demand at the current price level in the domestic economy:

$$CA = S(P) - D(P) \quad (3)$$

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 (surplus) generates present and future external liabilities (assets) which must later be repaid<sup>6</sup> (spend). This mechanism is formally described by the following equation:

$$DS = S(P_E) - D(P_E) \quad (4)$$

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 balance:

$$DS - CA = [S(P_E) - S(P)] - [D(P_E) - D(P)] \quad (5)$$

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<sup>6</sup> excess aggregate supply will have to be created at the equilibrium price level

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

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

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

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

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

which rearranges to give:

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

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

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

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

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:

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

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

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

where  $\varepsilon_s$  and  $\varepsilon_d$  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 (assets).

#### 4. Indicators of Exchange Rate Misalignment

Given below are three indicators of misalignment, i.e. over/under valuation of the currency that proceed from the DARER concept. The first indicator (*the debt misalignment index*) identifies the currency misalignment due to the very existence of the debt. The second indicator (*the trend misalignment index*) applies the concept of the Hodrick-Prescott (HP) filter, Band-Pass filter (BP) or other filtering methods, which is used to determine the “trend misalignment”. The third indicator (*the total misalignment index*) combines the two concepts to express, from a “broader” perspective, information on the overvaluation/undervaluation of the exchange rate.

##### *Debt misalignment of the exchange rate*

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



$$I_{DM} = \{100/[100 + (DARER-R)]-1\}.100 \quad (7)$$

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

### ***Trend misalignment of the exchange rate***

Trend misalignment is a rather “imperfect” substitute for misalignment 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 equilibrium exchange rate among economists modeling this variable in many developing countries. To calculate the trend misalignment we propose to use the Hodrick-Prescott (HP) filter<sup>7</sup> or the Band Pass Filter (BP).

In the case under review, the value of the parameter  $\lambda = 100$  recommended for annual data was used. Based on knowledge of the HP filter, a trend misalignment index is defined below. The misalignment relative to the real exchange rate trend is expressed in concrete form by the trend misalignment index ( $I_{TrO}$ ). The proposed formalized notation for the calculation of this index can be stated in the following form:

$$I_{TrO} = \{100/[100 + (FT_{_R} - R)]-1\}.100 \quad (8)$$

Where R is the real exchange rate,  $FT_{_R}$  is the trend of the R based on selected filtering methods. The debt misalignment index should say: “*By what percentage the real exchange rate is misaligned relative to its trend*”. This misalignment is also expressed in per cent.

### ***Total misalignment of the exchange rate***

The debt misalignment only gives us an idea of the potential misalignment of the currency due to the build-up of external debt, not of the total misalignment. As noted above, for the latter we need to have an idea of the long-run fundamental equilibrium real exchange rate, which 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 statistical filtering, i.e. HP or BP filter. This method has its fundamental limitations, so we should emphasize 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 misalignment of the real exchange rate is expressed in concrete form by the total misalignment index ( $I_{TO}$ ). The proposed formalized notation for the calculation of this index can be stated in the following form:

$$I_{TO} = \{100/[100+(DARER - FT_{_R})]-1\}.100 \quad (9)$$

The total misalignment index should say: “*By what percentage the real exchange rate trend is misaligned due to the build-up of external balance*”. This misalignment is also expressed in per

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<sup>7</sup> Calculation of misalignment using the deviation of the real exchange rate from trend is routinely applied in the empirical literature – see, for example, Milesi-Ferreti and Razin (1998), Kaminski, Lizondo and Reinhart (1997) and IMF (1998).

cent. Alternatively, we can also obtain the value of the total misalignment by summing the debt misalignment and the trend misalignment (the deviations of the actual real exchange rate from the trend).

