Exchange Rate Regimes and Equilibrium Exchange Rates in East Asia

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Exchange Rate Regimes
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Se-Eun Jeong
Jacques Mazier*

Estimation of equilibrium exchange rates is conducted for the three main Asian currencies (Japan, China, South Korea) with theoretical framework of Williamson [1994]. It highlights the problems of regional monetary cooperation that have gained momentum after the outbreak of the 1997-1998 financial crises in East Asia. The Chinese yuan became undervalued during the second part of the 1990s, which can explain its resistance faced with the Asian crisis. The yen became marked by contrast between a weak undervaluation against the dollar since 1998 and an overvaluation against the Chinese yuan since 1995 and Korean won since 1998. As for the Korean won, an overvaluation appeared before the Asian crisis, followed by an undervaluation compared to the dollar and yen. Persisting misalignments of these three currencies attest to the need for regional monetary cooperation. Estimated equilibrium exchange rates would be useful to set exchange rate parities at the launching of any new institutional arrangements (common basket peg policy, yen bloc, ACU).

RÉGIMES DE CHANGE
ET TAUX DE CHANGE D’ÉQUILIBRE EN ASIE DE L’EST


JEL Classification: F31, F32, F33, F42.

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INTRODUCTION

The financial crisis in Asian countries in 1997-1998, partly due to the de facto dollar peg policy of several countries, and the high level of integration in the region, stimulated renewed literature on the regional monetary organisation in Asia. According to one frequently-mooted argument not long ago, the only viable exchange rate arrangements would have been the extreme solutions, the free floating or the currency board, even the dollarisation (Eichengreen, Hausmann [1999]). Since 1998 it has been observed, however, that in practice there is more flexibility in the sustaining peg but that the dollar continues to play an important role. The choice of exchange rate regime depends much on the peculiar characteristics of each country or of each zone and the intermediate solutions conserve a lot of advantages in many circumstances. That is the case of Asian countries for which, beyond the short-term responses, different regional solutions have been proposed.

The short-term responses adopted since 1998 are reduced, for a lot of countries, to a dollar peg policy because it doesn’t require a high degree of co-operation. The progress has been limited in this field. The Chiang Mai Initiative of May 2000 principally included swap agreements between the partner countries, but presented the interest of integrating, in addition to the ASEAN countries, the three principal regional actors, that is, China, Korea and Japan.

The policy of a common basket peg composed of the dollar, the yen and the mark (or the euro) was put forward by Williamson [1999] with a study of the advantages expected for the participants according to their trade structure. The efficiency of this policy was compared with alternative strategies. The stability of the real effective exchange rates might have been almost as great as in the case of unilateral peg, irrespective of the precise definition of the basket, but the adoption of such a policy demands a level of regional cooperation difficult to realise for the time being.

The creation of an Asian Currency Unit (ACU), that is, a basket of Asian currencies, was also proposed (Kim, Ryou [2001]), according to a schema inspired by the experience of the European Monetary System (EMS). The real exchange rate stabilization would be obtained with the yen acting as an indirect peg currency, but the same kind of monetary cooperation problems arise. In addition, the geographical configuration for such a proposition would be a controversial question. (Kwan [2001]).

Whatever the institutional organisation chosen, the credibility of an intermediate regime implies three conditions: the resolution of complicated political problems between the partner countries; the existence of commitments and guarantees in the short term under the form of anti-speculation mechanisms, with a sufficiently flexible but robust way of management and support commitments at the regional level; the explicit strategy for the medium and long term for regional integration. These conditions are not fulfilled in the East Asian countries and elaborate forms of regional monetary cooperation are not feasible in short term. However, the already high level of integration among Asian countries and the private actors’ pressure constitute forces in favour of more monetary stability at the regional level while preserving flexible forms of co-operation.
Sufficiently flexible cooperation is desirable because of the differences in the development levels of the Asian countries. Too strict a parity might lead to overvaluation in the near future for the less developed countries. The experience of the EMS shows that parity readjustments have been inevitable, but at the same time have permitted the stabilisation and progressive convergence of the participant currencies. In the Asian region, flexible forms of cooperation, not too risky politically, but favourable to the monetary stability, have to be sought.

