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Exchange Rate Misalignments and World Imbalances: A FEER Approach for Emerging Countries

Nabil Aflouk[*], Se-Eun Jeong[‡], Jacques Mazier[§], Jamel Saadaoui[‡‡][i]

Abstract

Since the mid-1990s, the world imbalances have increased significantly with a large US current deficit facing Asian surpluses, mainly Chinese. Since 2007, a partial reduction of these imbalances has been obtained, largely thanks to production's decreases, without large exchange rate adjustments. The Asian surpluses have remained important. The objective of this paper is to examine the exchange rate misalignments (ERM) of the main emerging countries in Asia and Latin America since the 1980s, so as to shed light on the 2000s by a long term analysis and compare with the industrialized countries' case. Our results confirm that ERM have been reduced since the mid-2000s at the world level, but the dollar remained overvalued against the East Asian countries, except the yen. Chinese, Indian and Brazilian exchange rate policies have been much contrasted since the 1980s. The Indian rupee has been more often overvalued while a more balance situation prevailed in Brazil only since the 2000s. The Latin American countries have faced wider and more dispersed ERM and current imbalances than East Asian countries. But Argentina, Chile and Uruguay benefits now of undervalued currencies while Mexico is closer to equilibrium.

JEL: F31, F32, O11

Keyword: Equilibrium Exchange Rate, Current Account Balance, Macroeconomic Balance, Emerging Countries

[*] PhD Student, Paris North University, CEPN-CNRS, aflouknabil@yahoo.fr

[‡] Professor, College of Economics and Management, Chungnam National University, jseeun@cnu.ac.kr

[§] Professor, Paris North University, CEPN-CNRS, mazier@univ-paris13.fr

[‡‡] PhD student, Paris North University, CEPN-CNRS, jamelsaadaoui@gmail.com

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1. Introduction

Since the mid-1990s, the world imbalances have increased significantly with a large US current deficit facing Asian surpluses, mainly Chinese. These imbalances reflect internal disequilibrium in each area, mainly American households' over-indebtedness and the declining US competitiveness on one hand, the insufficient Chinese households' consumption on the other hand. These imbalances have been lasting, partly thanks to the financial liberalization which has facilitated their financing. The present financial crisis has been the consequence of these imbalances. Since 2007, a partial reduction of these imbalances has been obtained, largely thanks to production's decreases, without large exchange rate adjustments. However, the Asian surpluses have remained important.

Exchange rates misalignments have been studied in details in the literature using two main approaches: the Behavioral Equilibrium Exchange Rate (BEER) and the Fundamental Equilibrium Exchange Rate (FEER). They generally concluded that the dollar was overvalued and that the euro was undervalued during the first half of the 2000s. While these misalignments have been gradually reduced, the yuan remained undervalued since the second half of the 1990s.

However less attention has been paid to emerging countries' ERM where contrasted evolutions can be observed. In most of the Asian emerging countries large current surpluses have been observed after the Asian crisis of 1997-1998. The oil producer countries have also benefited of important surpluses thanks to oil price's increase. Many countries in Latin America and in Africa have, on the contrary, suffered of current deficits, although limited. These divergent evolutions between emerging countries reflect different choices relating to growth model and exchange rate regime.

The objective of this paper is to examine the ERM of the main emerging countries in Asia and Latin America since the 1980s, so as to shed light on the 2000s by a long term analysis and compare with the case of industrialized countries.

For this purpose, a FEER approach is implemented. The FEER is defined as the level of exchange rate which allows the economy to reach the internal and external equilibriums at the same time (Williamson, 1983). The internal equilibrium is defined as the full utilization of productive resources of one country without generating inflation pressures. The external equilibrium corresponds to a sustainable current account.

In a first step, using a model of world trade, FEERs are estimated for the main currencies (the dollar, the euro, the yen, the yuan and the pound sterling). In a second step, FEERs can be estimated for each emerging country, using simple national models and linking the estimation of national FEERs to the multinational model's results to get bilateral misalignments of each currency.

Our results confirm that ERM have been reduced since the mid-2000s at the world level, but the dollar remained overvalued against the East Asian countries, except the yen. Chinese, Indian and Brazilian exchange rate policies have been much contrasted since the 1980s. The Indian rupee has been more often overvalued while a more balance situation prevailed in Brazil only since the 2000s. The Latin American countries have faced wider and more dispersed ERM and current imbalances than East Asian countries. But Argentina, Chile and Uruguay benefits now of undervalued currencies while Mexico is closer to equilibrium.

This paper is organized as follow. A second section summarizes the theoretical and methodological background. A third section presents the multinational model and the national models used to estimate the FEERs. A fourth section gives estimates of the external and internal equilibriums but focuses mainly on external imbalances. A fifth section presents estimates of the FEER for the main currencies and for emerging currencies. A comparison is made with other estimations, especially with the BEER approach. A last section concludes.

2. Theoretical and methodological background

By definition, ERM is defined as the gap, in percentage, between observed exchange rates and equilibrium exchange rates. Yet, various methodologies can be used to estimate equilibrium exchange rates.

2.1. Equilibrium exchange rates methodologies

The PPP (Purchasing Power Parity) is the oldest one and simplest methodology to estimate equilibrium exchange rates. In order to explain movements of equilibrium exchange rates, this simple approach only relies on the relative prices. It ignores, however, other structural factors and seems too schematic, even when completed by a Balassa-Samuelson effect.

Beyond the PPP hypothesis, two main theories of equilibrium exchange rates can be distinguished: a) the Fundamental Equilibrium Exchange Rate (Williamson, 1983) and its recent developments (Cline, 2008), b) the Behavioural Equilibrium Exchange Rate which is an econometric approach (Clark & MacDonald, 1998). The Natural Real Exchange Rate (NATREX) tries to give a theoretical basis with a dynamic analysis but is close to the BEER approach in practice (Stein & Allen, 1997).

The BEER approach explains the exchange rate dynamic with some main variables (usually the net foreign assets, the terms of trade, the productivity and the oil prices) which influence the real exchange rate at long term.

A long term equation is first estimated by a co-integration method and then, using an error correction model, a short term equation is estimated. The ERM are simply measured by the gap between the observed exchange rate and its long run value. This econometric approach is rather easy to manage and gives useful results. However, the theoretical basis can be regarded as underdeveloped. And the recent improvements have been mainly econometric and statistic.

The FEER is defined as the exchange rate prevailing when the economy simultaneously reaches the external equilibrium (a sustainable current account determined by structural parameters) and the internal equilibrium (full utilization of the productive potential). This approach is based on a structural model which mainly describes foreign trade relations and relates explicitly movements of exchange rates to internal and external imbalances. It has the advantage of focusing directly on structural parameters of each country. It allows for the estimation of equilibrium exchange rates of the different partners in a coherent manner by using a multinational trade model, which is rarely assured in other approaches. Its limited linkages with the inter-temporal optimizing literature are often criticized but the FEER does not pretend to describe the modality of the return to the equilibrium. It searches only, for each period, to estimate the real misalignment induced by the internal and external imbalances in terms of comparative statics.

Despite the fact that each approach has its advantages and its drawbacks, we prefer the FEER approach because it is more explicitly articulated with the structural characteristics of each country and it ensures greater consistency of estimates across countries.

2.2. The FEER approach and the SMIM

We conduct a two-step analysis (Jeong et al., 2010) in order to estimate the ERM, first at the world level for the main currencies (the dollar, the euro, the yuan, the yen and the pound sterling), second at the level of each emerging country.

First, for the main currencies, the methodology used is a synthesis of previous works on the FEER (Borowski & Couharde, 2003; Jeong & Mazier, 2003) and of the Symmetric Matrix Inversion Method (SMIM) recently proposed by Cline (2008). A multinational model describing the foreign trade of the main countries and of the Rest of the World is used to calculate the main currencies' equilibrium exchange rates. It is well known that in an *n-country* model there are only *n-1 independent bilateral exchange rates*, because the first country's exchange rate (usually the dollar) is the numeraire against which the others are compared. Consequently, there is an overdetermination problem in the FEER approach, as there are more equations (current account targets) than unknowns (exchange rates).

In this paper, we use the n^{th} country as a residual in order to solve the overdetermination problem and to ensure the consistency of the world trade in volume and in value. Exports and imports of the residual country are calculated as residual of the world trade equilibrium in constant and current prices. But the equilibrium exchange rate of the residual currency, consistent with those of the other currencies, cannot allow the residual country to reach its equilibrium current account. In that respect the residual country is ignored in the estimation of the equilibrium exchange rates of the other currencies. In practice, in earlier works, it was generally the Rest of the World which was the residual country.

To avoid such an asymmetric approach and following the SMIM approach, the six countries (the United States, China, Japan, the United Kingdom, the Euro area and the Rest of the World) will be treated symmetrically by carrying out six sets of estimates with six multinational models where each country is treated successively as a residual. A simple average of the results could be obtained. However, there is a high degree of consistency in the alternative estimates of equilibrium exchange rates for any given country across the 5 solutions in which the current account target of the country in question is included (designated OCI for own country included). Conversely, there is sometimes a great difference between the average value and the value obtained in the resolution where the country or area target is not included (designated OCE for one country excluded). Consequently, the solution adopted in this paper will be to use (as the estimate of the FEERs) the average of equilibrium exchange rates obtained from all the solutions, except the one for which the country in question is regarded as a residual (OCI).

Secondly, for each emerging country, an equilibrium exchange rate will be estimated using a simple national model of foreign trade. The equilibrium exchange rate will be defined, as previously, as the exchange rate compatible with the internal and external equilibriums of each country. It has been shown that, for a relatively small country, a national model gives results very close to the ones obtained with a multinational model where the studied country would be explicitly described (Jeong & Mazier, 2003).

This methodology improves previous works at several levels. Compared with approaches which ignore one area (the Rest of the World in practice), our model gives a symmetric treatment of all the countries, like Cline's SMIM, as each country is successively treated as residual. Compared with Williamson's earlier works using large econometric models, we construct simpler model to manage. However, the foreign trade model takes fully account of the interdependencies among main economies, including the one treated as a residual, which ensures consistency of worldwide results. Another advantage of our approach is the case of small countries which can be simply linked to the world model's results, as it will be explained more in detail. In this sense, our approach takes more consistently account of structural parameters of each economy and is more manageable than a model of thirty-five countries with a simple reduced equation between the current account and the real effective exchange rate for each country (Cline, 2008). Moreover, our model incorporates the effects of the foreign debt service and of the oil prices on the current account but they are treated as exogenous.

Lastly, based on studies of the medium-term determinants of current accounts (Faruqee & Isard, 1998; Chinn & Prasad, 2003), the equilibrium current account are determined by estimating structural determinants of current account (the demographic features, the developmental stage, the public deficit, the net foreign assets, etc...) relying on panel regression techniques. It avoids using an ad hoc approach which is often used, but seems less well founded. Sensitivity tests are conducted in order to assess the sensitivity of the results to adopted targets (current account target, internal equilibrium) and to values of parameters (price-elasticities).

3. Macroeconomic modeling

3.1. The multinational model

The model describes the trade structure of the main countries or areas, namely, the United States, Japan, China, the Euro area, the United Kingdom and the Rest of the World using standard foreign trade equations: export volume equation [1], import volume equation [4], export price equation [7] and import price equation [8]. Each country is successively treated as a residual and in that case export and import volumes are determined as residual of the equations of world trade equilibrium in value [5] and in volume [6] while their export and import prices are determined in the same manner as for other trading partners. We notice that this multinational specification gives a full account of interdependent effects in volume and prices of exports and imports of all countries. We incorporate a consumer prices equation [9] to take into account the feedback effect between the consumer prices and the import prices. The real effective exchange rate is defined relatively to the consumption prices. Finally, the current account is defined as in equation [11]. For the residual country, its current account can be calculated (equation [12]) but is not taken in account.

With usual notations, the model is written as:

Foreign trade volume equations

Export volume equation

$$X_i = X_{0i} DM_i^{\eta xi} COMPX^{\varepsilon xi} \quad [1]$$

$$DM_i = \prod_{j \neq i} M_j^{\alpha ij} \quad [2]$$

$$COMPX_i = PMX_i / PX_i \quad [3]$$

Import volume equation

$$M_i = M_{0i} DI_i^{\eta mi} \left(PD_i / PM_i \right)^{\varepsilon mi} \quad [4]$$

With i = 1 ~ 5 {among Japan, China, the United States, the Euro area, the United Kingdom, the Rest of the World} = {all the countries except the residual one}

World trade equilibrium in value and in volume

Equilibrium in value

$$\sum_i PX_i X_i / E_i = \sum_i PM_i M_i / E_i \quad [5]$$

Equilibrium in volume

$$\sum_i X_i = \sum_i M_i \quad [6]$$

With i = 1 ~ 6

Price equations

Export price equation

$$PX_i = PMX_i^{\alpha xi} P_i^{1-\alpha xi} \quad [7]$$

$$PMX_i = \prod_{j \neq i} \left(E_i PX_j / E_j \right)^{\lambda ij}$$

Import price equation

$$PM_i = PMM_i^{\alpha mi} PD_i^{1-\alpha mi} \quad [8]$$

$$PMM_i = \prod_{j \neq i} \left(E_i PX_j / E_j \right)^{\mu ij}$$

Consumer price equation

$$PD_i = PM_i^{ai} P_i^{1-ai} \quad [9]$$

Real effective exchange rates

$$R_i = \prod_{j \neq i} \left[\left(PD_j / E_j \right)^{vij} / \left(PD_i / E_i \right) \right] \quad [10]$$

With i = 1 ~ 6

Current account

Current account

$$B_i = PX_i X_i - PM_i M_i - E_i P_{pet} M_{peti} - i_i E_i F_i \quad [11]$$

$$B_{res} = -\sum_{i=1}^{5} B_i \quad [12]$$

With i = 1 ~ 5 {among Japan, China, the United States, the Euro area, the United Kingdom, the Rest of the World} = {all the countries except the residual one}

The multinational model variables are defined as follow: *X*, non-oil exports in volume; *DM*, world demand in volume; *DI*, internal demand in volume; *COMPX*, export prices competitiveness; *PX*, export prices; *PMX*, competitor export prices; *M*, non-oil imports in volume; *PM*, import prices; *PMM*, world import prices; *PD*, consumer prices; *P*, production prices; *E*, nominal bilateral exchange rates vis-à-vis the dollar; *R*, real effective exchange rates; *B*, current account; *i*, interest rates for external debt; *F*, net external debt; *Ppet*, oil price; *Mpet*, net oil import.

We notice that in the model the dollar plays the role of numeraire ($E_3 = 1$) and the bilateral exchange rates of other currencies against the dollar are written as 1 dollar = E_1 yens = E_2 yuans = E_4 euros = E_5 pounds = E_6 monetary unities of the Rest of the World.

In this framework, the FEERs are defined as the real effective exchange rates compatible with the simultaneous realization of the internal and external equilibriums at medium term of each trading partner. The internal equilibrium means that actual output follows the potential production and the external equilibrium means that actual current account corresponds to the sustainable current account at medium term.

The model is written in logarithmic differential compared with the equilibrium, which directly calculates the extent of the misalignment. Variables in lower case correspond to the log differences of these variables, thus $e = dLogE = dE/E = (E - E^e)/E^e$ for the bilateral exchange rate and $x = dLogX = dX/X = (X - X^e)/X^e$ for other variables, except for current account $b = (B/PY) - (B/PY)^e$ where the variable *b* represents the difference between the observed current account and the equilibrium current account as a percentage of GDP. The values of bilateral ERM (*e*) are given by solving the model in logarithmic differential (appendix 1).

On the whole, each multinational model comprises 35 endogenous variables (*x*, *m*, *px*, *pm*, *pd* for the six countries or areas and the five bilateral exchange rates *e*) for 35 equations (*x*, *m*, *b* for the five countries other than the residual one, *px*, *pm*, *pd* for the six countries and the two world trade equilibrium equations). The real effective exchange rates are calculated *ex post* using bilateral exchange rates and consumer prices.

The production prices *p* are supposed to be at equilibrium, which means that we do not include a price-wage loop in our model. The two exogenous variables are the internal and the external equilibrium gap (*di* and *b*, respectively).

In logarithmic differential form, the degree by which the economy deviates from its internal and external equilibrium determines the degree of misalignments of its currency. On the one hand, the degree of deviation of internal demand is measured by $di = (DI - DI^e)/DI^e$ where DI^* is the equilibrium internal demand. This equilibrium internal demand is linked to the potential production. On the other hand, the gap between actual current account and equilibrium one, as a percentage of GDP, is given by *b*. This variable, which quantifies the deviation from the external equilibrium, is central in determining ERM.

As mentioned before, each country is treated successively as residual, which gives six multinational models. The six countries are treated symmetrically, including the Rest of the World, and six sets of estimates are done successively with each multinational model. In each case it permits to calculate an "equilibrium exchange rate" of the residual currency (e_{res})

coherent with the equilibrium exchange rates of the five other countries, but not with its current account target. A simple average of the results could be obtained. But it is preferable to use (as an estimate of the equilibrium exchange rates) the average obtained for all the solutions, except the one for which the country in question is regarded as a residual (OCI).

3.2. The national model

For each emerging country, except China, it is possible to estimate an equilibrium exchange rate using a foreign trade model in which the world demand and world trade prices are exogenous. As explained above, it is not necessary for a relatively small country at the world scale to use a multinational model to estimate equilibrium exchange rates. The following equations specify the trade volume and price equations for a small country facing world economy. The equation [17] describes the formation of current account.

With usual notations, the model is written as:

$$X_i = X_{0i} D_i^{*\eta xi} \left(E_i P_i^* / PX_i \right)^{\varepsilon xi} = X_{0i} D_i^{*\eta xi} R_i^{(1-\alpha xi)\varepsilon xi} \quad [13]$$

$$M_i = M_{0i} DI_i^{\eta mi} \left(P_i / PM_i \right)^{\varepsilon mi} = M_{0i} DI^{\eta mi} R_i^{-\alpha mi \varepsilon mi} \quad [14]$$

$$PX_i = \left(E_i P_i^* \right)^{\alpha xi} P_i^{1-\alpha xi} = R_i^{\alpha xi} P_i \quad [15]$$

$$PM_i = \left(E_i P_i^* \right)^{\alpha mi} P_i^{1-\alpha mi} = R_i^{\alpha mi} P_i \quad [16]$$

$$B_i = PX_i X_i - PM_i M_i - E_i P_{pet} M_{peti} - i_i E_i F_i \quad [17]$$

$$R_i = \left(E_i P_i^* / P_i \right) \quad [18]$$

$$P_i^* = PX_i^* = \prod_{j \neq i} \left(PX_j / E_j \right)^{\lambda ij} \cong PM_i^* = \prod_{j \neq i} \left(PX_j / E_j \right)^{\mu ij} \quad [19]$$

With i = 1 ~ 12 {Korea, India, Malaysia, Thailand, Indonesia, Philippines, Brazil, Argentina, Mexico, Chili, Uruguay, Colombia} and j = 1 ~ 6 {Japan, China, the United States, the Euro area, the United Kingdom, the Rest of the World}[1]

The national model variables are defined as follow: *X*, non-oil exports in volume; D^*, world demand in volume; P^*, world prices; *PX*, export prices; *M*, non-oil imports in volume; *DI*, internal demand in volume; *PM*, import prices; *P*, production prices; *E*, bilateral exchange rate against the dollar; *R*, real effective exchange rates; *B*, current balance; *i*, interest rates for external debt; *F*, net external debt; *Ppet*, oil price; *Mpet*, net oil import.

Solving this simplified model in logarithmic differential (appendix 2) form gives *r*, misalignment in real effective terms $r = dLogR = dR/R = (R - R^*)/R^*$:

$$r_i = \left[\frac{\left(\left(b_i / \left[\mu_i T_i \left(1 - \sigma_{petxi} - \sigma_{xi} \right) \right] \right) + \eta m_i di_i - \eta x_i d_i^* \right)}{\left(\left(1 - \alpha x_i \right) \varepsilon x_i + \varepsilon m_i \alpha m_i + \alpha x_i - \alpha m_i \right)} \right] \quad [20]$$

[1] The Rest of the World is calculated as in the multinational model. In addition, we remove the country for which we calculate the misalignment from the world trade flows in order to calculate the Rest of the World in the national model. The difference is negligible since the countries in the national model are small at the world level.