## 5. DARER Estimates for the China

DARER has been applied empirically chiefly to newly industrialized nations and some new member states of the EU. Fabella (1996) has been made the estimates of DARER for the Philippines and Thailand during the period 1980–1992.<sup>8</sup> Frait and Komárek (2002) make similar calculation for selected euro candidates, i.e. for the Czech Republic, Hungary, Poland and Slovakia. For empirical application to China, 1993 was chosen as the base year for the calculation. In this year the current switched from deficit to surplus, which than continues. The simulation was performed for annual data (from 1993 to 2006) for the both CPI and PPI indexes against USD and JPY. The Chinese CPI (PPI) was chosen as domestic price level  $P$  and the US and Japanese CPI (PPI) as foreign price level  $P^*$ . 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 CNY/USD (CNY/JPY) rates were used. The difference (DS-CA) can be approximated in two ways. The first boundary approximation (pessimistic) is the entire current account balance (deficit or surplus). This case assumes that rapid attainment of a balanced current account would be desirable. The second boundary approximation (optimistic) is the current account balance minus net inflow of foreign direct investment. This case assumes that an improvement (lower deficit, higher surplus) 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 directly estimate Chinese elasticities from the structural macroeconomic model. Given the problems in the data area, however, this is practically impossible for the time being. Hence typical elasticities for an open economy as given by 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 ( $\varepsilon_s = 0.3$  and  $\varepsilon_d = 0.5$ ).<sup>9</sup>

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, Komárek and Frait

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<sup>8</sup> 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.

<sup>9</sup> The same elasticities ( $\varepsilon_s = 0.2$  and  $\varepsilon_d = 0.4$ ) were chosen in the work of Frait and Komárek (2002). 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  $\varepsilon_d = 0.5$ ).

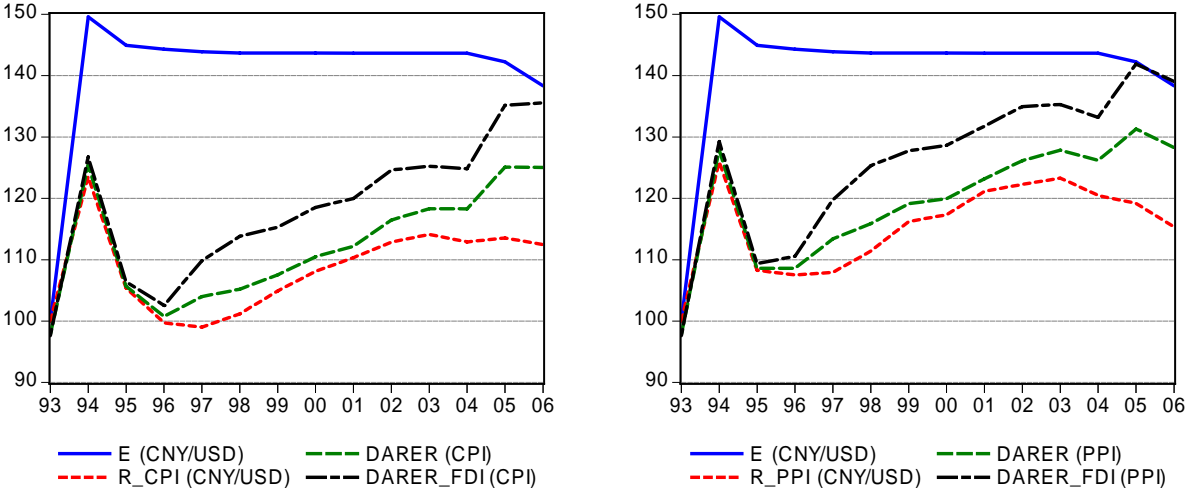
(2002) propose, to use it as a medium-run concept (i.e. for medium-run elasticities) for identifying currency overvaluation.

When applying the DARER method empirically, 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 or contribute to the stronger undervaluation of the exchange rate.

This approach follows from the logic that the largest deviation of DARER from the real exchange rate occurred in 2006, when the current account surplus and FDI inflows were the largest. One of the problematic aspects of the model is also visible, namely its inability to differentiate between a narrowing of the deficit (surplus) due to the income effect and a narrowing of the deficit (surplus) due to the substitution effect.<sup>10</sup> 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 undervaluation greater in the CPI variant.

The results of the DARER estimations deflated both by CPI and PPI index (including and excluding the FDI effect) against USD are given in Figure 3, against JPY in Figure 6 in appendix.

Figure 3: Nominal and real CNY against USD and DARER



Note: E – nominal bilateral exchange rate, R – real exchange rate, CPI – consumer price index, PPI – producer price index, FDI – foreign direct investment.