In these renewed exchange rate regime discussion, the question of equilibrium exchange rate is a crucial factor of success. The fixed exchange rate system is exposed to speculative attacks in case of parity unsustainability. The estimation of equilibrium exchange rates could contribute to improve the credibility of peg policy (unilateral peg or common basket peg) by giving a measure of the misalignment. Likewise, equilibrium exchange rates could form part of the determination of the ACU by providing a parity scale close to the equilibrium.

This research has the aim of finding the equilibrium exchange rates for the three major Asian currencies, the Japanese yen, the Chinese yuan and the Korean won with the theoretical framework of the Fundamental Equilibrium Exchange Rate in the manner of Williamson [1985], [1994]. Other methodologies exist like the BEER approach (Behavioural Equilibrium Exchange Rates in Clark, Macdonald [1999]) or the NATREX model (Natural Real Exchange Rate of Stein and alii [1995]). These approaches rest on a reduced equation for estimating the fundamental determinants of the equilibrium exchange rates. Although they are easier to implement, they seem less suitable than the FEER for various reasons. The fundamentals and specification of the reduced equation are based on a structural model that focused on the sustainability of the external balance or on a portfolio balance. But the transition from the structural to the reduced model often lacks accuracy. These approaches do not take the internal equilibrium clearly into account. Lastly, the compatibility of the equilibrium exchange rates of the different commercial partners is not always ensured.

The estimation is conducted with the help of a multinational model that describes the trade of the three countries with their principal partners, the United States, the euro zone and the rest of the world. Without resorting to simulations of heavy multinational models like in earlier approaches of the FEER, our method is inspired by those followed in Couharde & Mazier [2000] and Borowski & Couharde [2000]. It complements them in three points, the explicit inclusion of the rest of the world, the consideration of the debt service and the econometric estimation of the current account balance targets with medium term determinants (Faruque & Debelle [1998]; Chinn & Prasad [2000]). These equilibrium exchange rates are then used to operationalise alternative regional monetary arrangements in Asia. The first section presents the structure of the model and its principal parameters. In the second section we give the estimation of equilibrium current account determination as well as output gaps. The third section presents the estimation results of the equilibrium exchange rates with those of sensitivity tests. The principal lessons which can be drawn for the alternative exchange rates regimes in Asia are discussed in a third section.
MULTINATIONAL MODEL OF EQUILIBRIUM EXCHANGE RATES

The structure of the model

The model describes the trade structure of the three Asian countries, as well as of the United States and the Euro zone in volume and in prices. The rest of the world is also included to guarantee the equilibrium at world level. With the usual notation, the model is written as:

Trade volume equations

\[ X_i = X_{0i}D_{M_{i}^{x}}C_{PMX_{i}^{x}} \]
\[ DM_i = \Pi_j M_{j}^{m_{ij}} \]
\[ COMPX_i = PMX_i / (PX_i) \]
\[ M_i = M_{0i}D_{M_{i}^{x}}(PD_{i}/PM_{i})^{x_{mi}} \]

with

\[ i = \{ 1 = \text{Japan}, 2 = \text{Korea}, 3 = \text{China}, 4 = \text{United States}, 5 = \text{Euro zone} \} \]

World trade equilibrium in value and in volume

\[ \Sigma PX_i X_i = \Sigma PM_i M_i \]
\[ \Sigma X_i = \Sigma M_i \]

Price equations

\[ PM_i = PMM_{i}^{a_{mi}}PD_{i}^{1 - a_{mi}} \]
\[ PMM_i = \Pi_j (E_{j}PX_{j}/E_{j})^{\mu_{ij}} \]
\[ PX_i = (E_{j}PMX_{j})^{\alpha_{si}}(P_{i})^{1 - \alpha_{si}} \]
\[ PMX_i = \Pi_j (E_{j}PX_{j}/E_{j})^{\lambda_{ij}} \]
\[ PD_i = PMM_{i}^{a_{i}}P_{i}^{1 - a_{i}} \]
\[ R_i = \Pi_j (PD_{j}/E_{j})^{\nu_{ij}}/(PD_{i}/E_{i}) \]

with \( i = \{ 1 - 6, 6 = \text{rest of the world} \} \).