Where $\sigma_{petx} = EP_{pet}M_{pet}/PXX$, ratio of net oil imports on non-oil exports and $\sigma_x = iEF/PXX$, ratio of foreign debt service on non-oil exports.

The FEER approach focuses on the real effective exchange rates. However, the nominal bilateral exchange rate against the dollar of each currency can be more intelligible. By using the equation [18], we can find out *e*, the degree of misalignment in bilateral nominal term; the partner countries' misalignments are given by the previous multinational model:

$$e_i = r_i - \sum_{j \neq i} \lambda_{ij} \left(px_j - e_j \right) \quad [21]$$

We can also compute the effective ERM based on consumer prices:

$$rc_i = \left(1 - \alpha m_i \mu_i\right) r_i + \sum_{j \neq i} \nu_{ij} \left(pd_j - e_j \right) - \sum_{j \neq i} \lambda_{ij} \left(px_j - e_j \right) \quad [22]$$

3.3. Foreign trade elasticities

Without doing original econometric work, trade equations are taken from existing estimations realized with specifications close to the standard model presented before. We use especially long-term elasticities. The main results are presented in appendix 3. Considering the uncertainty surrounding estimations, sensitivity tests to elasticity modifications are provided in appendix 4. The sensitivity to volume and price elasticities appears to be limited.

4. External and internal equilibrium at medium term

4.1. Estimation of equilibrium current account

As current account equals the difference between domestic saving and investment, the current account equilibrium is examined from the perspective of the medium and long run determinants of saving and investment behaviors (Faruqee & Isard, 1998; Chinn & Prasad, 2003). According to these authors, the main determinants of the current account at medium term are: the demographic characteristics, such as, the dependency ratios of dependent populations relative to the working age population, which is expected to exert a negative influence, with a higher dependency ratio leading to more spending; the net foreign asset, which is expected to have a positive effect, due to the capital income resulting from it; the government budget balance, with a public deficit having a negative effect on the current account, but this effect may be regarded as a simple accounting one[2] which should not to be introduced.

Finally, we introduce a short-term effect, the output gap, since a higher utilization of production capacity leads to a deterioration of the current account. Yet, this last variable will be eliminated in the simulation of the equilibrium current account.

The equations of current account are estimated with panel data for 1980-2003 period and for two groups of countries. In a medium term perspective, we use non-overlapping four years average of annual data (Lee et al., 2008).

[2] There are other variables, such as the openness ratio, which plays negatively, a higher openness meaning a greater possibility of assuring the debt service in the future, or the relative real GDP per capita, which exerts a non linear influence according to stages of development. We tried these variables, but results were not significant enough. Moreover, relative GDP per capita is evaluated non stationary by most of tests.

The variables of equation [23] are defined as follows: *CA*, current account as % of GDP; *ISNFA*, initial stock of net foreign assets at the beginning of each period of 4 years as % of GDP; *CDR*, child dependency ratio, population under the age of 15 years as % of population aged 15 to 64; *ODR*, old dependency ratio, population over the age of 65 years as % of population aged 15 to 64; *OG*, output gap in % of the potential production. The sources of the different variables are presented in appendix 5.

$$CA_{it} = \alpha_i + \alpha_t + \beta_0 + \beta_1 ISNFA_{it} + \beta_2 CDR_{it} + \beta_3 ODR_{it} + \beta_4 OG_{it} + \varepsilon_{it} \quad [23]$$

One group is composed of 19 industrial countries (Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Korea, Spain, Sweden, the United Kingdom and the United States) and will be used for determining the current account targets of the United States, Japan, the Euro area, the United Kingdom and Korea.

The other group, composed of 26 emerging economies (Algeria, Argentina, Bolivia, Brazil, Chile, China, Colombia, Ecuador, Egypt, India, Indonesia, Malaysia, Mexico, Morocco, Pakistan, Paraguay, Peru, Philippines, Singapore, Sri Lanka, Thailand, Tunisia, Turkey, Uruguay, Venezuela and Vietnam), will be used for determining the current account target of China and other emerging countries.

The results of unit root tests are presented in appendix 6. As it can be seen, we reject the null hypothesis of non-stationarity in all the series.

For industrialized countries, the estimated coefficients of equation [23] are on the whole significant with the predicted signs (Table 1) in different specifications. The dependency ratios are not highly significant, although they are the best theoretically justified variables. Output gap turns out to have negative effects on current account. Country effects raise the determination ratio. On the whole the cross section specification with country fixed effects seems the most relevant and is adopted in order to calculate the equilibrium current account.

Table 1. Determinants of the current account for industrialized countries

	OLS Pooled	*Individual Fixed Effects*	*Temporal Fixed Effects*
Constant	6.69** (2.14)	11.27*** (3.29)	0.69 (0.29)
ISNFA	0.06*** (10.87)	0.02** (2.22)	0.07*** (8.51)
CDR	-0.16** (-2.23)	-0.26*** (-4.18)	0.00 (0.02)
ODR	-0.09 (-1.32)	-0.19** (-2.28)	-0.03 (-0.51)
OG	-0.31*** (-2.82)	-0.47*** (-5.77)	-0.51*** (-4.09)
Adjusted R²	*0.47*	*0.89*	*0.56*

(Source: authors' estimates)
(( ) = T statistics; *** = significant at 1%, ** = significant at 5%, * = significant at 10%)
(Coefficients robust to heteroskedasticity)

Results for emerging countries are less conclusive than those for industrial countries, as in the case of other empirical studies (Chinn & Prasad, 2003). The specification has been slightly modified by using a single dependency ratio (DR) with both child and old population and introducing the oil products balance (OB) as increasing oil prices improve oil producers' current accounts and deteriorate other emerging countries' current accounts. As previously, the coefficients are on the whole significant with predicted signs in the different specifications (Table 2). Country effects raise the determination ratio. Like previously, the cross section specification with country fixed effects seems the most relevant and is adopted in order to calculate the equilibrium current account.

Table 2. Determinants of current account for developing countries

	OLS Pooled	*Individual Fixed Effects*	*Temporal Fixed Effects*
Constant	8.78*** (6.62)	14.23*** (7.11)	3.85*** (2.79)
ISNFA	0.07*** (9.88)	0.06*** (6.20)	0.07*** (11.90)
DR	-0.11*** (-5.45)	-0.20*** (-6.67)	-0.03 (-1.60)
OB	0.21*** (6.35)	0.22*** (2.65)	0.19*** (6.27)
OG	-0.39** (-2.49)	-0.37** (-2.49)	-0.32* (-1.86)
Adjusted R²	*0.50*	*0.57*	*0.60*

(Source: authors' estimates)
(( ) = T statistics; *** = significant at 1%, ** = significant at 5%, * = significant at 10%)
(Coefficients robust to heteroskedasticity)

4.2. The simulated equilibrium current balances

For simulating equilibrium current balances, we use the value of initial stocks of net foreign asset at the beginning of each four years period's and four years average values of dependency ratios and other variables, but we exclude output gap in order to remove short-term effects. Figures 1 to 5 show the observed and equilibrium values of the current account for the main industrialized and emerging countries.

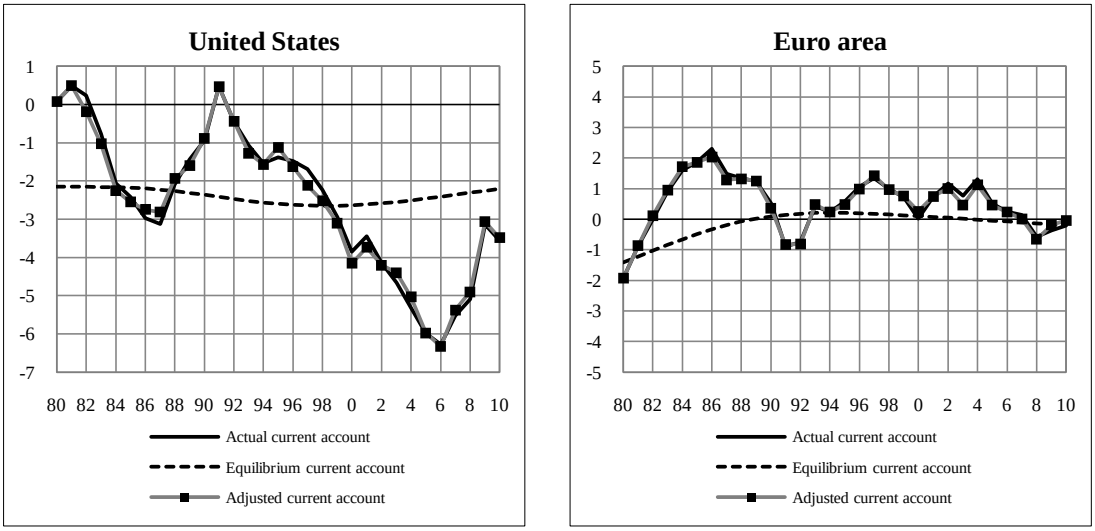
A last correction should be specified. In the FEER theoretical framework, the whole difference between observed current balance and equilibrium one must not be interpreted entirely as an external disequilibrium. This difference is partly due to delayed effects of exchange rates variations that have not yet occurred entirely, but should be taking into account in the estimation. This correction is made using the dynamic structure of external trade equations. These figures show observed and adjusted current accounts with equilibrium ones.

The US current account target is between -2 and -3% of GDP over the period. In several approaches on international imbalances, the target of -3% of GDP is selected for the U.S. current account deficit in the medium term (Ahearne et al., 2007). The simulated target for the current account deficit of the United States thus appears consistent with approaches that set the standard deficit on an ad hoc basis. The US current account has known contrasted periods

with large deficits, like in the middle of the 1980s and the 2000s, and more equilibrated positions at the beginning of the 1980s and 1990s (figure 1).

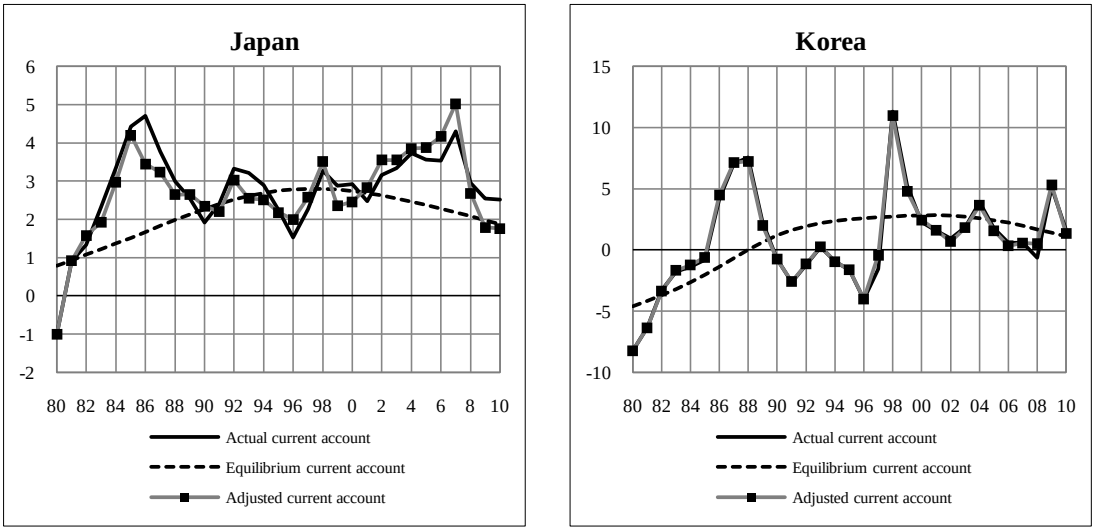
The Euro area is in a very different situation. Since the mid-1990s, the Euro area's equilibrium current account has been close to zero with a slight improvement over the early 1980s, thanks to a growing external position. The amplitude of current imbalances in the Euro area (as a whole) is weak compared to those observed in other major world economies. However, this "balanced" situation in the Euro area masks a great heterogeneity for each Euro area's member.

Figure 1: Actual and equilibrium current accounts of the USA and the Euro area[3]



(Source: authors' calculation, International Monetary Fund (World Economic Outlook, April 2010) for the observed current account as % of GDP, forecast for 2010)

Figure 2: Actual and equilibrium current accounts of Japan and Korea



(Source: authors' calculation, International Monetary Fund (World Economic Outlook, April 2010) for the observed current account as % of GDP, forecast for 2010)

[3] The observed current account of the main trade partners have been corrected from the global discrepancy proportionately to theirs weights in the world trade (Source: CHELEM; World Economic Outlook, April 2010 (International Monetary Fund)).

Since the 1980s Japan has known huge current surpluses, far above its equilibrium value during the 1980s and 2000s. Actually this equilibrium current account balance has experienced contrasting trends. It has increased until the mid-1990s under the effect of its improving net external position due to surpluses' accumulation. Then the Japanese equilibrium current account balance deteriorated due, mainly, to a sharp increase in the old dependency ratio (ODR) which reduced national savings since it increased the share of inactive with low saving ratio (figure 2).

South Korea presents some similitude with the Japanese case with large current surpluses in the second half of the 1980s and after the Asian crisis of 1997. The equilibrium current account has increased a lot since the 1980s, from around -4% of GDP up to 1% in the 1990s, thanks to its increasing net external position and a moderate declining dependency ratio. During the 2000s the Korean current account remained close to its equilibrium value.

The B(R)ICs, the most important emerging countries, are interesting to compare together because they have faced contrasted evolutions (figure 3). First, China had an equilibrium current account close to zero % of GDP during the 1980s and the first years of 1990s, which seems coherent with the policy adopted by Chinese authorities that wanted to avoid the resort to large external debt. The structural reforms, which started in 1979, have allowed a progressive openness to foreign trade while the productive sector was modernized. During the 1990s the openness has accelerated with large inflows of foreign direct investments. Since the mid-1990s, the equilibrium current account has increased to reach 2% of GDP in 2008. In this evolution the improvement of net external position and the decreasing of the dependency ratio played a positive role. On the whole Chinese surpluses have become larger after the second half of the 1990s in spite of the impact of the Asian crisis after 1998.

Second, in India economic reforms have been more limited than in China (Chauvin & Lemoine, 2005). However accelerated growth and increasing imports have induced large current deficits, which reflects a very different economic strategy compared with China. At the beginning of the 2000s, the improvement of the current account was mainly explained by a slowdown with decreasing imports and by rising agricultural prices of export goods. It didn't last and the growth recovery combined with the increase of oil prices induced a new huge deficit after 2005. The current account equilibrium, largely negative during the 1980s, increased progressively to reach zero % of GDP at the middle of the 2000s, mainly thanks to the improvement of the net external position and of the dependency ratio. At the end of the 2000s, the equilibrium current account decreased to -1% of GDP due to a degradation of the net external position.

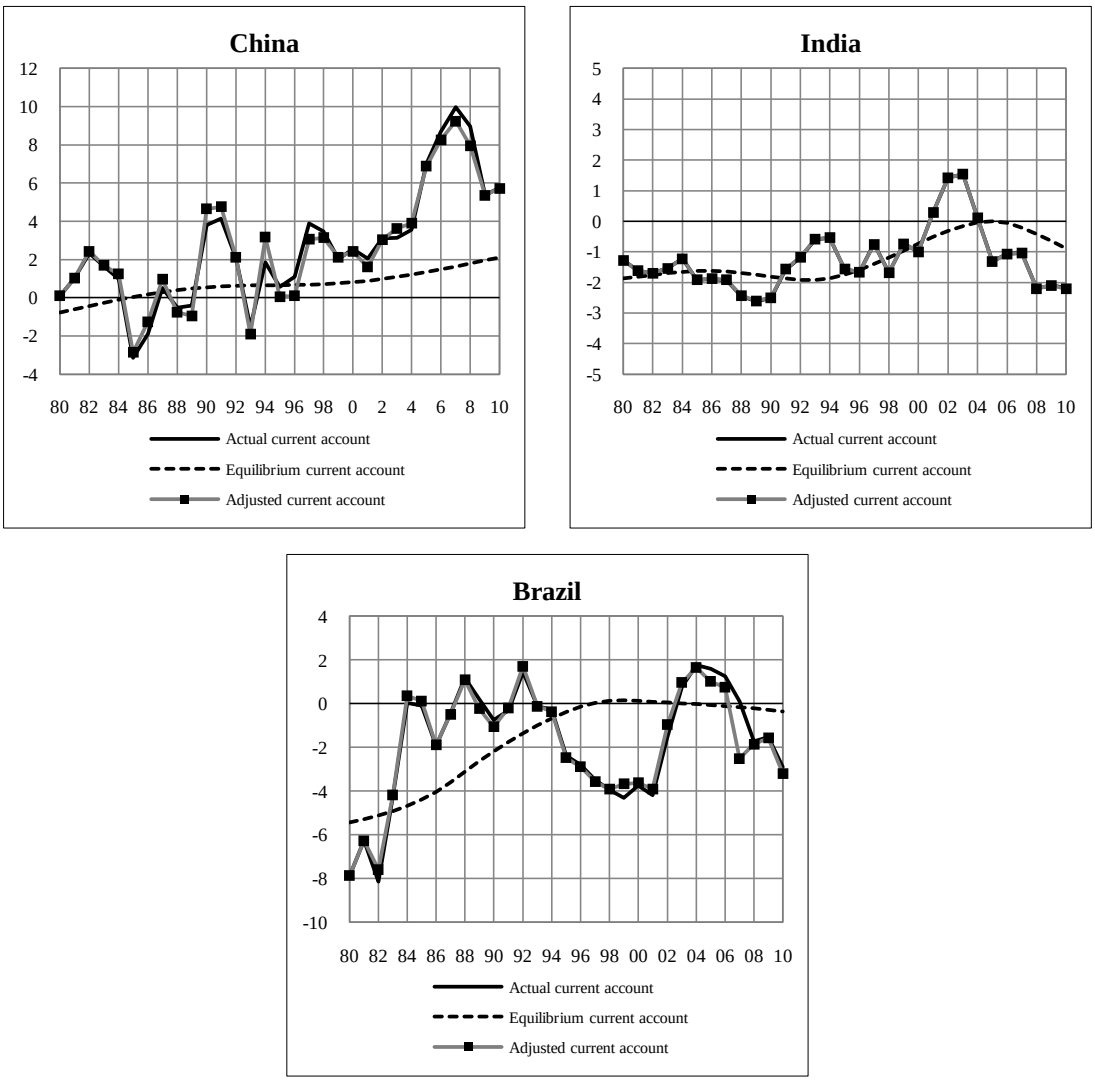
Third, Brazil is a last case as current deficits have been far larger than in China and India at the beginning of the 1980s (around -8% of GDP, before the debt crisis) and in the second half of the 1990s (-4% of GDP, after the success of the Plan Real and the large flow of foreign direct investments). The current account equilibrium was highly negative at the beginning of the 1980s (-5% of GDP), which reflected a growth strategy based on foreign debt, quite different from the Chinese and even Indian cases. But it increased regularly up to a level close to 0% in the 2000s, mainly thanks to the decline of the dependency ratio.

The South East Asian countries present some similarities (figure 4). During the 1980s and especially during the 1990s before the financial crisis of 1997-1998, their current accounts have often been inferior to their equilibrium values which were close to 0% of GDP in Indonesia and Malaysia and negative, but increasing thanks to the decrease of the dependency ratios, in Thailand and Philippines. High rates of growth and the resort to foreign debt and

FDI can explain this configuration. After the Asian crisis and the large devaluations that followed, the East Asian countries have accumulated important current surpluses with the export booms. During the 2000s these surpluses have decreased, especially in Thailand and, to a less extent, in Indonesia. On the whole, the current accounts remained higher than the equilibrium values which were close to 0% of GDP. In Malaysia and Philippines the current surpluses were larger, but with increasing equilibrium values due the improvement of their net foreign positions, especially in Malaysia.