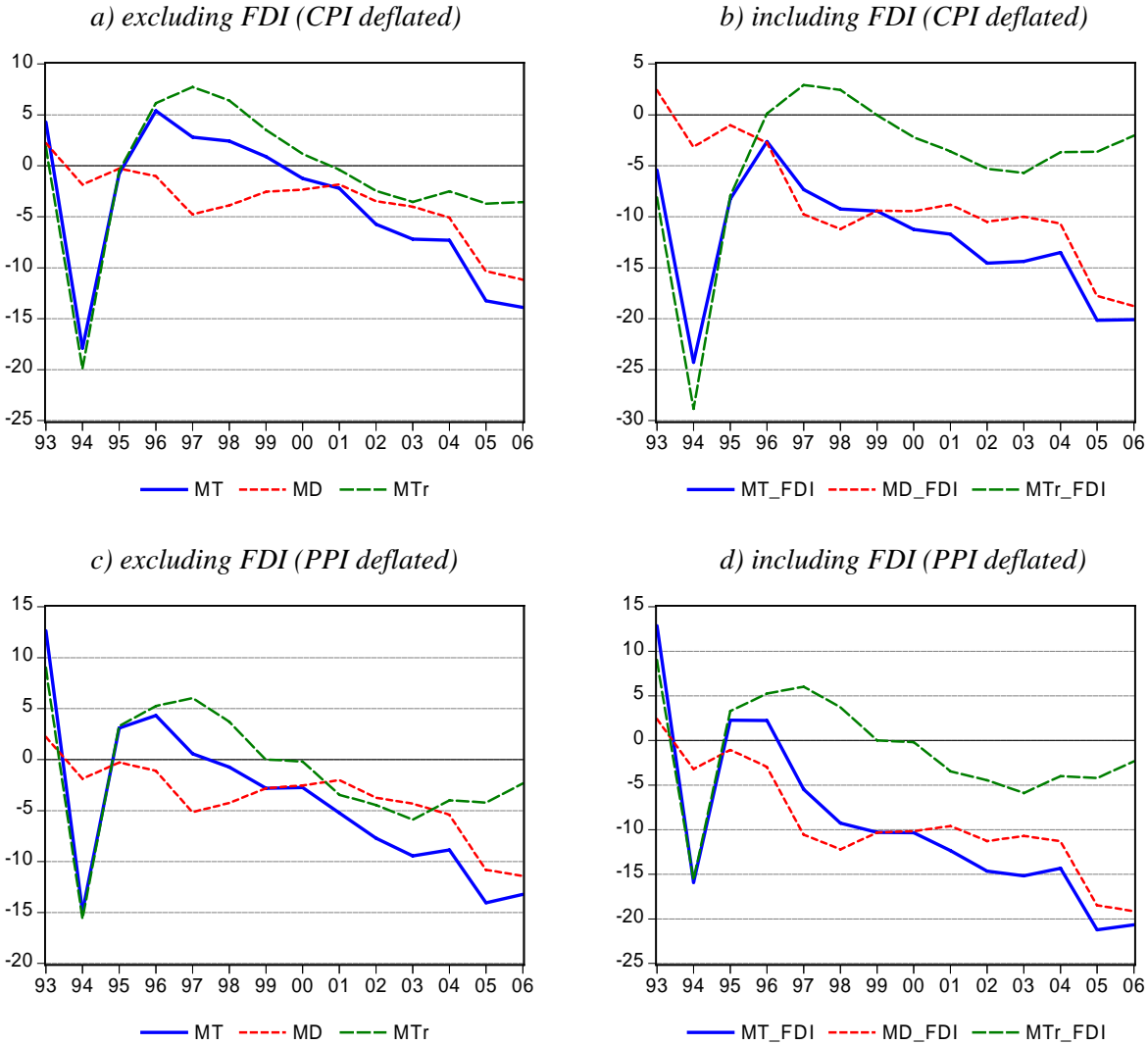
Source: own calculations based on IMF-IFS and EIB (The Economist) data.

The real exchange rate deflated both by CPI and PPI lies under the DARER trajectories, which indicates the undervaluation of the currency. The undervaluation of the Yuan against USD starts slowly in mid-1995 and maintain up to now. It could be also seen that the Chinese

<sup>10</sup> 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).

economy was not strongly affected by Asian crises during 1998-99, which also confirm our calculations.