Where \( X = \text{exports in volume; } DM = \text{world demand in volume; } COMPX = \text{export price competitiveness; } PX = \text{export prices; } PMX = \text{competitor export prices; } M = \text{imports in volume; } PM = \text{import prices; } PMM = \text{world import prices; } PD = \text{consumer prices; } P = \text{producer prices; } E = \text{nominal bilateral exchange rates vis-à-vis the dollar; } R = \text{real effective exchange rates.} \)

We notice that in the model the dollar plays the role of reference (\( E_{4} = 1 \)) and the bilateral exchange rates of the other currencies against the dollar are written as \( 1S = E_{1} \text{yen; } 1W = E_{2} \text{won; } 1Y = E_{3} \text{yuan; } 1E = E_{5} \text{euro; } E_{6} \text{monetary units of the rest of the world.} \)
The weighting coefficients for the real effective exchange rate are equal to the shares of partner countries in the imports and exports of country \( i \); those for world import prices are equal to the shares of partner countries in the imports of country \( i \); those for the principal competitors’ export prices are equal to the shares of partner countries on third markets.

The fundamental equilibrium exchange rate (FEER) is defined as that which permits simultaneous attainment of internal equilibrium and external equilibrium. The external equilibrium corresponds to a sustainable current account balance determined in function of structural parameters. The internal equilibrium represents the full utilisation of productive potential.

As we mentioned, the estimations are made in logarithmic differentials. Variables in lower case represents logarithmic differentials, as \( e = dE/E = (E - E^e)/E^e \) for the bilateral exchange rates and \( x = dX/X = (X - X^e)/X^e \) for the other variables. In this approach the FEER in bilateral terms \( E^e \) is not calculated directly, but indirectly by estimating first the misalignment \( dE/E = (E - E^e)/E^e \) between the observed bilateral exchange rate \( E \) and the equilibrium level \( E^e \).

The internal equilibrium gap of country \( i \) is represented by the variable

\[
b_i = d(B_i/P_i Y_i) = B_i/P_i Y_i - B_i^e/P_i Y_i^e = \mu_i d(B_i/P_iM_i) \]

\[
= \mu_i d((px_i x_i - pm_i M_i - i E_i F_i)/pm_i M_i) \]

\[
= \mu_i dT_i - \mu_i d(i E_i F_i / pm_i M_i) \]

\[
= \mu_i dT_i - \mu_i (i E_i F_i / pm_i M_i) (e_i - pm_i - m_i) \]

\[
b_i \Rightarrow \mu_i dT_i (px_i x_i - pm_i M_i - i E_i F_i / pm_i M_i) = \mu_i dT_i (e_i - pm_i - m_i) \]

Where \( T_i = px_i x_i / pm_i M_i = \) ratio of exports to imports;
\( \mu_i = pm_i M_i / P_i Y_i = \) openness ratio; \( F_i = \) net external assets in dollars;
\( i_i = \) interest rates; \( \sigma_i = i E_i F_i / px_i X_i = \) ratio of external debt service to exports.

In the estimation of the equilibrium exchange rates, the observed current account \( B_i/P_i \) should be corrected for the effects of exchange rate variations in some past years because some parts of current account disequilibrium are just due to delayed adjustment to exchange rate variations.

In all, the model is comprised of 35 endogenous variables \( (x_i, m_i, px_i, pm_i, pd_i \) for the six countries or areas and the five bilateral exchange rates \( e_i \) in 35 equations \( (x_i, m_i, b_i \) for the five countries other than the rest of the world, \( px_i, pm_i, pd_i \) for the six countries plus the two world trade equilibrium equations). The real effective exchange rates \( r_i \) are afterwards calculated with the help of the bilateral exchange rates and internal demand prices. The producer prices \( p_i \) are assumed unchanged at the actual level of calculation, which means that the price-wages circle isn’t considered in this model. The exogenous variables are the internal equilibrium gap and the external equilibrium gap \( (di_i \) and \( b_i \).
Compared to earlier studies of the same kind, the following methodological differences must be emphasised:

– The target current account $B^e/P^eY^e$ is determined for the five countries studied by an equation incorporating the medium run determinants (output gap, government budgetary balance, dependency ratio of young and old population, income per capita, net inflows of foreign direct investment, net foreign assets and degree of openness) and estimated on panel data, for a group of the 19 industrialised countries on the one hand, and on the other hand for a group of 18 emerging countries.