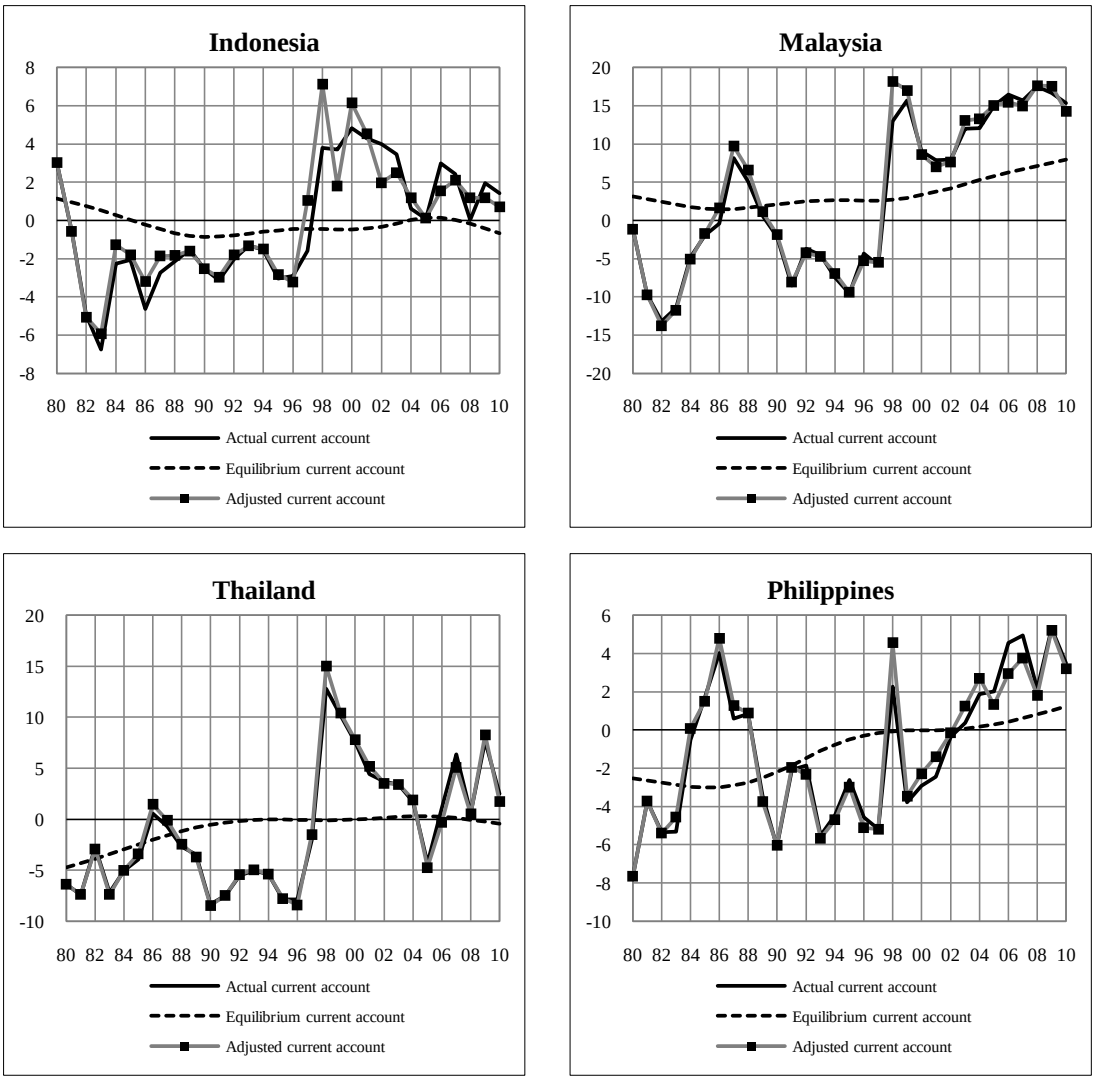
The current account imbalances of Latin American countries are larger and more frequent than those observed in East Asia (figure 5). In Mexico and Colombia, after the debt crisis of 1982 and the following devaluations, the current surpluses didn't last. Deficits reappeared and remained during the 1990s and 2000s, largely under the current account equilibrium. These equilibrium values increased sharply from -5% at the beginning of the 1980s up to 0% at the end of the 2000s due to the decline of the dependency ratio and to the rising oil prices during the 2000s, especially in the Mexican case.

Figure 3: Actual and equilibrium current accounts of China, India and Brazil



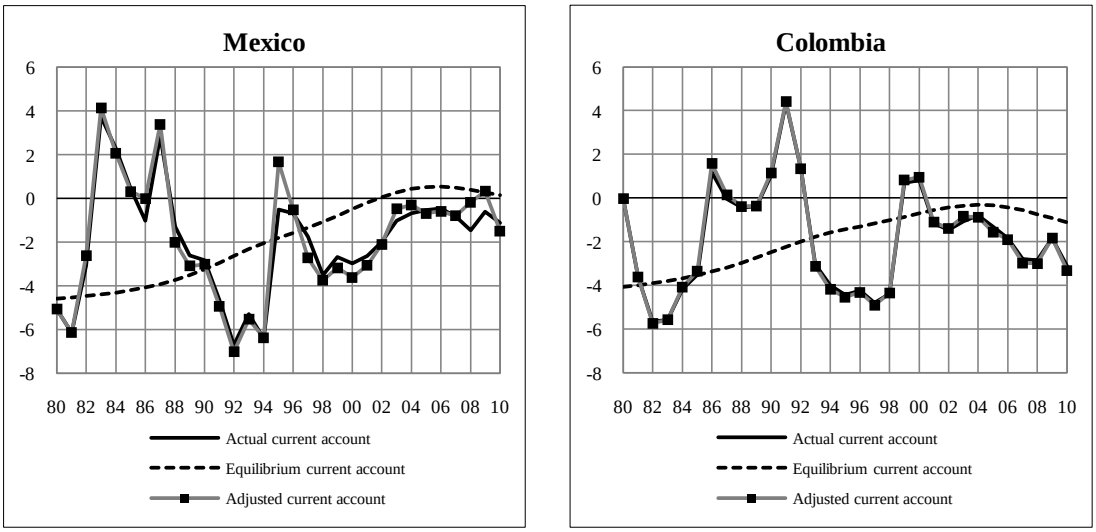
(Source: authors' calculation, International Monetary Fund (World Economic Outlook, April 2010) for the observed current account as % of GDP, forecast for 2010)

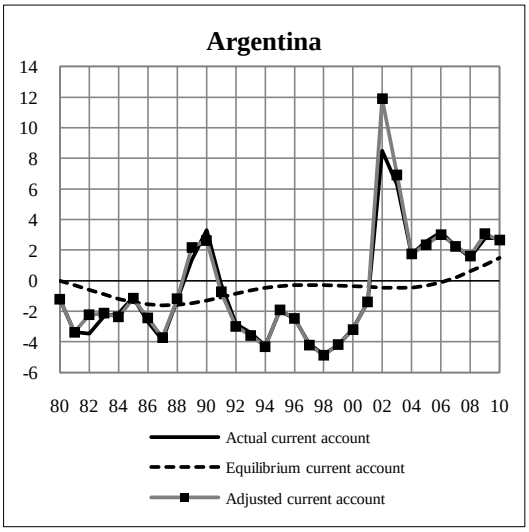
Figure 4: Actual and equilibrium current accounts of South East Asian countries



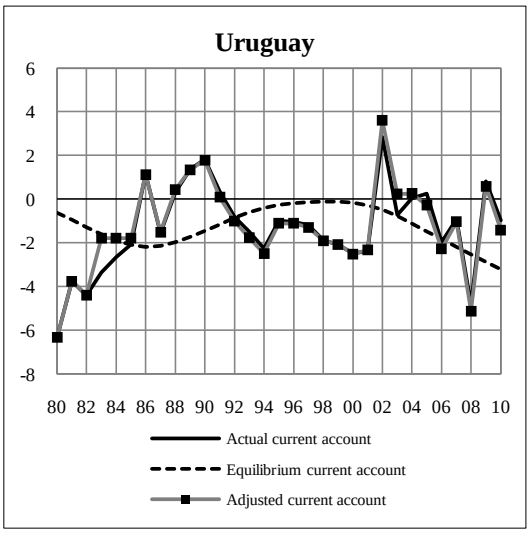
(Source: authors' calculation, International Monetary Fund (World Economic Outlook, April 2010) for the observed current account as % of GDP, forecast for 2010)

Figure 5: Actual and equilibrium current accounts of Latin American countries









(Source: authors' calculation, International Monetary Fund (World Economic Outlook, April 2010) for the observed current account as % of GDP, forecast for 2010)

Argentina is a case study. The 1980s were marked by chaotic evolutions with high inflation, recurrent depreciation, current deficits and a succession of stabilization plans which failed and led to the adoption of the currency board in 1991. During the 1990s current deficits enlarged up to -5% of GDP, well under the equilibrium value, until the crisis of 2002 and the end of the currency board. The production's decline and large depreciation then induced a huge current surplus which declined after, but remained above the equilibrium value close to 0% of GDP in the 2000s. The increase of the current account equilibrium in Argentina since the 1980s has resulted of two opposite trends, a favorable evolution of the dependency ratio and the rising oil net exports on one hand, a deterioration of the net foreign assets on the other, which led to stabilization around 0% of GDP.

The beginning of the 1980s was marked in Chile, like in many Latin American countries, by successive anti-inflation plans in a context of incertitude following the Mexican crisis of 1982. Huge current deficits (around -10% of GDP) characterized that period but were progressively reduced in the middle of the 1980s when Chile recovered a steady and more sustainable growth. Except during the mess provoked by the Asian and Russian crisis in 1997-1998, current account improved and led to increasing surpluses in the 2000s. The equilibrium current account appears in line with this trend, permanently negative but

increasing from -4% of GDP in 1980 to -2% in the 2000s. The decline of the dependency ratio and the improvement of the net foreign position explain this evolution.

Uruguay's current account presents some similitude with the Chilean case, although less favorable in the long run. Huge deficits at the beginning of the 1980s were followed by more balanced positions at the end of that decade and a deficit around -2% of GDP during the 1990s and 2000s. The equilibrium current account improved slightly during the 1990s up to 0% of GDP thanks to the positive impact of the net foreign assets and of the oil products balance. But it decreased during the 2000s down to -2% of GDP, due to rising dependency ratio, deterioration of the net exports of oil products and erosion of the net foreign position.

4.3. The estimation of internal equilibrium

The internal equilibrium is defined as the state of full utilization of productive resources, without inflation pressures. For sake of simplification, a restrictive approach, limited to the measure of the potential output, is adopted. This approach of internal equilibrium seems less suited for emerging countries like China or Brazil, where the concepts of potential output and full employment raise many problems, particularly because of the extent of regional imbalances and hidden underemployment in rural areas (Bouveret et al., 2006). This estimation of output gap is simply taken as representative of the degree of deviation of the internal demand (di). It must be regarded as a first step, which seems, however, sufficient at this stage. Indeed, as we shall see, results are only slightly sensitive to output gap's estimates.

Different methods can be employed in calculating potential production and the corresponding output gap. For industrialized countries, we take the values estimated with production function by the OECD[4]. This approach relies on estimated productions functions and a measure of the available productions factors in the country. It demands more information and more hypotheses regarding economic mechanisms than other simpler approaches, but is less mechanical and is theoretically more relevant.

For developing countries, this kind of estimates is not available. So we calculate output gap by using the Hodrick-Prescott filter on real GDP over the period 1970-2013[5]. However, a study in depth on this issue found that output gaps of East Asian countries estimated by several methods are similar for the period 1975-2000 (Gerlach & Yiu, 2004). In addition, our sensitivity tests show that errors in output gap estimation do not disrupt the whole conclusion. In the case of China, an increase of 1% in output gap leads to less than 1% of undervaluation.

5. Equilibrium exchange rates and misalignments

Results will be presented in four steps, first the main OECD countries, the USA and the Euro area for the western side, Japan and Korea for the Asian side, second the B(R)ICs as the main emerging countries, third the East Asian countries and last the Latin American ones. Although the methodology is basically the same, equilibrium exchange rates and misalignments are not estimated in the same way for all the countries.

[4] Economic Outlook, OECD, December 2008.

[5] As it is known, this filter has certain disadvantages. It does not define well the output gap at the beginning and at the end of samples. It tends to neglect the structural breaks and the regime shifts. For prolonged slowdowns it deviates too much from a production function gap. We use the Hodrick-Prescott filter with a lower smoothing parameter than that of industrialized countries to take into account that the business cycle is shorter in emerging countries.

For the main economic partners (the U.S.A., the Euro area, the U.K., Japan, China and the Rest of the World), with the internal and external equilibrium previously estimated, the multinational model is used six times to produce misalignments in terms of real effective exchange rates $r = dLogR = dR/R = (R - R^e)/R^e$ and nominal exchange rate against the dollar $e = dLogE = dE/E = (E - E^e)/E^e$, each country playing successively the role of residual country without its own current account target. The final solution is obtained by making an average of the 5 runs in which the current account target of each country is included (designated OCI for own country included).

This allows determining undervaluations ($e > 0$ and $r > 0$) or overvaluations ($e < 0$ and $r < 0$) for the dollar, the euro, the yen, the yuan, the pound sterling and the Rest of the World's currency over the period 1982-2009. In the following tables and figures results are not given for the pound sterling and the Rest of the World.

For the other countries, Korea, India, Brazil, the other East Asian and Latin American countries, a simple national model is used for each country and linked to the results of the multinational model to obtain misalignments in terms of real effective exchange rates (using relative consumption prices) and nominal exchange rate against the dollar.

For all the countries examined, the following tables give the under (over)valuation in real effective (r) and nominal bilateral terms (e) for the period 1982-2009. Figures show the evolution of the observed and equilibrium exchange rate over the period, in real effective and nominal bilateral against the dollar terms.

5.1. Estimates of FEER for the main OECD countries

In real effective terms, the dollar was undervalued at the beginning of the 1980s but this undervaluation declined and was replaced by an overvaluation in the middle of the 1980s while current deficit increased up to -3% of GDP. Conversely, after the sharp real depreciation of the dollar between 1985 and 1990, the current account improved and the dollar became undervalued (20% in 1990, less in the middle of the 1990s). Yet, this undervaluation decreased with the dollar's real appreciation and the American currency became overvalued (11% in 2001). Since then, in spite of its real depreciation, the dollar appeared more and more overvalued (reaching 30% in 2005 and 2006). This reflected the growing American imbalances and the structural loss of American competitiveness which was illustrated by an even stronger real depreciation of the dollar's equilibrium exchange rate. After the crisis erupted in 2007, the real overvaluation of the dollar has been reduced and might reach 8% in 2009 (table 3 and figure 6).

The euro real effective exchange rate's evolution is rather opposite to the dollar's one but the euro's misalignments appeared smaller than the dollar's ones, which reflects more reduced imbalances of the Euro area as a whole. The euro was undervalued during the 1980s (between 10-20% in real terms, slightly more against the dollar). This undervaluation remained, but declined with the sharp appreciation of the euro against the dollar from 1985 to 1990, while Euro area's surplus disappeared. From the mid-1990s to 2000, the euro has depreciated in real effective terms but remained close to its equilibrium value, which depreciated also, reflecting the problems of European competitiveness during this period. Since 2000, the euro became undervalued in real terms (7% in 2001) in spite of its real appreciation, thanks to painful structural adjustments, mainly in Germany, which induced a real appreciation of the euro

equilibrium exchange rate. With ongoing real revaluation, the euro real undervaluation has declined and has been replaced from 2005 by a slight overvaluation.

Table 3: Undervaluation (e > 0 and r > 0) or overvaluation (e < 0 and r < 0) for the United States, the Euro area, Japan and Korea (in %)

	e_eu	*e_jpn*	*e_kor*	*r_us*	*r_eu*	*r_jpn*	*r_kor*
1982	2.8	-3.0	17.2	13.8	8.0	4.9	7.5
1983	14.1	1.2	26.8	7.4	15.2	5.2	8.3
1984	18.2	10.3	21.2	-3.9	12.2	5.5	3.6
1985	27.4	18.9	8.1	-7.4	19.1	14.1	1.0
1986	33.2	21.0	25.2	-7.8	21.0	11.0	10.6
1987	21.6	17.3	25.4	-9.3	11.0	6.9	14.0
1988	5.3	-2.0	16.0	5.3	9.5	1.9	14.0
1989	5.1	-2.7	-7.8	9.6	11.7	4.1	-1.9
1990	-3.4	0.2	-15.5	15.1	1.2	4.3	-9.0
1991	-22.1	-4.9	-26.9	23.6	-10.6	6.1	-11.2
1992	-23.6	-5.6	-23.9	19.2	-10.0	6.5	-7.7
1993	-7.1	-8.8	-22.3	11.1	4.5	1.8	-5.5
1994	-5.5	-2.5	-11.6	7.1	-3.4	-0.8	-12.3
1995	-6.6	-10.6	-19.7	8.5	1.2	-3.4	-8.5
1996	-5.6	-14.7	-29.9	3.7	4.2	-4.7	-18.6
1997	-3.4	-10.2	-19.8	0.0	3.5	-2.7	-9.3
1998	-6.7	-10.7	11.4	-1.5	0.6	-2.8	15.0
1999	-3.8	-14.3	1.8	-4.3	2.0	-8.9	3.2
2000	3.6	-2.1	-3.1	-13.0	0.1	-5.0	-5.9
2001	11.8	2.3	-4.2	-11.0	6.8	-1.4	-5.9
2002	15.2	9.7	0.7	-16.3	6.6	2.4	-5.5
2003	15.1	15.9	6.7	-17.7	2.2	4.0	-2.7
2004	22.5	23.3	22.6	-23.7	6.0	7.3	2.7
2005	23.0	32.3	23.0	-31.0	0.1	8.8	-2.8
2006	23.4	35.7	21.5	-32.6	-0.9	10.1	-5.7
2007	11.1	26.9	15.6	-22.9	-3.4	10.8	-3.1
2008	11.8	22.0	16.5	-23.6	-4.5	5.2	-2.4
2009	7.2	6.4	19.5	-9.9	-2.0	-5.1	5.8
2010	8.8	8.2	11.3	-11.0	-1.0	-3.8	-0.6

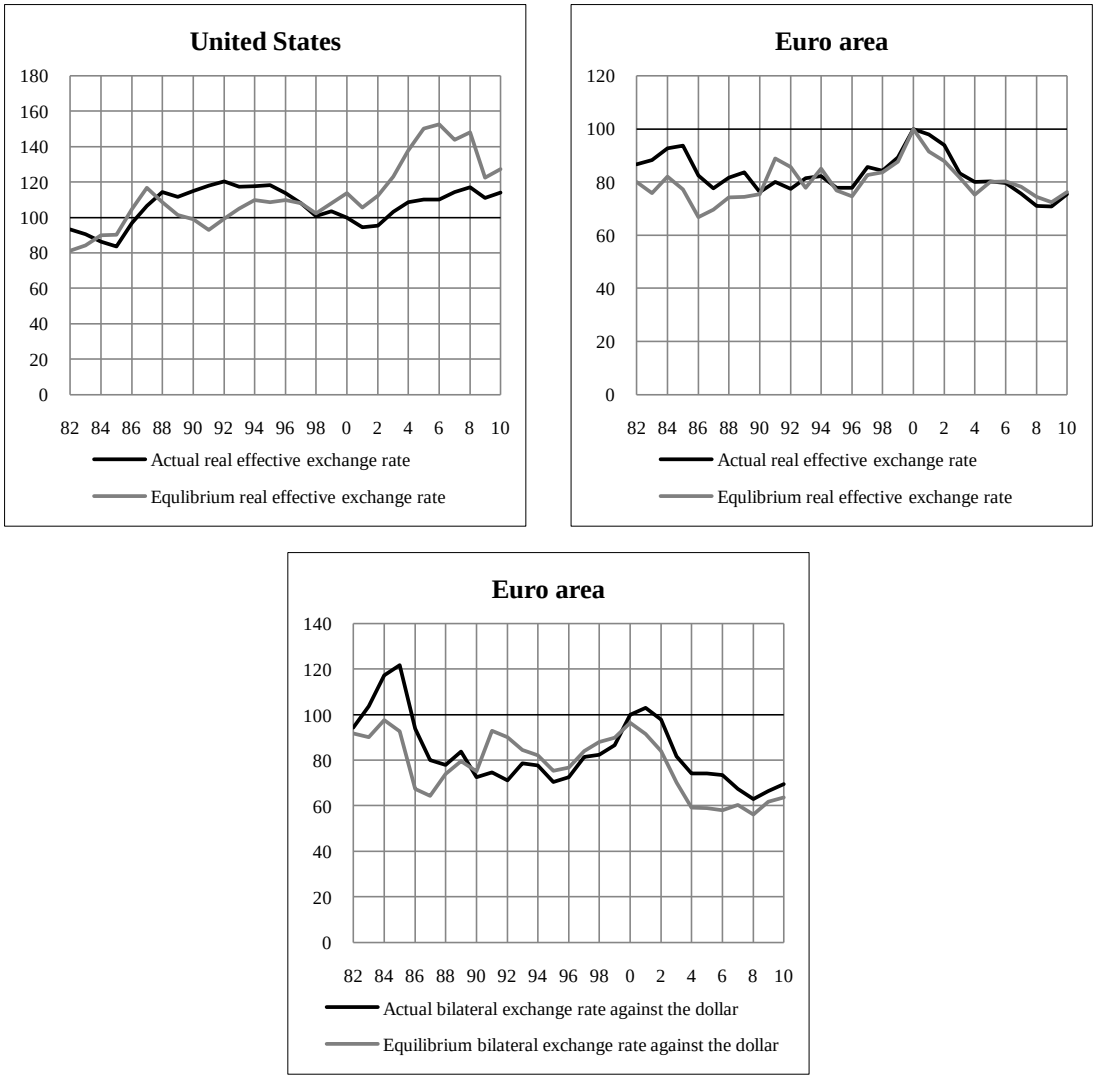
(Source: authors' calculations, forecast for 2010)

In nominal bilateral term against the dollar, the euro was overvalued from 1994 to 1998, although it has depreciated. This reflected the undervaluation of the dollar during the second

half of the 1990s. After 2000 the euro became undervalued against the dollar (22% from 2004 to 2006) in spite of the dollar depreciation.