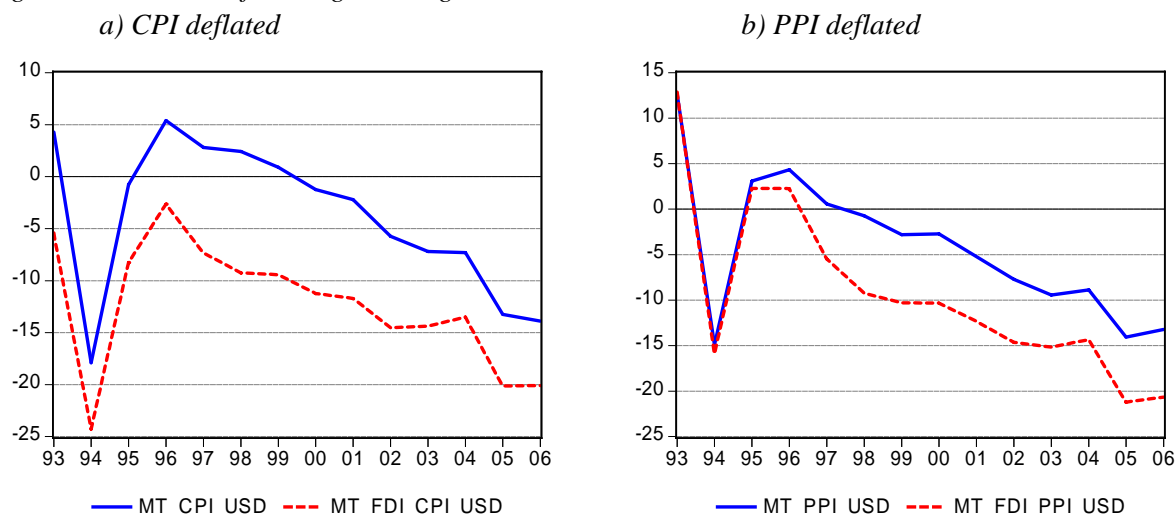
Figure 4: Total, debt and trend misalignment against USD (%)



Note: MT – total misalignment, MD – debt misalignment and MTr – trend misalignment, FDI – foreign direct investment.  
 Source: own calculations based on IMF-IFS and EIB (The Economist) data.

The calculations suggest that the real exchange rate of the Chinese currency is becoming increasingly undervalued both for CPI and PPI indexes. According to the variant taking FDI into account CNY is around 20% undervalued in real terms, but according to the FDI-excluding variant the yuan appears to be undervalued around 13%. This sizeable gap is due to the difference between the cumulative CA balance and the cumulative CA+FDI balance, as shown in Figure 3 for the USD, in Figure 6 than for JPY. Hence, the corridors of misalignment have to be constructed in order to show the dynamic of misalignment – see Figure 5 for the USD and Figure 8 for JPY in appendix.

Figure 5: Corridors of misalignment against USD



Note: MT – total misalignment, CPI – consumer price index, FDI – foreign direct investment, PPI – producer price index FDI – foreign direct investment.

Source: own calculations based on IMF-IFS and EIB (The Economist) data.

## 6. 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 and vice versa. This ignores very important aspects of intertemporal optimization 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 behavior. In this case, sustainability is ensured if the resulting current account path is consistent with intertemporal solvency, i.e. if the economy optimizes 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 economies as China 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, we 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.

The prospect of an appreciation of the Chinese currency in real terms is a long-run phenomenon that will come out of a rise in non-traded goods prices accompanying more balanced growth. Due to concerns about the pitfalls inherent in reforming its domestic financial system, however China will rightly open its capital accounts with great care. We will recommend not consider changing the peg to float immediately and to discuss all relevant ways in which higher flexibility could be introduced to the Chinese exchange rate policy. The degree of real undervaluation subsequently increases, reaching in average almost 20-25% in the end of 2006.