– Summing up these targets enables us to find the target for the rest of the world $(B^e/P^eY^e_{RW})$. But this target cannot be utilised for the estimation of the equilibrium exchange rate of the rest of the world in the same way as for the other countries, that is, this constraint cannot be imposed on all the countries. The model, however, allows us to calculate an “equilibrium exchange rate” for the rest of the world $(e_{RW})$ without this being compatible with its current account target $B^e/P^eY^e_{RW}$. The equilibrium exchange rate of the rest of the world is determined to be coherent with the equilibrium exchange rates of the five other countries under the constraint of world trade.

– The foreign debt service is explicitly considered in the equation of the current account target.

The parameters of the trade bloc equations

Without our own econometric work, the majority of the equations were taken from existing estimations that were realised with specifications close to the standardized model presented before. We used long-term elasticities of trade equations. Considering the uncertainties of estimation, sensitivity tests to elasticity modifications will be made later in the research. The following table 1 compares trade bloc elasticities for the five countries provided by different available estimations.

On the whole, the elasticities for a given country are relatively close to one another, except for few cases. Considering, for a synthetic comparison, the total effect of a variation in real exchange rates on the trade balance $(S = \alpha (1 - \alpha x) + \beta \alpha m - \alpha m + \alpha x)$, the different estimations produce rather similar results. Only the NIGEM model and the Kim model for Korea give lower values. The elasticities of the MIMOSA model for Japan and the United States, close to those of Wren-Lewis, of Barell for Korea, of Dées for China and of Hervé for the Euro zone are taken for our simulation.

The prices elasticities are rather in accordance with their generally admitted hierarchical positions 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 prices in exports and imports is considered

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1. The Kim model for Korea presents some particular specifications. The ECB model of the euro zone has been estimated using the whole intra and extra-European trade, which is not correct, while the Hervé model is restricted to the extra-European trade.
as of low significance. In addition Japanese and American exporters turn out to be largely price makers.

Lastly, special treatment was necessary for the Chinese exchange rate as the official level was not appropriate due to the existence of dual foreign exchange systems from the beginning of the 1980s to 1994. In 1979 the Chinese exchange rate regime was characterised by the government monopoly on foreign currencies and an administratively fixed exchange rate, which overvalued the Chinese currency. This system was compatible with the centralised organisation of trade, where the trade companies could compensate their loss due to the overvaluation by profits on imports. In 1981, the authorities created a rate of conversion for the commercial transactions, which made exports lucrative, and they also gave exporters the right to use their foreign currency holdings.

Table 1. Elasticities of volume and prices equations of trade bloc

<table>
<thead>
<tr>
<th>Country</th>
<th>Price elasticities</th>
<th>Income elasticities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\varepsilon_x$</td>
<td>$\varepsilon_m$</td>
</tr>
<tr>
<td>Japan MIMOSA</td>
<td>1.26</td>
<td>1.47</td>
</tr>
<tr>
<td>Japan NIGEM</td>
<td>1.19</td>
<td>0.61</td>
</tr>
<tr>
<td>Japan Wren-Lewis</td>
<td>1.36</td>
<td>1.16</td>
</tr>
<tr>
<td>Korea Barell</td>
<td>2.2</td>
<td>1.11</td>
</tr>
<tr>
<td>Korea Kim</td>
<td>1.111</td>
<td>0.102</td>
</tr>
<tr>
<td>China Dées</td>
<td>0.71</td>
<td>1.02</td>
</tr>
<tr>
<td>China Brillet</td>
<td>0.66</td>
<td>0.462</td>
</tr>
<tr>
<td>United States MIMOSA</td>
<td>0.91</td>
<td>1.44</td>
</tr>
<tr>
<td>United States NIGEM</td>
<td>0.52</td>
<td>0.61</td>
</tr>
<tr>
<td>United States Wren-Lewis</td>
<td>0.96</td>
<td>1.35</td>
</tr>
<tr>
<td>Euro zone ECB</td>
<td>0.82</td>
<td>0.3</td>
</tr>
<tr>
<td>Euro zone Hervé</td>
<td>1.39</td>
<td>0.3</td>
</tr>
</tbody>
</table>

* Import prices are not estimated econometrically in the NIGEM model.