This reflected the growing imbalances of the U.S. economy which have led to a depreciation of the equilibrium exchange rate of the dollar. Following the crisis, the undervaluation declined and the euro is close to its equilibrium value in 2009. But, as it has been shown (Jeong et al., 2010); this rather balanced situation of the euro covers huge intra-european imbalances in the 2000s.

Figure 6: Actual and equilibrium real effective and bilateral exchange rates of the dollar and euro (2000 = 100)



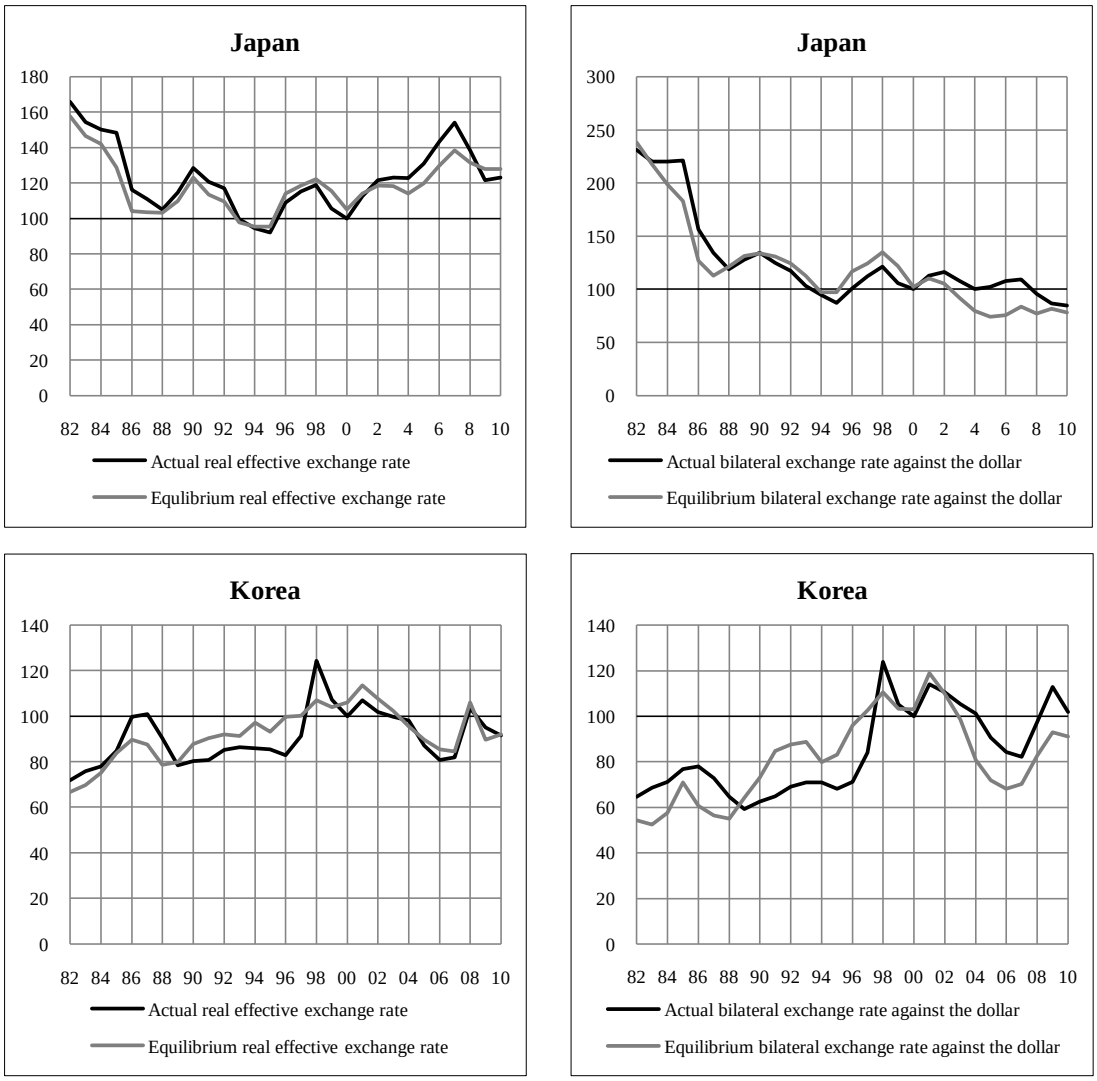
(Source: authors' calculations, IFS for bilateral exchange rates, partial data for 2010)

After a rather long period of undervaluation in real and nominal terms during the 1980s, the yen became slightly overvalued in real effective terms after the middle of the 1990s due to the strong yen revaluation against the dollar and to the progressive erosion of the Japanese model of production which had allowed a revaluation of the equilibrium value of the yen. During the 2000s the yen became largely undervalued against the dollar, but also in real effective terms, thanks to the large real depreciation of the yen and to the stability of the yen-dollar parity. This contributed to the recovery of the Japanese economy with important current surpluses

during that period. This undervaluation has been reduced and disappeared after the burst of the crisis which induced a sharp revaluation of the yen.

In Korea, a period of undervaluation of the won during the 1980s, linked to the export growth strategy, was followed by a rather marked overvaluation, both in nominal and real terms. But, at the opposite of the Japanese case, this occurred after a real depreciation during the first half of the 1980s and, then, a stable dollar-won parity. This overvaluation of the won has been regarded as one of the factors explaining the Korean crisis in 1997. The sharp devaluation of 1998 led to a large undervaluation and current surpluses. However this didn't last, as the won appreciated, both against the dollar and in real effective terms, especially against the other East Asian currencies. The current account remained in slight surplus, but generally under its equilibrium value during most of the 2000s, with a won overvalued in real terms. The undervaluation against the dollar was less pronounced than in Japan and the euro area. After the burst of the crisis in 2008 the evolution has been at the opposite of the Japanese case, with a sharp depreciation, both against the dollar and in real terms, which has allowed preserving a nominal undervaluation (table 3 and figure 7).

Figure 7: Actual and equilibrium real effective and bilateral exchange rates of the yen and the won (2000 = 100)



(Source: authors' calculations, IFS for bilateral exchange rates, partial data for 2010)

Last, the question of the gap between ex ante and ex post current account targets can be examined. In a previous methodology (Jeong & Mazier, 2003), the ex ante and ex post current account targets were equal for all the countries or areas of the world model, except for the Rest of the World since it was treated as a residual. In this article, we have treated symmetrically all the countries of the trade model (Rest of World included) like in Cline (2008). All the countries or areas are treated successively as a residual. In this new methodology, the ex ante and ex post current account targets are slightly different. But the average deviation remains inferior to 0.3 % of GDP (in absolute value) for the period 2004-2009.

5.2. Estimates of FEER for Brasil, India and China

In China the beginning of the 1980s is difficult to interpret due to the mode of regulation of the external trade that prevailed at that time. However, the yuan seemed to be overvalued in the middle of the 1980s with a massive current account deficit. The introduction of an exchange rate determined in the swap centers led to a de facto devaluation that permitted to reverse this situation and yuan was even strongly undervalued in 1991 with a significant current surplus in a context of an economic slowdown. Continued devaluations and the increasing usage of the swap centers exchange rate allowed the actual exchange rate to keep up with the depreciation of the equilibrium exchange rate and to preserve undervaluation during most of the time in a context of degradation of the current account and of high inflation, so that in 1994, the year of the unification of the exchange rate system, the yuan was even undervalued in nominal and real terms. The second half of the 1990s, in particular since 1997, marked a turning point. The economic boom and the return of current surplus illustrated the success of the trade openness policy of the past years. This explained the revaluation of the equilibrium exchange rate of the yuan during the second half of the 1990s, both in nominal and real terms, in sharp contrast with the previous period. The stabilization of the yuan against the dollar and even the appreciation of the real effective exchange rate of the yuan meant in fact a persistent undervaluation larger than before, both in nominal and real terms. This diagnostic could help to find an explanation of the resistance of the yuan facing the Asian crisis of 1997-1998 during which the yuan was already undervalued. However this undervaluation has been temporally reduced after the Asian crisis and the large devaluations of most of the East Asian competitors. After 2002 the undervaluation of the yuan has been amplified against the dollar, up to 47% in 2006. It has been reduced since then, but remained high in 2009 (around 22%). Although more moderate at the beginning of the 2000s, the undervaluation in real effective terms has increased in the second half (table 5 and figure 8).

The evolution of the Indian rupee's exchange rate presents some similarities with the yuan case: sharp devaluation until 1994 in real effective terms and until 2002 in bilateral terms against the dollar, then stabilization in nominal terms with appreciation in real effective terms. But, beyond these rather similar evolutions, the Indian exchange rate policy appears very different. During the devaluation period, undervaluation and overvaluation have alternated as in China, but with a tendency towards a more marked and durable overvaluation. Current account deficit has been permanent and larger in India than in China, with levels frequently under the equilibrium value. After the stabilization of the real exchange rate (1994) and of the bilateral one against the dollar (2002), the overvaluation in nominal and real terms has been the rule, except during the years 2001-2003. The opposition between Chinese and Indian exchange rate policies is striking since 2004, which has a strong impact on the growth model of the two countries.

Table 4: Undervaluation (e > 0 and r > 0) or overvaluation (e < 0 and r < 0) for China, India and Brazil (in %)

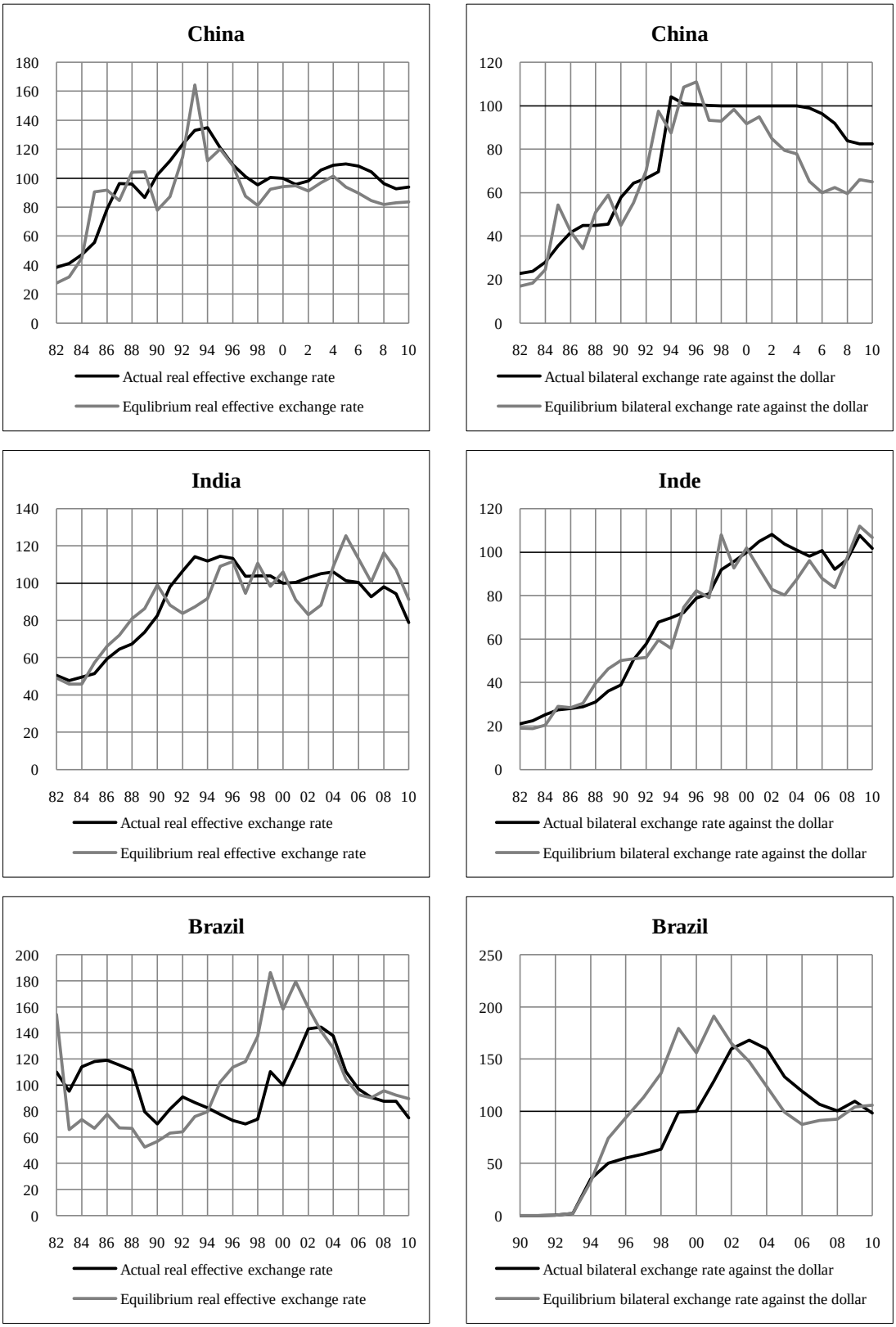
	e_chn	*e_ind*	*e_bra*	*r_chn*	*r_ind*	*r_bra*
1982	29.9	10.3	-28.1	33.7	2.9	-33.8
1983	25.6	19.6	60.3	25.4	4.1	37.1
1984	12.9	23.8	66.9	5.7	7.9	57.1
1985	-42.6	-5.1	66.7	-48.7	-10.7	43.2
1986	-1.1	-1.3	59.0	-15.2	-11.0	43.0
1987	27.2	-5.1	64.2	13.0	-10.7	54.0
1988	-12.3	-21.9	50.4	-8.2	-18.2	51.4
1989	-26.0	-21.9	37.4	-18.6	-15.9	42.1
1990	25.2	-22.4	15.9	27.3	-18.0	21.0
1991	15.0	-0.6	9.7	24.9	10.6	25.5
1992	-5.3	12.0	17.3	7.4	23.8	34.8
1993	-33.7	13.8	-2.0	-21.0	27.0	13.3
1994	17.3	25.1	7.2	18.6	19.9	4.1
1995	-7.4	-3.2	-38.7	0.8	4.8	-27.5
1996	-9.9	-4.1	-53.3	0.7	1.6	-44.6
1997	7.1	2.2	-65.4	14.5	9.2	-51.9
1998	7.4	-15.0	-76.4	16.0	-6.3	-61.9
1999	1.8	3.5	-59.2	8.5	5.4	-52.4
2000	8.8	-2.0	-44.4	6.1	-5.8	-45.8
2001	5.2	13.7	-39.3	1.0	9.7	-39.6
2002	16.4	30.6	-3.4	7.1	21.4	-10.8
2003	23.0	29.1	13.0	8.4	17.6	2.0
2004	25.1	15.4	25.7	7.1	-2.6	7.0
2005	41.8	2.1	29.7	15.9	-21.3	5.1
2006	47.4	14.7	31.1	19.2	-12.0	4.5
2007	38.6	9.9	15.7	21.2	-8.1	0.3
2008	34.5	-0.9	8.3	16.2	-17.2	-8.4
2009	22.4	-3.8	5.0	10.8	-12.9	-5.1
2010	23.8	-4.6	-7.5	11.4	-14.6	-17.6

(Source: authors' calculations, forecast for 2010)

Brazil has faced quite different issues. It began the period with an overvaluation inherited from the development scheme of the 1970s. After the contagion process of the Mexican crisis of 1982 a succession of exchange rate adjustments occurred in the framework of orthodox programs negotiated with the IMF or heterodox packages adopted in spite of Washington institutions' hostility. Combining crawling peg and, when necessary, maxi-devaluations,

Brazil maintained a large undervaluation, contributing to a current account close to 0% of GDP, far above the equilibrium value, while inflation was speeding up to hyperinflation.

Figure 8: Actual and equilibrium real effective and bilateral exchange rates of the Chinese yuan, the Indian rupee and the Brazilian real (2000 = 100)



(Source: authors' calculations, IFS for bilateral exchange rates, partial data for 2010)

The monetarist Collor Plan stopped this dynamic in March 1990 but, six months after, inflation resumed its race, leading to new transitory stabilization packages, including exchange rate adjustments. Consequently, until the adoption of the Real Plan in 1994, real and nominal exchange rates continued to be undervalued.

With the adoption of the Real Plan, Brazil focused on price stabilization and gave up its priority for competitiveness, stressing on capital flows to balance current deficit. In spite of the success of the Plan and some adjustments of a target zone pegged on dollar, inertial inflation entailed increasing overvaluation in real and nominal terms (-76% against the dollar in 1998). Such imbalances could not last. At the end of 1998 contagion of the Asian and Russian crises carried on a speculative attack against a Brazilian economy mined by macroeconomic imbalances. After a 50% devaluation and some adjustments allowed by the adoption of a floating regime, the real and nominal exchange rates returned progressively to a level close to the equilibrium one at the beginning of the 2000s, while current account became equilibrated.

From 2002 to 2007 the real remained close to its equilibrium value in real terms and undervalued against the dollar, in spite of an appreciation trend. Current account surpluses were obtained thanks to rising raw materials' prices, dynamic world demand and improvement in competitiveness (Salama, 2009). This favorable trend was reflected in an appreciation of the equilibrium value of the real, in accordance with the observed appreciation.

With the world crisis, real appreciation and peg to the dollar became more difficult to sustain. Real overvaluation and current deficit reappeared, although limited by comparison with what has been observed in the past. However, at the end of the 2000s, Brazil, like India, is much more constrained by its exchange rate policy, in clear cut with China which uses undervaluation of the yuan at the expense of its competitors.

5.3. Estimates of FEER for other East Asian currencies

Thailand, Philippines and Malaysia present some similarities with respect to exchange rate policy during the 1980s. The early 1980s were marked by the end of economic boom with current account deficit and overvaluation. The peg to the dollar in the middle of the 1980s allowed a real depreciation and an improvement of their current account, leading to an undervaluation of their currencies between 1985 and 1988, especially in Philippines and to a less extent in Malaysia where the ringgit was close to its equilibrium value. A reversal took place at the end of the 1980s where economic recovery was related to the reappearance of important current deficits. The peg to the dollar led to large overvaluation in nominal terms, but less in real effective terms. Thailand was the most affected while the phenomenon was less marked in Philippines where the growth was more modest and current deficit more contained. The Malaysian ringgit remained as before close to equilibrium, as Malaysian economy was more trade open, which reduced misalignments' amplitude (table 6 and figure 9).