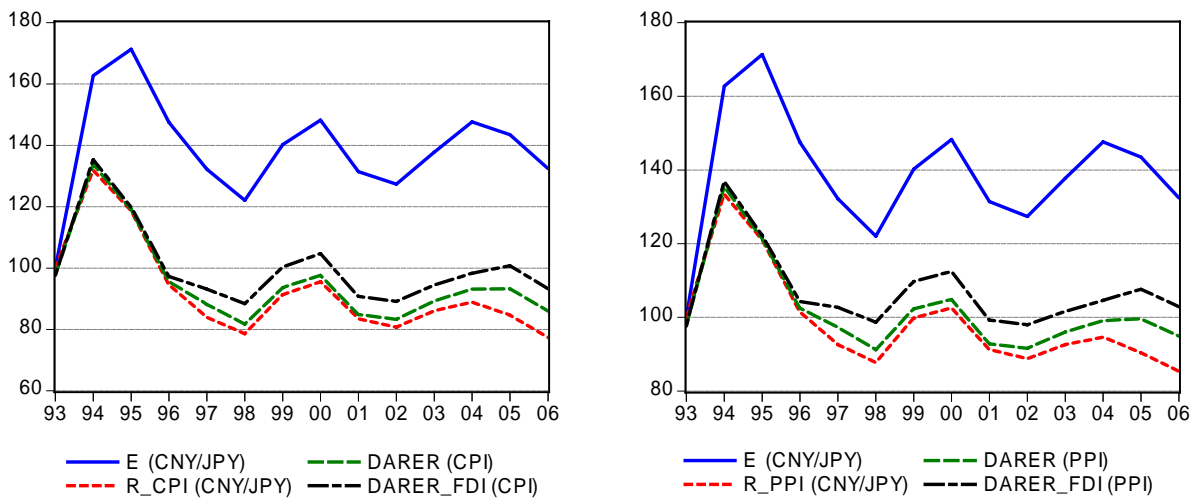
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## Appendix

Figure 6: Nominal and real CNY against JPY and DARER

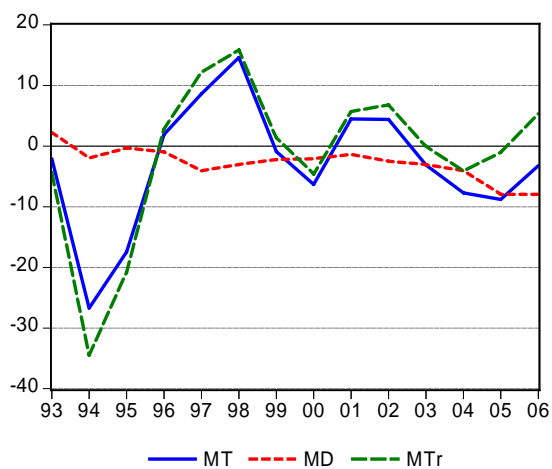


Note: *E* – nominal bilateral exchange rate, *R* – real exchange rate, *CPI* – consumer price index, *PPI* – producer price index, *FDI* – foreign direct investment.

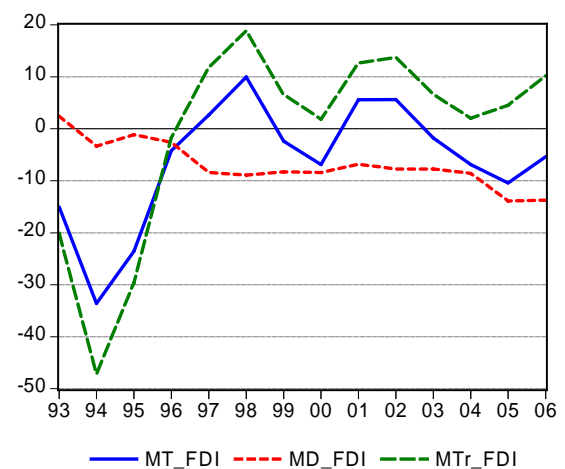
Source: own calculations based on IMF-IFS and EIB (The Economist) data.