In 1996, at the eve of the Asian crisis, with newly increasing current deficit in Thailand, the bath was overvalued (-13% in real terms, -28% against the dollar). The overvaluation was more limited in Philippines and even less marked in Malaysia. Except for Thailand where overvaluation appeared significant (although more modest than at the start of the 1990s),

overvaluation does not seem to have been the main cause of the crisis in these East Asian countries. The large devaluations following the crisis contributed to the reconstitution of important current surpluses in Thailand and Malaysia, but not durably in Philippines. The bath and, to a less extent, the ringgit became undervalued, but not the Philippine peso as Philippines faced more structural problems at that time.

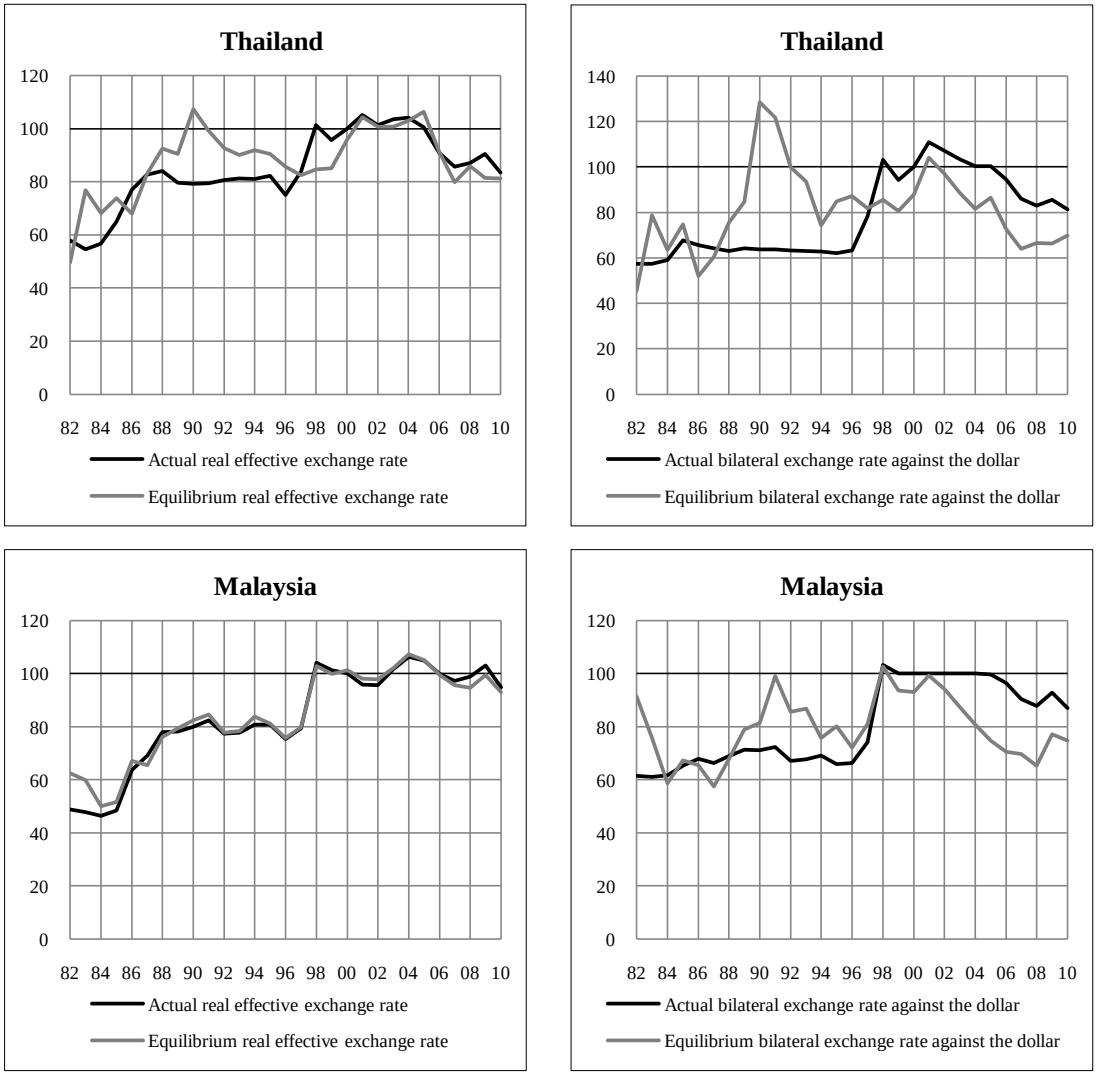
Table 5: Undervaluation (e > 0 and r > 0) or overvaluation (e < 0 and r < 0) for Thailand, Malaysia, Philippines and Indonesia (in %)

	e_tha	*e_mal*	*e_phi*	*e_indo*	*r_tha*	*r_mal*	*r_phi*	*r_indo*
1982	26.2	-32.7	-28.7	-44.9	15.6	-24.8	-30.2	-45.8
1983	-27.2	-19.4	3.1	-49.8	-34.1	-22.5	-10.4	-57.1
1984	-7.1	5.0	45.3	-1.6	-18.4	-7.6	25.1	-15.2
1985	-9.3	-3.0	46.3	-16.8	-12.9	-6.6	34.7	-21.0
1986	26.2	3.7	73.6	-37.3	12.5	-5.3	53.6	-42.7
1987	6.1	15.5	38.0	-8.3	-0.3	5.5	26.2	-12.5
1988	-16.4	1.9	22.2	-18.5	-9.5	2.6	19.8	-13.8
1989	-24.3	-9.6	-9.6	-18.7	-12.9	-1.6	-3.3	-11.6
1990	-50.3	-12.4	-23.9	-25.8	-30.2	-2.9	-15.2	-18.7
1991	-47.7	-26.9	-8.2	-34.3	-22.1	-2.5	3.2	-18.4
1992	-36.6	-21.7	-15.0	-22.3	-14.1	-0.7	-0.5	-7.1
1993	-32.6	-22.0	-33.8	-18.5	-10.5	-0.6	-12.6	-2.8
1994	-15.5	-8.9	-14.2	-2.1	-12.5	-3.6	-12.3	-5.1
1995	-26.8	-17.8	-15.1	-16.5	-9.5	-0.4	-3.9	-6.6
1996	-27.5	-8.1	-18.9	-9.0	-13.3	-0.6	-8.5	-2.7
1997	-4.4	-8.6	-16.8	11.9	1.9	-0.6	-5.3	16.5
1998	20.5	0.5	-1.1	28.3	17.9	1.3	3.8	27.6
1999	16.9	6.9	-11.9	2.0	11.9	1.4	-6.1	3.8
2000	13.8	7.5	-1.5	14.1	4.4	-1.2	-4.1	8.0
2001	6.5	0.8	-3.4	20.6	0.8	-2.1	-4.5	14.6
2002	10.4	6.2	3.0	20.1	0.5	-2.3	-3.5	11.0
2003	16.9	14.4	8.4	22.9	2.7	-0.4	-1.7	11.7
2004	23.1	23.8	20.5	19.5	1.1	-0.8	0.2	0.9
2005	16.0	33.2	26.1	24.3	-5.7	-0.2	-1.0	-1.8
2006	30.0	37.0	32.6	38.2	-0.4	0.5	1.9	8.5
2007	34.6	29.9	28.4	32.2	7.0	1.7	5.5	11.1
2008	24.8	34.5	23.8	25.8	1.5	4.4	2.6	4.9
2009	28.8	20.2	25.0	25.7	10.5	3.5	9.8	12.2
2010	16.4	16.6	19.0	26.7	2.8	2.0	5.2	12.8

(Source: authors' calculations, forecast for 2010)

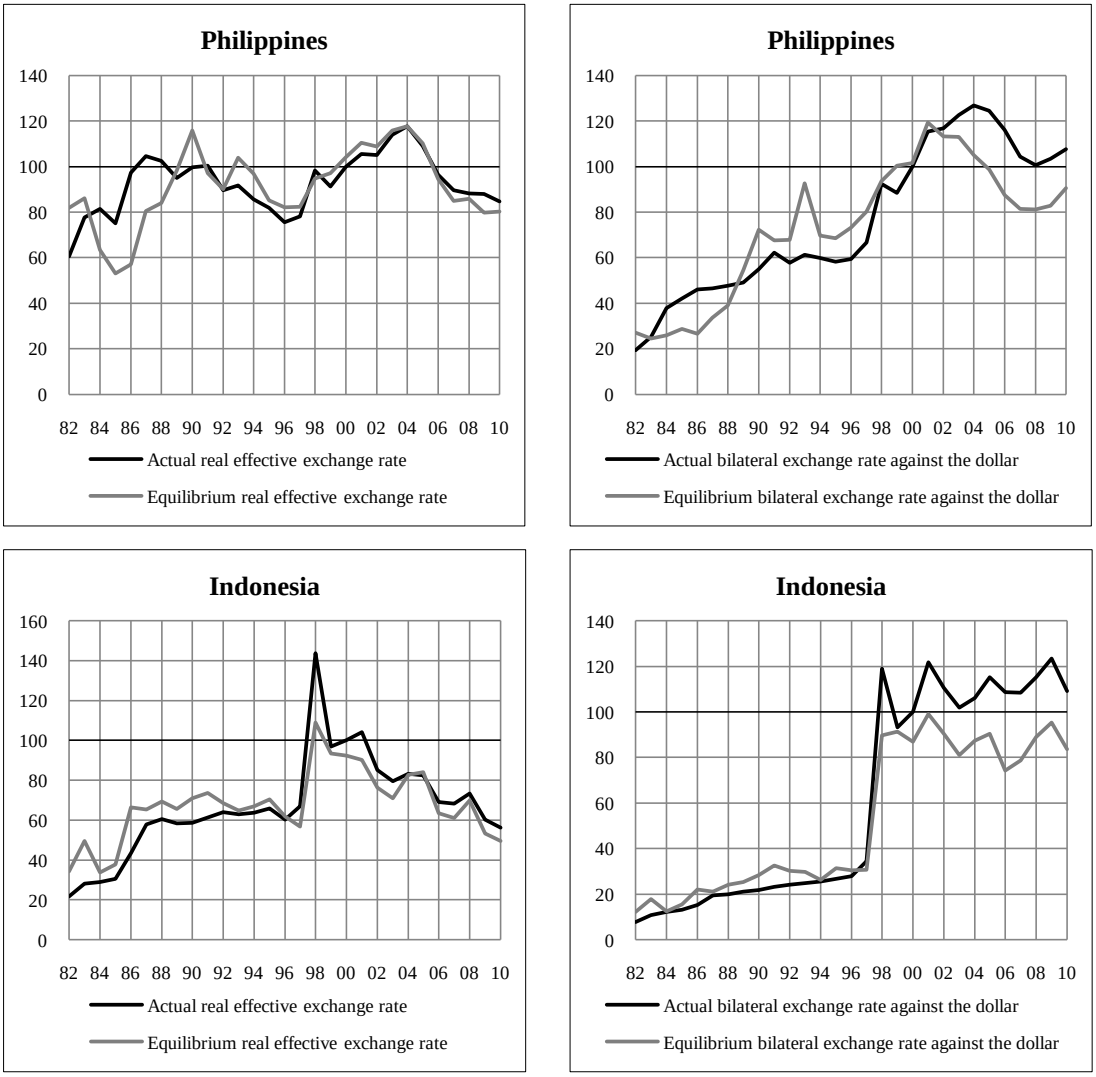
During the 2000s, in spite a general movement of appreciation, the East Asian currencies remained undervalued against the dollar (around 20-30 %), but less in real effective terms. However, compared with the Chinese yuan, they appeared far less undervalued, which induced a bias in the international competition among East Asian countries. Since the beginning of the crisis in 2007 the undervaluation has been preserved and even increased in real terms, thanks to the peg to the dollar.

Figure 9: Actual and equilibrium real effective and bilateral exchange rates of the bath, the ringgit, the Philippine peso and the Indonesian rupee (2000 = 100)



Indonesia, as an oil-exporting country, presents some specificity. The counter-oil shock in 1986 has degraded its current account, leading to overvaluation of its currency until the middle of the 1990s. At that time, with sustained growth and current account more under control, overvaluation became weak and did not seem to have played a large role in the crisis of 1997. However the currency the most affected by the crisis has been the Indonesian rupee, which might be explained more by political reasons and other economic imbalances than strictly monetary reasons. The devaluation of the Indonesian rupee was of the most important amplitude among the East Asian countries, in real and nominal terms. It resulted in a rather limited amelioration of the current account and in an undervaluation of the rupee which could be regarded as modest, compared with the amplitude of the shock. This result could reflect the

destructive effects of the crisis on the Indonesian productive system. The situation has been progressively normalized afterwards, the country taking advantage of the rising oil prices during the 2000s. The undervaluation of the Indonesian rupee (around 20-30% against the dollar) was in line with the other East Asian countries at the end of the 2000s, but slightly less pronounced in real terms.



(Source: authors' calculations, IFS for bilateral exchange rates, partial data for 2010)

5.4. Estimates of FEER for other Latin American currencies

Contrary to the East Asian countries, ERM of the Latin American countries are wider and more dispersed, due to larger heterogeneity and smaller economic integration between countries. If all are affected by the debt crisis of the 1980s, the financial recovery following the Brady Plan in the late 1980s, the speculative crises of the end of the 1990s and the last financial crisis, varieties of stabilization and nominal exchange rate policies determine very different macroeconomic paths and disequilibrium. Argentine and Mexican cases are interesting to examine first in this perspective.

In Argentina, at the beginning of the 1980s, accelerating inflation entailed the overvaluation of the peso and large current deficits in spite of the crawling peg regime. After a new

stabilization package the government adopted the heterodox Austral plan in 1985 aimed to break inflation by a policy mix combining prices, wages and exchange rates freezing after a sharp devaluation. After a while, the loosening of this policy brought about a return of inflation and overvaluation, as the government delayed exchange rate adjustments to fight inflation.

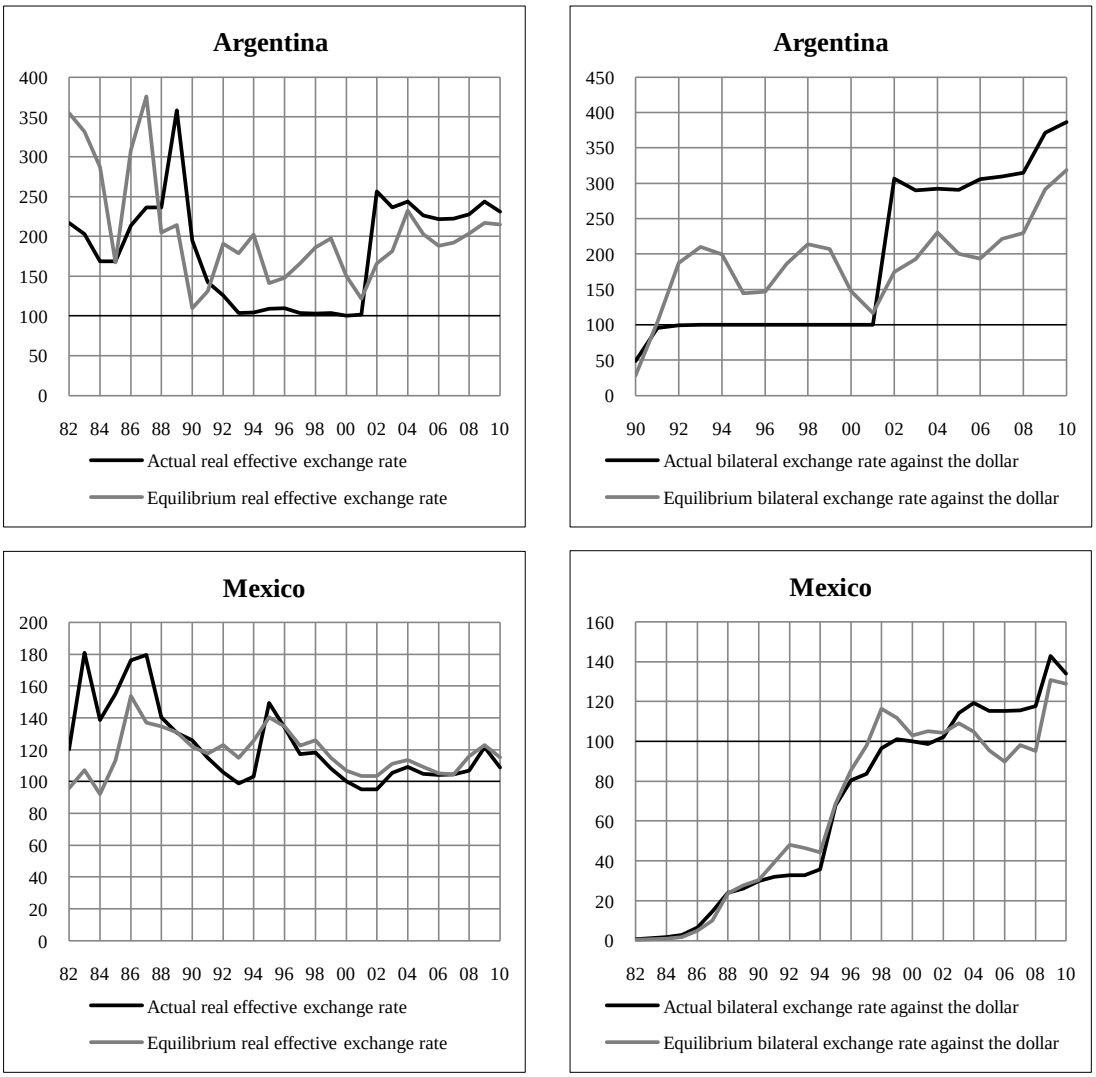
Table 6: Undervaluation (e > 0 and r > 0) or overvaluation (e < 0 and r < 0) for Argentina, Mexico, Chile, Colombia and Uruguay (in %)

	e_arg	*e_mex*	*e_chi*	*e_col*	*e_urg*	*r_arg*	*r_mex*	*r_chi*	*r_col*	*r_urg*
1982	-44.3	32.8	-39.9	-30.2	-54.7	-49.2	22.9	-42.1	-34.7	-58.3
1983	-31.0	75.4	2.5	-27.3	8.9	-49.2	52.2	-15.9	-43.6	-10.8
1984	-35.2	63.8	-30.6	-4.8	8.4	-53.3	40.9	-43.3	-23.2	-10.9
1985	8.2	41.2	-51.5	12.8	-1.3	0.9	31.5	-49.5	5.1	-7.8
1986	-24.7	29.1	-5.5	62.9	36.8	-36.8	13.7	-16.6	44.9	20.2
1987	-41.2	37.5	24.0	61.3	19.7	-46.3	27.1	13.3	48.9	10.4
1988	11.8	1.6	22.3	53.4	21.8	14.3	4.1	20.6	51.0	21.8
1989	47.8	-6.6	8.7	44.3	17.2	51.4	-0.2	11.7	45.9	20.7
1990	53.2	-2.4	4.5	57.0	20.1	57.4	3.3	8.6	56.7	23.4
1991	-8.5	-20.7	6.6	46.6	-3.5	8.3	-2.2	20.1	58.4	12.6
1992	-63.7	-38.5	-2.6	49.0	-13.4	-41.6	-14.8	14.3	61.7	5.5
1993	-74.4	-34.4	-31.9	-37.8	-28.4	-54.2	-15.0	-11.9	-18.6	-10.5
1994	-69.2	-21.5	-2.5	-45.6	-17.7	-66.1	-19.9	-4.4	-42.4	-17.9
1995	-36.8	-1.2	-0.6	-53.7	-22.1	-25.5	6.4	7.1	-38.5	-11.1
1996	-38.4	-6.2	-16.3	-54.7	-16.2	-29.9	-0.6	-8.3	-42.9	-9.3
1997	-62.2	-15.6	-23.2	-68.7	-17.1	-47.4	-4.6	-10.6	-51.8	-6.6
1998	-75.9	-18.6	-30.4	-58.0	-18.9	-59.1	-6.4	-15.8	-41.9	-7.8
1999	-72.6	-9.9	9.3	12.5	-23.7	-64.5	-6.0	8.7	12.8	-18.9
2000	-38.7	-2.8	3.5	16.8	-22.6	-40.5	-6.6	-2.1	9.7	-24.6
2001	-15.4	-6.3	0.5	-8.2	-26.2	-18.6	-8.6	-3.7	-11.3	-27.0
2002	56.3	-2.0	7.0	-10.4	24.7	43.7	-8.4	-1.6	-16.5	13.0
2003	40.8	4.4	8.7	0.2	6.2	26.7	-5.3	-2.1	-9.2	-4.1
2004	23.7	13.1	37.0	7.4	19.4	4.8	-3.9	14.5	-9.1	0.9
2005	37.2	18.8	40.9	7.8	29.2	11.0	-4.0	12.8	-14.1	4.0
2006	45.6	24.8	62.1	10.0	20.5	16.4	-1.0	28.9	-13.6	-4.1
2007	33.6	16.3	47.0	-10.2	27.0	14.6	0.1	24.2	-22.3	8.0
2008	31.4	21.1	18.0	-3.5	4.2	11.4	-8.2	0.2	-17.9	-10.0
2009	24.2	8.8	25.5	4.5	43.4	11.9	-1.2	12.0	-5.2	26.1
2010	19.4	3.9	12.0	-26.3	27.2	7.2	-5.5	0.7	-33.0	13.4

(Source: authors' calculations, forecast for 2010)

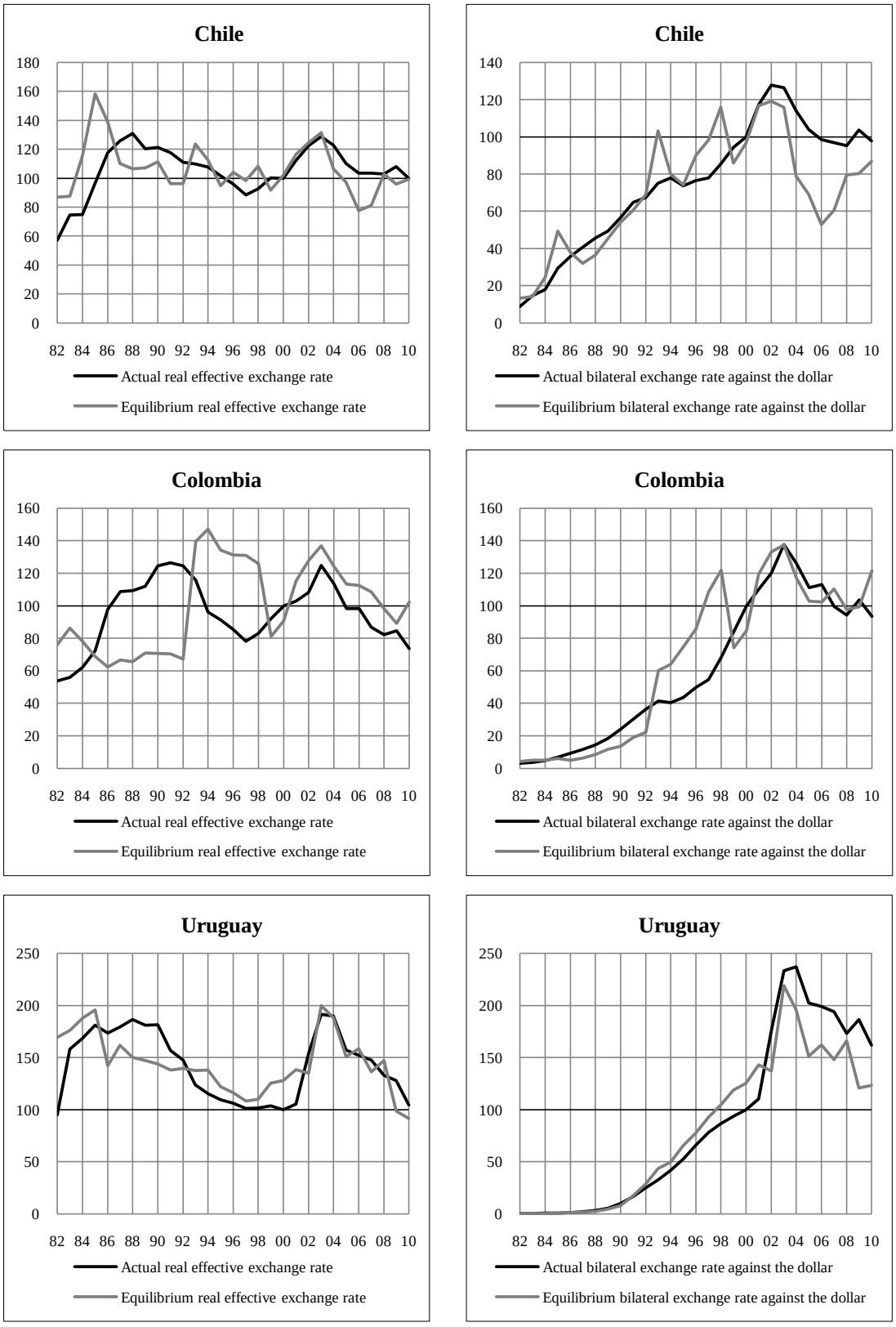
A succession of stabilization plans were then implemented with more accommodating exchange rate policy aimed to preserve competitiveness, which led to undervaluation of the peso and current surplus in 1988 and 1989. But accelerating inflation led the Menem government to experiment various packages before the adoption of a more radical program based on a currency board in 1991. This led to a sharp real appreciation, huge current deficit and large overvaluation between 1992 and the burst of the crisis in 2001. The end of the currency board and the maxi-devaluation induced a strong reversal with durable undervaluation in nominal terms against the dollar (around 30%) during the 2000s and, to a less extent, in real effective terms (from 40% down to 5% and up to around 15%) with large current surplus in a favorable context of rising oil and commodities prices. Consequently, Argentina faced the last crisis in a better position with an undervalued peso and rising current surplus in spite of a moderate appreciation in real and nominal terms. However the real undervaluation may be overestimated in the last years, as the official statistics of prices used to evaluate real exchange rates are known as underestimating the actual rate of inflation (table 7 and figure 10).

Figure 10: Actual and equilibrium real effective and bilateral exchange rates of the Argentine and the Mexican pesos (2000 = 100)



(Source: authors' calculations, IFS for bilateral exchange rates, partial data for 2010)

Figure 11: Actual and equilibrium real effective and bilateral exchange rates for Chile, Colombia and Uruguay (2000 = 100)



(Source: authors' calculations, IFS for bilateral exchange rates, partial data for 2010)

Although large, the amplitude of exchange rate's evolutions is more limited in Mexico than in Argentina. The debt crisis originated in Mexico in 1982 led to an inflationary cycle with price

explosion and strong exchange rate depreciation. Successive failure of stabilization plans entailed a dramatic chase between price hikes and exchange rate adjustments allowing however a steady undervaluation, both in nominal and real terms with current surplus far above the equilibrium value.

The heterodox Pact for economic solidarity of December 1987 combined fiscal adjustment, a fixed exchange rate (followed by some slight depreciations), a temporary freeze of wages and prices and strong trade liberalization. The program succeeded in stopping inflation, but residual inflation entailed a strong real appreciation and growing current deficits (-6% of GDP between 1992 and 1994), favored by trade liberalization. An increasing overvaluation appeared, both in nominal and real terms.

Until 1992 external imbalances were regarded as sustainable, thanks to capital flows, following the Brady plan of 1989, and privatizations. But, in spite of important FDI, a large part of these capital flows were portfolio investment flows more reversible. Successive speculative attacks (the Tequila crisis in 1995) led to the abandon of the target zone exchange rate regime for floating with a large devaluation nominal and real and a dramatic slump. The current balance improved strongly and exchange rate became close to its equilibrium value. The large financial mobilization of IMF and the USA during the collapse and a successful stabilization package helped Mexican economy to recover external credibility and growth. But Mexico was touched indirectly by the Asian and Russian crises in 1997-1998 which led the government to devaluate by steps. In spite of this, the peso appreciated in real terms and became slightly overvalued in real terms and against the dollar until 2002.

After a new depreciation against the dollar, the peso remained stable in real terms and close to equilibrium, with a progressive improvement of the current account. In 2008 the world crisis and the fall of the trade with the USA led to a new decline of the current account and a limited overvaluation. The Mexican economy seems in a more balanced situation to face the present crisis than in previous periods but its exchange rate policy is more constrained than in other emerging countries.

Chile inherited of an imbalanced situation at the beginning of the 1980s with inflation and growing current deficit (-15% of GDP in 1981). In spite of a sharp devaluation in 1981 the inversion of the capital inflows led to the adoption of floating exchange rate. Large nominal and real depreciations followed, but important overvaluation remained until 1987 with progressively improving current account. From the end of the 1980s to the end of the 1990s a more balanced situation prevailed with stabilized nominal exchange rate, moderate real appreciation, limited current deficit and a currency often undervalued in real terms. The Asian and Russian crises were destabilizing factors with new imbalances and overvaluations. However nominal and real depreciations up to 2003 helped to recover equilibrium exchange rates and to improve current account. Since then, the Chilean economy enjoyed a rather steady and sustainable growth with growing current surplus (5% of GDP in 2006-2007), a currency appreciating in nominal and real terms while keeping large undervaluation. Although negatively affected by the world crisis of 2008, Chile faced it in a rather balanced position in spite of its reduced room for manoeuvre (table 7 and figure 11).

Colombia presents some similarity with Chile in terms of exchange rate profile, a long nominal depreciation up to 2002, a real depreciation during the 1980s followed by a more stabilized evolution with alternative periods of appreciation and depreciation. But imbalances have been far more important with current deficits and overvaluation at the beginning of 1980s, a long period of huge surpluses (4% of GDP in 1991) and massive undervaluation

(around 40- 60% in nominal and real terms) up to 1992. Since then, current deficits and large overvaluation have been the rule, except a brief improvement in 1999-2000. The Columbian economy faced the world crisis of 2008 in a more fragile and unbalanced position.

Uruguay's exchange rate evolution has, due to close relations, some similarities with the Argentine case in real terms, but not in nominal term, as a long nominal depreciation is observed until 2003, followed by an appreciation like in Chile and Colombia. The beginning of the 1980s was characterized by large imbalances, overvaluation in real terms and important real depreciation which led, at the end of the decade, to a more favorable situation with current surplus, stabilized real exchange rate and undervaluation. But, after a sharp real appreciation at the beginning of the 1990s, current imbalances reappeared with a long period of nominal and real overvaluation during the whole decade. Thanks to a large nominal and real devaluation in 2003 followed by an appreciation, a more balanced configuration has been observed during the 2000s with a real exchange rate close to its equilibrium value and an undervaluation against the dollar. However constraints have been reinforced facing the crisis since 2008.

6. Comparison between FEER and BEER approaches

6.1. Methodological considerations

The BEER approach is widely used to estimate ERM at the world level. Some authors have compared the BEER and FEER approaches in the same theoretical framework (see e.g. Driver and Westaway, 2004, Benassy-Quéré et al., 2009). Despite of conceptual differences, these two approaches can be seen as complements rather than substitutes.

More precisely, the FEER is a medium run concept. This exchange rate allows the economy to reach internal and external equilibrium at the same period. The essential point is "how to define the equilibrium". We can distinguish three time horizons (short run, medium run and long run). An equilibrium exchange rate is associated with each time horizon. These different measures of the equilibrium may be not equal. The FEER concept can be seen as a medium term equilibrium in which the equilibrium current account is at a level compatible with an eventual convergence to the stock-flow equilibrium (Driver and Westaway, 2004).

In addition, the BEER is a long run concept. When a country accumulates current account surplus; its net external position increases in percent of GDP. To stabilize its net external position in percent of GDP, its currency must appreciate above its equilibrium value and, thus, appears overvalued. In the long run, the current account is equal to zero and the growth rate of the net foreign asset in percent of GDP is equal to zero. This long term equilibrium corresponds to the stock-flow equilibrium for all the agents of the economy. This long term equilibrium may be reached, but it may take years or decades (Driver and Westaway, 2004).

In terms of international monetary cooperation, the most relevant approach seems to be the FEER because it focuses on current account imbalances at medium term. In this context, the BEER seems to be less relevant because of its time horizon. Actually, assets stocks are not stabilized at medium term[6] in percent of GDP, as the evolution of net foreign assets in industrialized and developing countries confirms it. However a comparison of BEER

[6] This statement remains true even in the case where the medium term is defined as a period of five or ten years.

estimations with our own FEER estimations gives some interesting lighting. A comparison is also made with Cline OCI's estimates (appendix 7).

6.2. Comparison between FEER and BEER estimations

Figure 12 compares FEERs and BEERs' misalignments for the main industrialized and emerging countries. At first glance, except for two main countries, India and Brazil, and some specific periods, the two approaches' misalignments present large similarities. On the whole, BEERs' misalignments are more important than FEERs' ones, which is consistent with the long term equilibrium nature of the BEER.

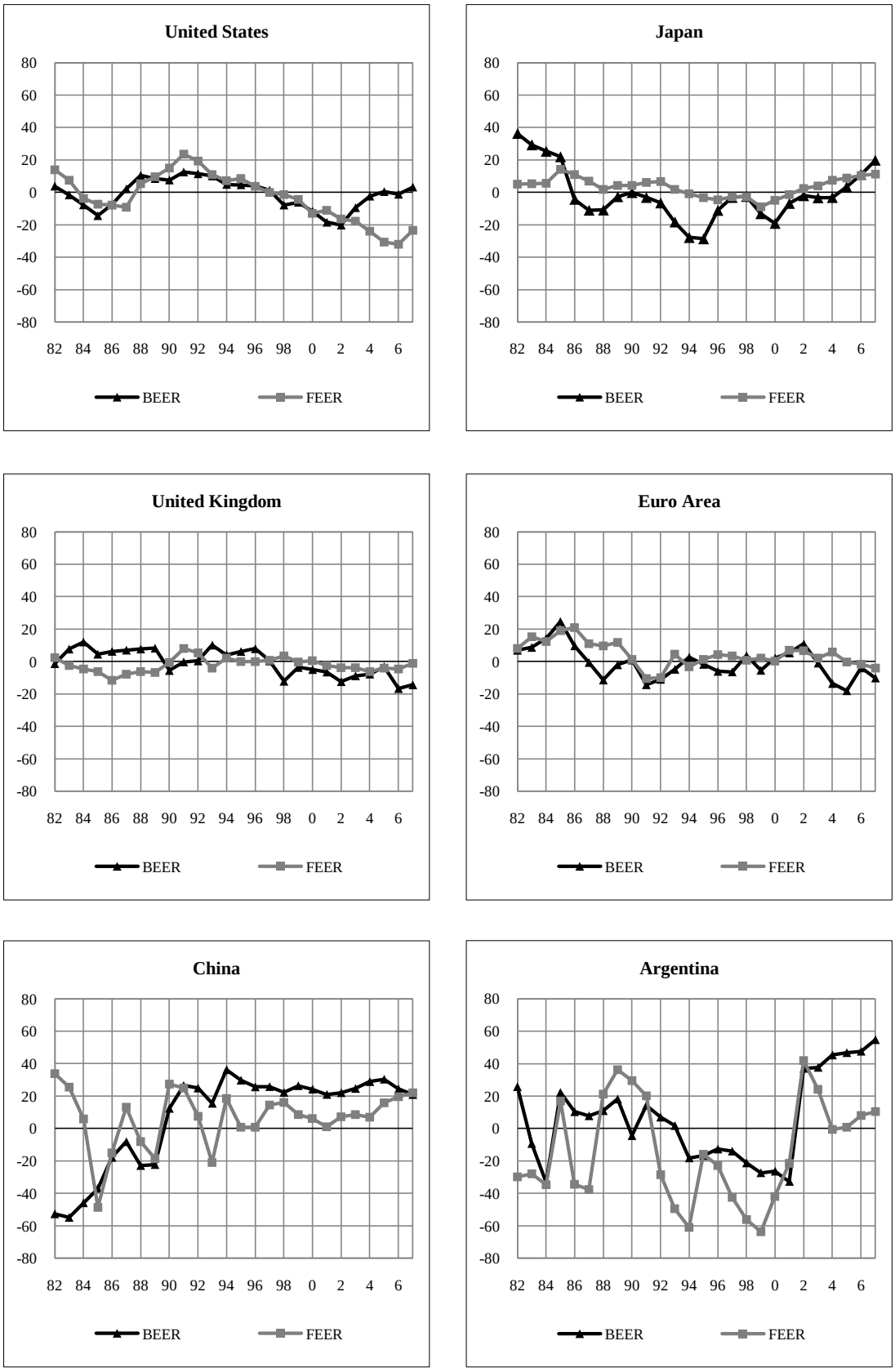
This first diagnosis can be précised by two indicators, the absolute average deviation (equal to the average difference between FEERs and BEERs) and the correlation coefficient between misalignments given by both approaches. The absolute average deviation is equal to 16% for all the countries, but is smaller for two third of them. Similarly, the correlation coefficient is above 0.5 for two third of the countries (table 7). The FEER and BEER give more divergent estimations for the three main emerging countries, China, Brazil and India, but are more convergent for industrialized countries and also for Mexico, Chile, Malaysia and Indonesia.

Table 7: FEER and BEER matrix

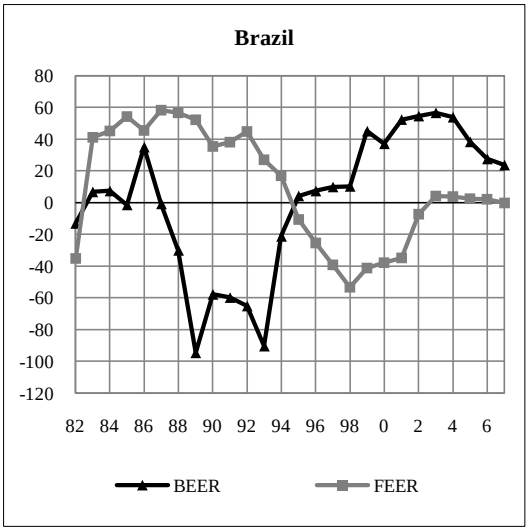
		Absolute average deviation	
		Below Average	**Above Average**
Correlation	**Above 50 %**	*USA, Euro area, Japan, Mexico, Korea, Indonesia, Malaysia, Chile*	*Argentina, Colombia, Uruguay*
	Below 50 %	*UK, Philippines, Thailand*	*China, Brazil, India*

For a better understanding of the FEER and BEER divergence, it can be recalled that the BEER is rather stable in the long run and, consequently, BEERs' misalignments are mainly deviations between real exchange rates and an average value. Generally, real appreciation above this mean value led to overvaluation and, inversely, real depreciation led to undervaluation. On the opposite, the FEER is linked to a rather stable current account balance. FEERs' misalignments reflect mainly deviations between observed and equilibrium current balance. Generally, a rising current account above the equilibrium value led to undervaluation and, inversely, a decreasing current account led to overvaluation. As a consequence, FEER and BEER misalignments are consistent when real exchange rate and current account are closely connected. As an illustration, we calculate the linear correlation coefficient between current account and real effective exchange rate. When the correlation is strong, the misalignments computed by the FEERs and BEERs follow the same path.