Figure 7: Total, debt and trend misalignment against JPY (%)

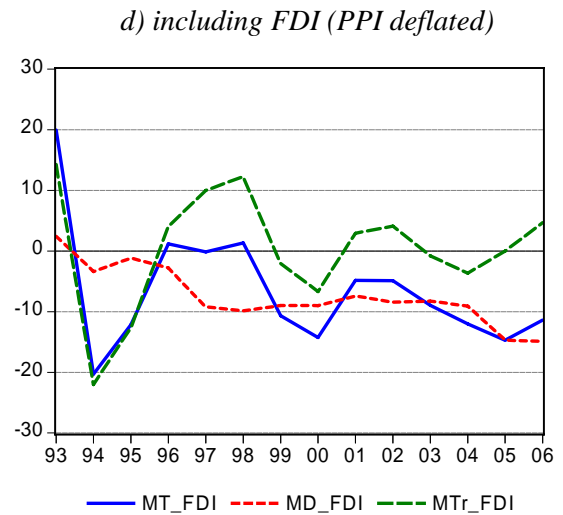
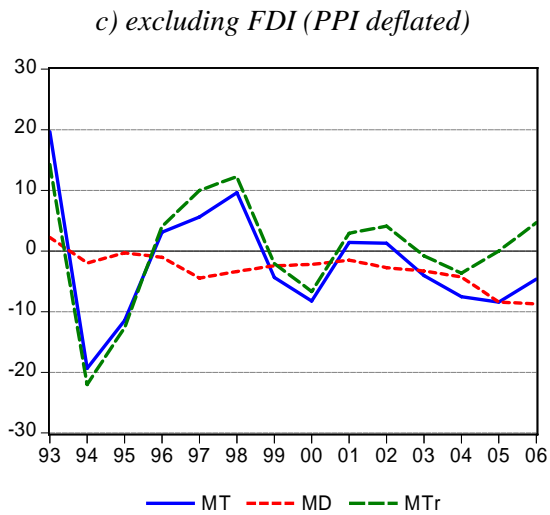
a) excluding FDI (CPI deflated)



b) including FDI (CPI deflated)

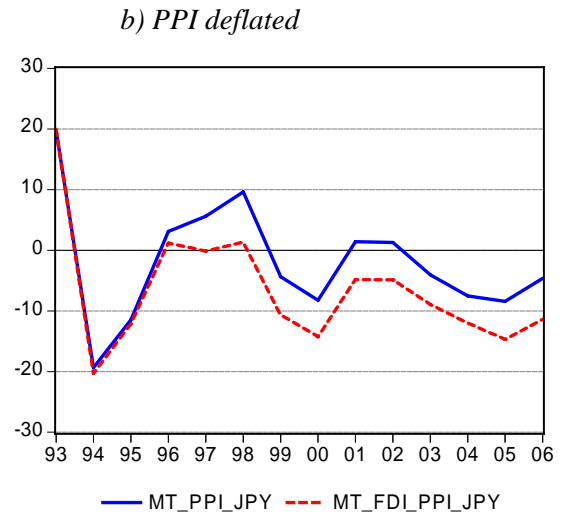
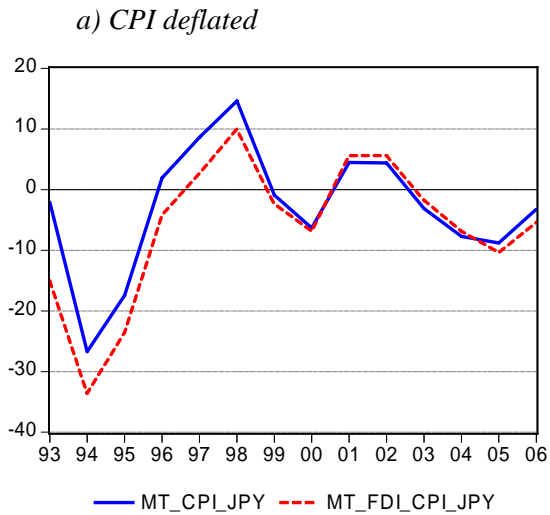






Note: MT – total misalignment, MD – debt misalignment and MTr – trend misalignment, FDI – foreign direct investment.  
 Source: own calculations based on IMF-IFS and EIB (The Economist) data.

Figure 8: Corridors of misalignment against JPY



Note: MT – total misalignment, CPI – consumer price index, FDI – foreign direct investment, PPI – producer price index.  
 Source: own calculations based on IMF-IFS and EIB (The Economist) data.