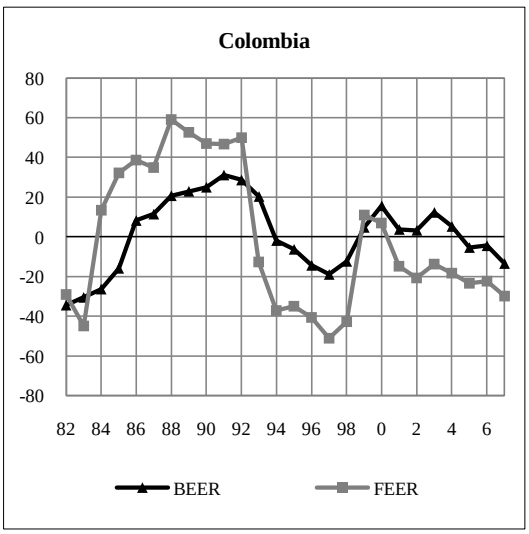
Figure 12: BEERs and FEERs' misalignments in percent[7]

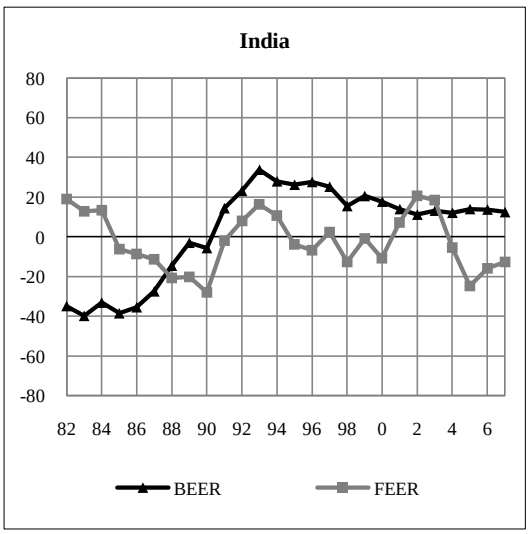


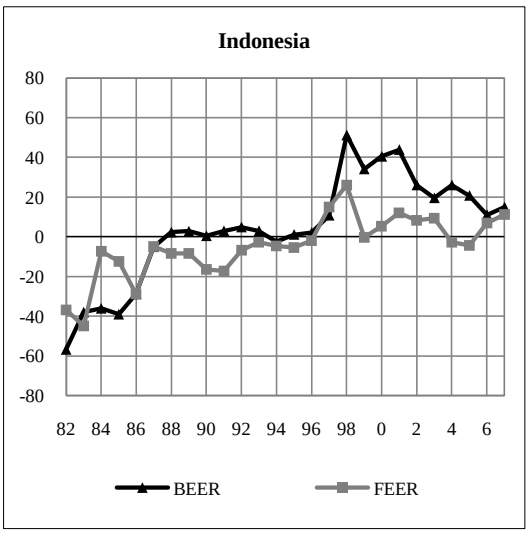
[7] The BEER results are extracted from a previous work on equilibrium exchange rates of Asian countries (Lopez and Mignon, 2009).

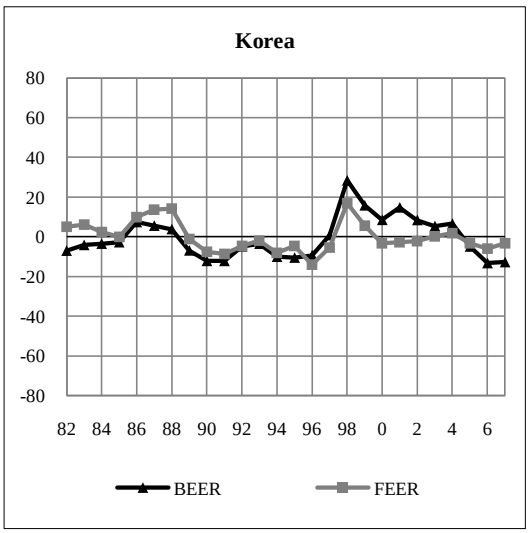

Brazil
80
60
40
20
0
-20
-40
-60
-80
-100
-120
82 84 86 88 90 92 94 96 98 0 2 4 6
BEER
FEER

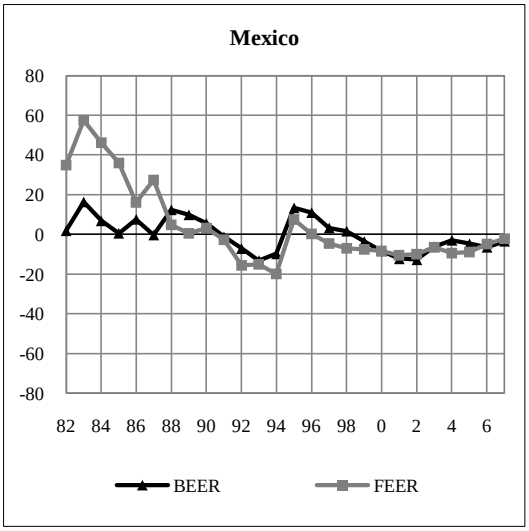

Chile
80
60
40
20
0
-20
-40
-60
-80
82 84 86 88 90 92 94 96 98 0 2 4 6
BEER
FEER

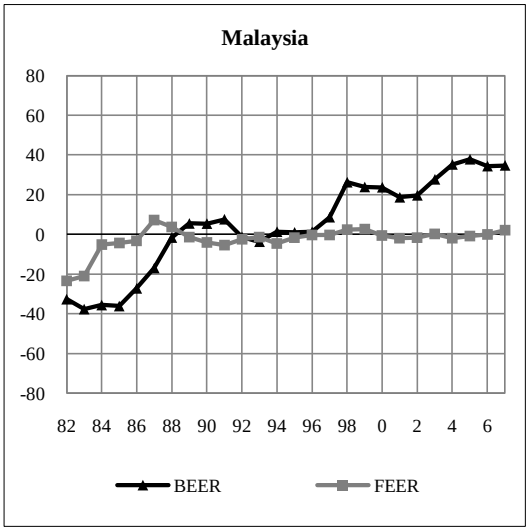

Colombia
80
60
40
20
0
-20
-40
-60
-80
82 84 86 88 90 92 94 96 98 0 2 4 6
BEER
FEER

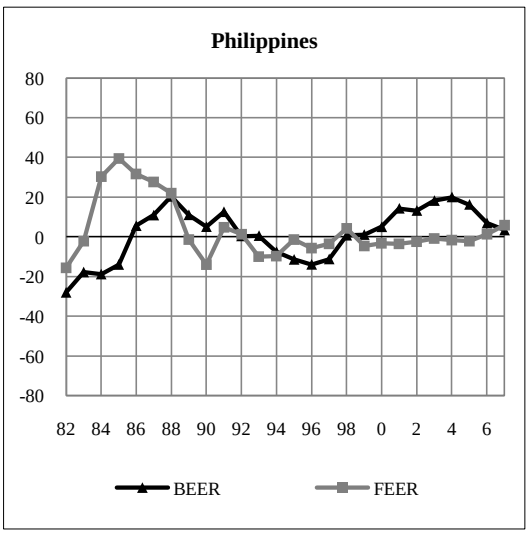

India
80
60
40
20
0
-20
-40
-60
-80
82 84 86 88 90 92 94 96 98 0 2 4 6
BEER
FEER


Indonesia
80
60
40
20
0
-20
-40
-60
-80
82 84 86 88 90 92 94 96 98 0 2 4 6
BEER
FEER

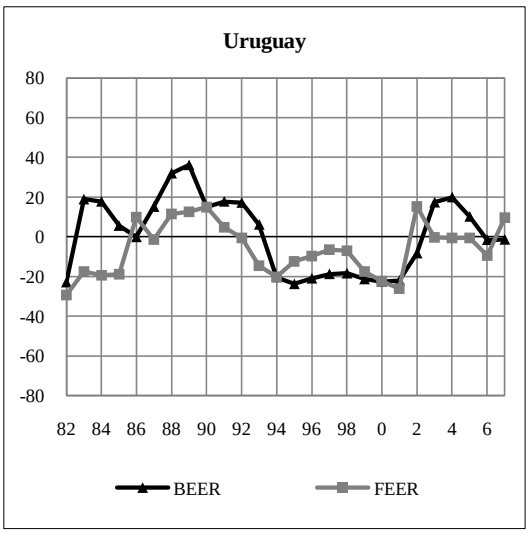

Korea
80
60
40
20
0
-20
-40
-60
-80
82 84 86 88 90 92 94 96 98 0 2 4 6
BEER
FEER











(Source: authors' calculations)

For industrialized countries, the correlation between current account and real effective exchange rate (appendix 8) is disconnected during some periods. Without these periods, we find strong correlations (for example, 83 % for the United States before 2003 and 72 % for Japan after 1984). For developing countries, we find also strong correlation (above 50 %) for all the countries, except for Brazil (32 %), India (49 %), Uruguay (39 %) and the Philippines (42 %). Like in industrialized countries, there are some periods during which these two variables seem to be disconnected (shade areas on figure 12). In these periods misalignments calculated by FEERs and BEERs follow different trends.

These questions can be examined more in detail for some countries. First, in Brazil the divergence between FEER and BEER is especially striking. With the FEER approach the Brazilian currency appeared undervalued between 1983 and 1994 in coherence with current balance close to 0% of GDP, but largely above the equilibrium value. The BEER gives on the opposite a strong overvaluation between 1987 and 1994 due to the sharp real appreciation observed from 1987 to 1990, but which didn't seem to have an impact on the current balance. This could be linked to structural improvement of the Brazilian economy during that period which has been reflected in the real appreciation of the equilibrium exchange rate.

On the opposite during the period 1995-2002 the FEER gives an increasing overvaluation following the Real Plan, consistent with huge current deficits. On the contrary the BEER gives an increasing undervaluation, especially after 1998, due simply to the real depreciation. Here again, this depreciation seemed to have only a positive impact with a very long delay due to the effects of the liberalization policy and the recourse to foreign capitals. These evolutions would be reflected in the real depreciation of the equilibrium exchange rate.

Second, India is another case of large de-connection between FEER and BEER. The BEER opposes two much contrasted periods, one from 1982 to 1990 with an overvalued rupee, the second from 1991 to 2007 with an undervalued rupee. This is simply linked to the large real depreciation which happened from 1988 to 1994 and was followed by stabilization. These two phases of over and undervaluation according to the BEER seems rather unrealistic as they are little connected with the large fluctuations of the current balance during these periods.

Third, China is a last case with some similarities with the Indian case regarding the diagnosis of the BEER. According to the BEER the yuan would have been overvalued from 1982 to 1990 in real terms and this overvaluation would have decreased and be replaced after 1992 by a large and permanent undervaluation, thanks to the real depreciation operated during the transition period. This diagnosis doesn't seem coherent with the alternation of periods of current surplus and deficits during the 1980s and the beginning of the 1990s. Similarly, the steady and strong undervaluation doesn't reflect the contrasted evolution of the current balance from the 1990s to the 2000s, notably with the consequences of the Asian crisis and the rising surplus in the last part of the 2000s.

In summary, for these three main emerging countries, the BEER approach gives a too simplified view of the equilibrium exchange rate, based, to make short, on a simple mean value, which doesn't integrate sufficiently structural changes that occurred. These structural changes are more taken in account by the FEER approach, although indirectly, which, for this reason, seems more appropriate.

7. Conclusion

Some general lessons can be drawn from this estimation of ERM and current account imbalances since the 1980s.

The dollar's misalignments in real effective terms have been the most marked during the 2000s among industrialized and emerging countries. They reflected the increasing imbalances of the US growth regime (over-indebtedness of households and declining competitiveness facing, mainly, China), illustrated by the depreciation of the dollar's equilibrium exchange rate. These misalignments were larger than during the middle of the 1980s when a first depreciation of the dollar's equilibrium exchange rate had been already observed, mainly due at that time to the penetration of Japanese products. They have been reduced since the burst of the crisis in 2007 through the fall of activity and imports which has induced a shrink of the US current deficit.

On the contrary, the euro's misalignments in real effective terms have been more limited during the 2000s, thanks to the euro's equilibrium exchange rate real appreciation. This appreciation reflected, mainly, the renewal of the German competitiveness after painful adjustments and restructuring at the expense of the rest of the European Union, for a large part. These limited euro's misalignments recover actually huge intra-European imbalances with a euro undervalued for Germany and overvalued for Southern European countries. However, during the first part of the 2000s, the euro was clearly undervalued against the dollar, but to a less extent than Asian currencies like the yen and the yuan, which meant an overvaluation of the euro against these currencies. This undervaluation of the euro against the dollar has been progressively reduced until 2009 thanks to the appreciation of the euro and the effects of the crisis. It can be noticed that the euro's misalignments were more pronounced in the middle of the 1980s, both in real and nominal terms, in spite of the euro's appreciation and due to the appreciation of the euro's equilibrium exchange rate against the dollar. At that time the US deficits were more reflected in European (German) surplus and less in Asian surplus, as to day.

Japan has contributed to increase world imbalances during the 2000s with a yen undervalued in real effective terms and even more in nominal term against the dollar, in spite of the stability of the dollar-yen parity. The yen's real depreciation has been sharper than the depreciation of the equilibrium exchange rate induced by the erosion of the Japanese model of production. It has helped to sustain the economic recovery at the expense of the rest of the world. This strategy of a yen undervalued had been used in the past from the 1970s to the begin of the 1990s to boost the Japanese growth, but at that time the yen appreciated in real and nominal terms thanks to the strength of the Japanese growth model. The 1990s had been a kind of exception with a yen overvalued. Since the burst of the crisis in 2007 the yen has appreciated strongly, the undervaluation has disappeared and the current surplus has been reduced. However this contribution to the reduction of the current imbalances has reinforced the constraints of the Japanese economy.

Among the BRICs, the main emerging countries, the exchange rate policy has been contrasted. The Chinese case is the most well known. From the 1980s to 1994 the trade openness strategy has been based on a Yuan's depreciation in real and nominal terms with alternatively periods of under and overvaluation, but preserving more undervaluation and avoiding the recourse to external indebtedness. Since the middle of the 1990s a turning point has appeared with a permanent yuan undervaluation in real and nominal terms, due to a real

revaluation of the yuan smaller than the equilibrium exchange rate's revaluation which resulted from the success of the Chinese strategy of openness. This undervaluation has been temporally attenuated with the consequences of the Asian crisis of 1997-1998, but it has amplified since 2002 and remained after the financial crisis of 2007. Chinese surpluses are one of the symptoms of the persistent world imbalances.

India has followed a different path, although there are similarities with China in the exchange rate's evolution: long period of real and nominal depreciations, followed at the end of the 1990s by a real appreciation and a nominal stabilization. But, during the depreciation period the duration of overvaluation has been longer than in China, with current imbalances more pronounced. After the stabilization the overvaluation has been almost the rule, with persistent current deficits, except for a short period between 2001 and 2003. India didn't enjoy a revaluation of its equilibrium exchange rate as China did, which can be interpreted as a less successful policy of liberalization and trade openness. Since the burst of the crisis of 2008 the rupee's overvaluation and current imbalances have amplified, which is rather scarce among emerging countries. It means huge overvaluation against the other Asian partners and put constraints on the future potential growth of India.

Brazil is a last case where three different periods can be distinguished. From the beginning of the 1980s to the adoption of the Real plan in 1994, a succession of stabilization programs and exchange rate adjustments tried to preserve competitiveness through permanent real and nominal undervaluation, but with inflation hardly under control. From 1994 to 2002 more focus was put on inflation stabilization and less on competitiveness, as foreign capital flows financed current deficits. Real and nominal overvaluation was permanent, but gradually decreased after 1998 and the return of devaluations. Since 2002 a more balanced situation prevailed with no misalignments in real terms, an undervaluation against the dollar and an appreciation of the equilibrium exchange rate which reflected improvement in Brazilian competitiveness. But things have worsened with the burst of the crisis. Undervaluation against the dollar have disappeared and real overvaluation is back, although moderately.

East Asian countries, including Korea, have roughly followed the same path in spite of inequality in the level of development: real and, often, nominal depreciation until the end of the 1980s, stabilization against the dollar with, in some cases, real appreciation during the 1990s, large devaluations after the Asian crisis of 1997-1998 followed, more or less rapidly, by revaluation against the dollar and in real terms. There is no general configuration in terms of under or overvaluation for all the East Asian currencies during the 1980s and 1990s. Periods of undervaluation and overvaluation have alternatively prevailed. Indonesia occupied a specific position due to its statue of oil producer. The Korean won and Thai baht were more overvalued before the Asian crisis of 1997. After the huge devaluations of 1997-1998 the real undervaluation didn't last and misalignments remained limited in real terms, but not against the dollar. During the 2000s all the East Asian currencies were undervalued against the dollar, but less than the yuan and the yen and more than the euro after its revaluation in the second half of the 2000s. Since the burst of the financial crisis of 2008, the undervaluation has been preserved against the dollar and amplified in real terms with rising current surpluses, above their equilibrium values. This configuration, although less marked than in the Chinese case, contributes to the persistence of current imbalances.

Latin American countries have known wider and more dispersed misalignments and current imbalances, but nominal stabilization has been observed since the 2000s. Argentina experimented three contrasted periods. During the 1980s a succession of stabilization plans trying to fight inflation led to overvaluation and was followed by policies more turned

towards competitiveness, inducing undervaluation, but also high inflation. During the 1990s the currency board regime led to huge deficits and overvaluation until the crisis of 2001. After the maxi-devaluation, undervaluation against the dollar prevailed, but was less durable in real terms. However Argentina faced the world crisis of 2008 in a more comfortable position with large surpluses and undervaluation, although the question of the measure of inflation induces some incertitude.

In Mexico three periods can also be considered. The first part of the 1980s was marked by stabilization plans which failed, but preserved undervaluation and current surpluses. From 1987 to the crisis of 1995 more heterodox plans, followed by trade liberalization, succeeded in stopping inflation, but entailed large overvaluation and current deficits. Since then, successive devaluations limited the overvaluation and the imbalances' amplitude and led to a progressive stabilization. In spite of this, facing the crisis of 2008, the room for manoeuvre of the Mexican economy, closely connected with the US, seems relatively limited.

Chile, Colombia and Uruguay presents some similarities in their exchange rate evolution, a long nominal depreciation up to 2002, a succession of depreciation and appreciation in real terms with a much larger amplitude in Uruguay. In Chile, after an overvaluation period during the first part of 1980s, a more balanced situation prevailed in spite of the destabilizing effects of the Asian crisis of 1997 and of the financial crisis of 2008. On long period imbalances have been much larger in Colombia and overvaluation has tended to amplify during the last crisis. On the contrary Uruguay has reduced its overvaluation since the middle of the 2000s.

On the whole in 2009, the dollar was still overvalued against all the East Asian currencies, except the yen which was close to equilibrium. The undervaluation of the yuan was the largest one. The dollar was also overvalued against some Latin American economies (Argentina, Chile and Uruguay) which benefited of undervalued currencies in real terms. Brazil and Mexico had currencies close to equilibrium against the dollar, but were slightly overvalued in real terms, which reduced their room for manoeuvre, especially for Mexico. The euro area, as a whole, was also close to equilibrium, but faced mainly huge intra-European imbalances. Last, Colombia and, above all, India suffered of overvalued currencies against the dollar and in real terms.

Appendix 1: Multinational model in differential logarithmic[8]

Multinational model in logarithmic differentials ($x = dX / X = (X - X^e) / X^e$) is transformed into:

$$x_i = \eta x_i \sum_{j \neq i} \alpha_{ij} m_j + \varepsilon x_i \left(pmx_i - px_i \right) \quad [24]$$

$$pmx_i = \sum_{j \neq i} \lambda_{ij} \left(px_j - e_j \right) + e_i$$

$$m_i = \eta m_i di_i + \varepsilon m_i \left(pd_i - pm_i \right) \quad [25]$$

$$pmm_i = \sum_{j \neq i} \mu_{ij} \left(px_j - e_j \right) + e_i$$

$$\sum_i vx_i \left(x_i + px_i - e_i \right) = \sum_i vm_i \left(m_i + pm_i - e_i \right) \quad [26]$$

$$\sum_i wx_i x_i = \sum_i wm_i m_i \quad [27]$$

$$px_i = \alpha x_i pmx_i + \left(1 - \alpha x_i\right) p_i \quad [28]$$

$$pm_i = \alpha m_i pmm_i + \left(1 - \alpha m_i\right) pd_i \quad [29]$$

$$pd_i = a_i pm_i + \left(1 - a_i\right) p_i \quad [30]$$

$$r_i = e_i - pd_i + \sum_{j \neq i} \left(pd_j - e_j \right) \quad [31]$$

$$b_i = \mu_i T_i \left(1 - \sigma_{petx_i} - \sigma_{x_i}\right) \left(px_i + x_i - pm_i - m_i \right) \quad [32]$$

With *wx*, *wm*, *vx*, *vm* = the shares of each country in the world exports in volume, the world imports in volume, the world exports in value and the world imports in value, respectively; $T = PXX / PMM$ = ratio of exportation to importation; $\mu = PMM/PY$ = openness ratio; F = net external position in dollars; i = interest rates; $\sigma_x = iEF/PXX$ = ratio of external debt services to exports and $\sigma_{petx} = EP_{pet}M_{pet}/PXX$, ratio of net oil imports on non-oil exports.

The way the equation [32] is derived should be explained:

---

[8] $\lambda_{ij} = \frac{X_{i \to j}}{X_i}; \mu_{ij} = \frac{M_{i \leftarrow j}}{M_i}; \alpha_{ij} = \frac{X_{i \to j}}{M_j}; \nu_{ij} = \left(\frac{X_{i \to j} + M_{i \leftarrow j}}{X_i + M_i} \right)$ (Source: authors' calculations, CHELEM, CEPII's database). Here, we use natural logarithms in order to simplify calculations. This approximation is acceptable at first order and in the vicinity of equilibrium.

$$b_i = \left(\frac{B_i}{P_i Y_i}\right) - \left(\frac{B_i^*}{P_i^* Y_i^*}\right) = d\left(\frac{B_i}{P_i Y_i}\right) = \mu_i d\left(\frac{B_i}{PM_i M_i}\right)$$

$$b_i = \mu_i d\left[\left(\frac{PX_i X_i}{PM_i M_i}\right) - 1 - \left(\frac{EP_{pet} M_{peti}}{PX_i X_i}\right)\left(\frac{PX_i X_i}{PM_i M_i}\right) - \left(\frac{i_i E_i F_i}{PX_i X_i}\right)\left(\frac{PX_i X_i}{PM_i M_i}\right)\right]$$

$$b_i = \mu_i dT_i \left(1 - \sigma_{petxi} - \sigma_{xi}\right)$$

Appendix 2: National model in differential logarithmic

National model in logarithmic differentials ($x = dX / X = (X - X^e) / X^e$) is transformed into:

$$x_i = \eta x_i d_i^* + \left(1 - \alpha x_i\right) \varepsilon x_i r_i \quad [33]$$

$$m_i = \eta m_i di_i - \left(\alpha m_i \varepsilon m_i\right) r_i \quad [34]$$

$$px_i = \alpha x_i r_i + p_i \quad [35]$$

$$pm_i = \alpha m_i r_i + p_i \quad [36]$$

$$b_i = \mu_i T_i \left(1 - \sigma_{petxi} - \sigma_{xi}\right)\left(px_i + x_i - pm_i - m_i\right) \quad [37]$$

We can compute r (equation [20]), the misalignment of "national euro" in real effective terms ($r = dLogR = dR / R = (R - R^*) / R^*$):

$$\frac{dT_i}{T_i} = px_i + x_i - pm_i - m_i$$

$$\frac{dT_i}{T_i} = \left(\eta x_i d_i^* - \eta m_i di_i\right) + \left[\left(1 - \alpha x_i \varepsilon x_i\right) + \varepsilon m_i \alpha m_i + \alpha x_i - \alpha m_i\right] r_i$$

$$b_i = \mu_i dT_i \left(1 - \sigma_{petxi} - \sigma_{xi}\right)$$

$$\frac{dT_i}{T_i} = \frac{b_i}{\mu_i T_i \left(1 - \sigma_{petxi} - \sigma_{xi}\right)}$$

$$r_i = \left[\frac{\left(\left(b_i \Big/ \left[\mu_i T_i \left(1 - \sigma_{petxi} - \sigma_{xi}\right)\right]\right) + \eta m_i di_i - \eta x_i d_i^*\right)}{\left(\left(1 - \alpha x_i\right) \varepsilon x_i + \varepsilon m_i \alpha m_i + \alpha x_i - \alpha m_i\right)}\right]$$

By using the equation [18] , we can find out *e*, the degree of misalignment in bilateral nominal terms (equation [21]); the partner countries' misalignments are given by the previous multinational model:

$$r_i = e_i + px_i^* - p_i$$

Like in the multinational model, we suppose that $p_i = \frac{\left(P_i - P_i^e\right)}{P_i^e} = 0$

$$e_i = r_i - \sum_{j \neq i} \lambda_{ij} \left(px_j - e_j \right)$$

We can also compute the effective ERM based on consumer prices (PD) (equation [22]):

$$RC_i = \frac{E_i PD_i^*}{PD_i}$$

$$rc_i = e_i + pd_i^* - pd_i$$

$$pd_i^* = \sum_{j \neq i} \nu_{ij} \left(pd_j - e_j \right)$$

$$pd_i = \mu_i pm_i + \left(1 - \mu_i\right) p_i$$

$$pm_i = \alpha m_i \left(e_i + pm_i^* \right) + \left(1 - \alpha m_i\right) p_i$$

$$pd_i = \alpha m_i \mu_i \left(e_i + pm_i^* \right)$$

$$rc_i = \left(1 - \alpha m_i \mu_i\right) r_i + pd_i^* - px_i^*$$

$$rc_i = \left(1 - \alpha m_i \mu_i\right) r_i + \sum_{j \neq i} \nu_{ij} \left(pd_j - e_j \right) - \sum_{j \neq i} \lambda_{ij} \left(px_j - e_j \right)$$

(pd_j, e_j, px_j obtained thanks to the multinational model)

Appendix 3: Trade elasticities

The elasticities of the MIMOSA model for Japan, the United States and the United Kingdom (close to those of Wren-Lewis), those of Dées for China and those of Hervé for the Euro area are taken for our simulation. The price elasticities are rather in accordance with the generally admitted hierarchical position of countries in the world trade. The relatively weak value for China could be surprising, but might be explained by the particular nature of the Chinese trade. The trade model of China was estimated for the period 1985-1998 and for the first half of the 1980s the role of exchange rates in exports and imports is considered as little significant. Notice also that Japanese and American exporters turn out to be largely price maker. The price elasticities are weaker in the OECD (2005) publication as they concern the total trade of goods and services. For the Rest of the World, estimation of elasticities has been made using data from CHELEM and OECD.

Country	*Source*	ε_x	ε_m	η_x	η_m
Japan	*MIMOSA*	**1.26**	**1.47**	**1.01**	**1.50**
	NIGEM	1.19	0.61	1.00	1.69
	Wren-Lewis	1.36	1.16	0.91	1.20
	OECD	1.05	0.40	1.00	1.00
China	*Dées*	**0.71**	**1.02**	**0.75**	**1.04**
	Brillet	0.66	0.46	1.00	0.98
	OECD	1.50	0.50*	1.00	1.57*
U.S.	*MIMOSA*	**0.91**	**1.44**	**1.04**	**1.56**
	NIGEM	0.52	0.61	1.00	2.52
	Wren-Lewis	0.96	1.35	1.12	2.00
	OECD	0.60	0.33	1.00	1.00
U.K.	*MIMOSA*	**0.70**	**1.33**	**0.87**	**1.82**
	Wren-Lewis	1.26	0.22	0.91	2.00
	OECD	0.60	0.28	1.00	1.00
Euro area	*ECB*	0.50	0.81	1.00	0.51**
	Hervé	**1.39**	**0.30**	**1.05**	**1.06**
RoW	*Ad hoc*	**1.00**	**1.00**	**1.00**	**1.00**
	Our estimates	0.58	1.66	1.00	1.35

(*Kwack et alii (2007), ** Non-oil import in volume)

For emerging countries, studies of Senhadji (1998), Senhadji & Montenegro (1999), Barrel et al., (1999), Ito et al. (1996) and of IMF (2000) have been used. For Korea and Thailand Barell's results, close to those of Senhadji, have been taken whereas for Indonesia FMI's elasticities have appeared more significant. For India Senhadji's results have been used. Two problems appeared for Malaysia and Philippines. Import price elasticity of Malaysia estimated by IMF seemed too weak while Philippines' one estimated by Senhadji was very high,

especially compared with IMF results. For these two countries, mean values obtained for the whole set of Senhadji's emerging countries have been preferred for import price and income elasticities (εm = 1.4; ηm = 1.1). Last, for Uruguay also, the import income elasticity appeared too high and a smaller value (1.5) has been used.

Country	*Source*	ε_x	ε_m	η_x	η_m
Korea	*Barell* *Kim*	**2.20** 1.11	**1.20** 0.10	**2.00** 1.29	**1.20** 1.59
India	*Senhadji*	**0.77**	**1.12**	**1.55**	**1.33**
Indonesia	*IMF* *Senhadji*	**0.32** -	**0.68** 1.51	**1.27** -	**1.66** 0.98
Malaysia	*IMF*	**0.53**	0.01	**1.86**	1.47
Philippines	*IMF* *Senhadji*	-0.10 **1.22**	-0.75 2.73	1.34 **1.19**	1.65 2.26
Thailand	*IMF* *Barell* *Senhadji*	0.99 **0.45** -	0.75 **0.93** 1.37	2.73 **2.59** -	1.03 **1.59** 1.69
Argentina	*Senhadji*	**0.24**	**1.07**	**1.28**	**1.27**
Brazil	*Senhadji*	**1.60**	**1.81**	**2.10**	**1.25**
Chile	*Ito et al.* *Senhadji*	0.10 **0.10**	0.23 0.02	2.87 **2.87**	1.70 **1.70**
Colombia	*Senhadji*	**1.73**	**0.78**	**1.39**	**1.09**
Mexico	*Senhadji* *Ito et al.*	- **0.77**	0.79 **1.43**	- **1.55**	1.32 **1.60**
Uruguay	*Senhadji*	**1.77**	**0.94**	**0.59**	5.54

Appendix 4: Sensitivity tests

Considering the existing uncertainties in the estimation of external and internal equilibrium and in the measure of trade elasticities, three kinds of sensibility tests have been performed:

- an increase of the target current balance of 1% of GDP (*bc*);
- an increase of the potential production of 1% (y^e);
- an increase of the export price elasticity of 20% (ε_x);
- an increase of the import price elasticity of 20% (ε_m).

Table 8: Sensitivity tests on real effective exchange rates (rc)

	bc	y^e	ε_x	ε_m
Korea	0.0066	0.0022	0.0014	0.0029
India	0.0542	0.0021	0.0004	0.0070
Indonesia	0.0140	0.0143	0.0146	0.0152
Malaysia	0.0030	0.0157	0.0162	0.0126
Philippines	0.0127	0.0052	0.0053	0.0063
Thailand	0.0120	0.0045	0.0043	0.0064
Argentina	0.0492	0.0169	0.0171	0.0203
Brazil	0.0365	0.0062	0.0060	0.0150
Chile	0.0202	0.0037	0.0001	0.0065
Colombia	0.0468	0.0100	0.0042	0.0110
Mexico	0.0113	0.0106	0.0046	0.0063
Uruguay	0.0209	0.0206	0.0072	0.0092

(Source: authors' calculations, absolute average of changes from the base simulation results)

Appendix 5: Sources

Variable	*Source*
CAS	*World Economic Outlook, IMF, April 2009*
ISNFA	*P.R. Lane and G.M. Milesi-Ferretti's Database, 2007*
CDR, ODR	*World population prospect, ONU, Last update, September 28, 2007*
OG	*Economic Outlook, OECD, December 2008*
OB	*CHELEM, CEPII's Database, 2009*

Appendix 6: Panel unit root test

Variables	*CA*	*ISNFA*	*CDR*	*ODR*	*DR*	*OG*	*OB*
Developed countries group	-2.16**	-1.20***	-3.83***	-11.29***	-	-7.65***	-
Emerging countries group	-3.32***	-2.23**	-	-	-2.48***	-8.20***	-4.08***

(Source: authors' calculation)
(*** = Significant at 1%, ** = significant at 5% using the test statistic Im Pesaran Shin; the rejection of the null hypothesis (of the presence of unit root), leads us to reject non-stationarity of the series.)

Appendix 7: Comparison with Cline's OCI estimates

In spite of some differences in the methodology, a comparison with Cline's estimates is possible. If, in both cases, the FEER framework is used, Cline's model has 35 countries, a simpler analysis of the foreign trade for each country and no structural approach of the current account equilibrium. Instead, it is simply supposed that external imbalances should not exceed 3% of GDP (in absolute value) in the medium term, which allows building a scenario of current account targets for the 30 non-oil exporting countries.

Table 9: Comparison with Cline's estimates (in %)

	Real Effective						***Nominal Bilateral***					
	2008		***2009***		***2010***		***2008***		***2009***		***2010***	
	Our's	***Cline***	***Our's***	***Cline***	***Our's***	***Cline***	***Our's***	***Cline***	***Our's***	***Cline***	***Our's***	***Cline***
USA	-23.6	-7.8	-9.9	-5.7	-11.0	-7.8	-	-	-	-	-	-
UK	-0.6	-4.2	-4.1	-6.3	-5.0	-1.4	13.3	1.0	4.4	2.5	4.5	4.5
EU	-4.5	-4.3	-2.0	-2.5	-1.0	-2.5	11.8	2.7	7.2	7.2	8.8	4.6
CHN	16.2	12.6	10.8	29.6	11.4	13.5	34.5	23.4	22.4	40.7	23.8	24.2
IND	-17.2	-2.1	-12.9	-12.0	-14.6	-1.8	-0.9	7.3	-3.8	-1.5	-4.6	7.7
BRA	-8.4	-0.4	-5.1	-27.8	-17.6	-5.9	8.3	5.8	5.0	-15.4	-7.5	0.0
JPN	5.2	4.2	-5.1	-0.2	-3.8	-2.0	22.0	15.1	6.4	16.1	8.2	8.8
KOR	-2.4	-2.0	5.8	-16.5	-0.6	-1.8	16.5	10.0	19.5	-3.0	11.3	9.5
INS	4.9	2.7	12.2	-16.4	12.8	-2.0	25.8	17.8	25.7	-5.0	26.7	14.6
MYS	4.4	8.5	3.5	19.3	2.0	12.5	34.5	23.1	20.2	30.5	16.6	29.0
PHI	2.6	1.5	9.8	2.8	5.2	-1.7	23.8	14.6	25.0	14.8	19.0	11.8
THA	1.5	1.7	10.5	-0.1	2.8	-2.0	24.8	14.6	28.8	12.4	16.4	10.8
ARG	11.4	-2.0	11.9	14.5	7.2	-2.9	31.4	4.5	24.2	16.9	19.4	1.8
CHI	0.2	-0.3	12.0	-10.9	0.7	-2.6	18.0	6.4	25.5	-6.2	12.0	3.3
COL	-17.9	-4.8	-5.2	-0.6	-33.0	-2.3	-3.5	-0.4	4.5	10.8	-26.3	1.5
MEX	-8.2	-0.1	-1.2	-9.2	-5.5	-0.8	21.1	2.1	8.8	-8.6	3.9	1.3

(Source: Cline, 2008; Cline & Williamson, 2008, 2009, 2010; authors' calculations, forecast for 2010)
(A positive number indicates an undervaluation. Conversely, a negative number indicates an overvaluation)

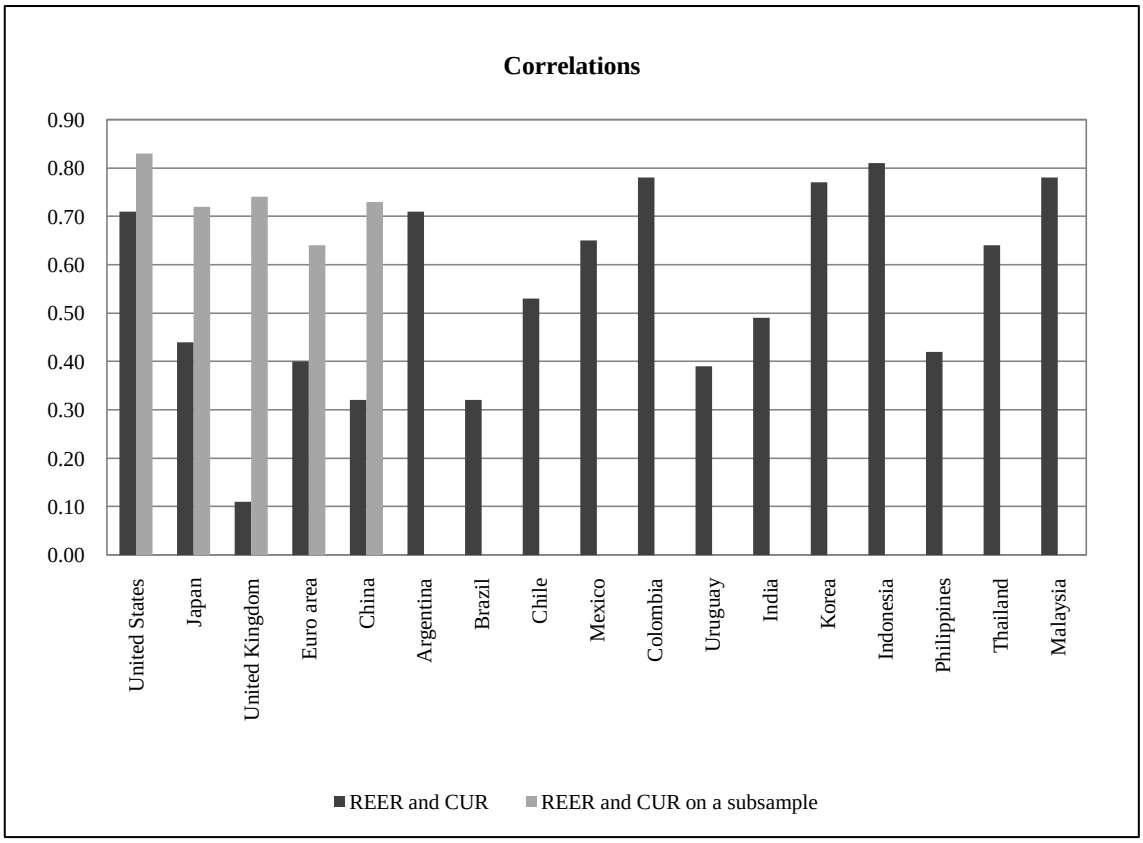
Our results are close to those of Cline, in real effective terms, with some divergence regarding the dollar, in 2008, which can be understood (table 4). In both cases the overvaluation of the euro in real effective terms remained small in 2008 and 2009, which can be explained by a limited current account deficit, close to its equilibrium value. For the dollar results are more

divergent, which has an incidence on all the estimated nominal bilateral misalignments against the dollar. The discrepancy in 2008 with Cline's results for the real effective misalignment of the dollar is mainly explained by differences in the US current account target. In a previous estimation for 2008, we had a target close to -3% of GDP (as in Cline's work) and results gave a more limited overvaluation of -11.1 % for the dollar in 2008. However, the actual estimation with an overvaluation of -24% seems plausible as the US current deficit was still -5% of GDP in 2008. For 2009, the results are very close in a previous work Cline & Williamson (2009) found that the dollar is overvalued by 17.7 % in real terms in 2009 but this estimation was made with the value of the exchange rate in March 2009 when the dollar appreciation was the highest after the financial meltdown in October 2008.

From March to November, the dollar depreciated by 12 % consecutively to the return of risk appetite of investors. This movement marked the end of the safe haven effect caused by the crisis. This depreciation of the dollar reduced the real effective overvaluation (Cline & Williamson, 2010).

For emerging countries, the results are globally convergent, on the whole period, with some exceptions which can be explained by differences in the current account targets. For example, our estimates give more overvalued currencies for India and Colombia relatively to those of Cline. For these two countries, Cline uses a target of -3 % of GDP. Conversely, our econometric estimates yield a target of -1 % which produces more overvalued currencies since the current account target is relatively higher.

Appendix 8: Correlation between real effective exchange rate and current account



(For industrialized countries, the subsamples are: before 2002 for the U.S., after 1984 for Japan, after 1990 for the U.K, after 1997 for the Euro area, after 1996 for China)

For industrialized countries, we choose to calculate the linear correlation between the real effective exchange rate in *t* and the current account in *t + 2* because of some inertia in the current account of these countries (excepted for Japan and China in which the current seems to react faster to the real effective exchange rate, we calculate the linear correlation between the real effective exchange rate in *t* and the current account in *t + 1*). For emerging countries, we calculate the linear correlation between the real effective exchange rate in *t* and the current account in *t* because of a weaker inertia.

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