The exports are a function of an indicator of world demand, that is, a weighted average of imports of the partner countries. The weights are taken to be equal to the market shares of the partner countries in total imports.

The export price of competitor countries is an average of export prices of the competitors on the third market, weighted by the importance of that third market in the exports of the country.

The world import price is defined as the weighted average of export prices of the supplier countries with a weight equal to their share in the total imports.

As referred to before, trade volume equations for the rest of the world are given as the world trade equilibrium in volume and in value¹.

In January 1985, the official exchange rate was adjusted to the rate of conversion, so that the two exchange rates were unified. At the same time, the autho-

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¹ For the price equations for the rest of the world (export price, import price, internal demand price) the following parameters were taken: $\alpha_{x,v} = 0.5$, $\alpha_{v} = 1$, $\alpha_{x} = 0.2$. 

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Riteties allowed the establishment of foreign currency swap centers where companies with quotas could sell their foreign currency at negotiated prices. The transactions conducted in these centers increased more and more and at the beginning of the 1990s the amount was equivalent to roughly half of the export revenues of the country. The exchange rate determined in these swap centers became increasingly utilised as reference, even for the obligatory sales of foreign currency of exporting companies to the Bank of China. So in 1993, four fifths of the currency transactions were realised in these swap centers. In January 1994, the authorities decided to normalise this situation. They abolished the double exchange rate regime and established a single exchange rate aligned to that of the swap centers.

From 1980 to 1994, the Chinese currency depreciated by more than 80% against US dollar at the official rate. In real effective terms measured with consumer prices, the depreciation was roughly 60% at the official rate. Since 1994, the yuan experienced a gradual, but limited, appreciation in real effective terms measured with consumer prices (figure 1). If the real effective exchange rate is calculated with the de facto bilateral nominal rates, which is a weighted sum of the official rates and of the swap rates, the depreciation was more even during the dual exchange rate regime period.

**Figure 1. Nominal bilateral and real effective exchange rate of Chinese yuan**

**EXTERNAL EQUILIBRIUM AND INTERNAL EQUILIBRIUM IN THE MEDIUM TERM**

The estimation of the equilibrium current account

One of the essential elements of the FEER approach is the concept of normal or underlying capital flows in the medium term in order to assure the external equilibrium of a country. That concept is based on the idea that capital flows fill the investment-saving gaps of countries. If countries have different economic
structures, with expected capital yields or saving needs conditioned by structural factors, it would be natural that investment and savings would not be the same from an international and intertemporal capital allocation point of view. As long as the capital moves in function of better yields, a country with better investment possibilities can borrow capital from countries disposing of a saving surplus and repay later. Equilibrium current accounts, reversed capital flows, determined by structural determinants, are not a normative notion, as often criticised as such. The structural determinants play the role of forces bringing the current balance back to its equilibrium level in the medium term. (Faruquee & Debelle [1998]; Chinn & Prasad [2000]).

In this framework, different variables, already tested in other studies of the same kind, have been chosen for the determination of the equilibrium current account (CUR): the relative per capita income, in % of the US (Y), the ratios of dependency (DEP) with a distinction between young and old dependent populations, the net FDI, the net foreign assets (NFA), the degree of openness (OPEN) and the governmental budget balance (GOV). Theoretically, the relation between the net foreign assets (NFA) and the medium term current account could be both positive and negative. On the one hand, the NFA appears as the accumulated amount of the current accounts. In an intertemporal perspective, a country that had initially negative NFA should obtain a current account surplus to repay its debt or, at least, should limit its current deficit to stabilise its ratio of external debt to GDP. In this framework, a negative relation is expected between NFA and the current balance. On the other hand, the debt cycle theory supposes that a country with a positive NFA exports its capital and gets the investment income from that capital. A positive relation is expected, therefore, between NFA and the current balance. In this framework, a negative relation is expected between NFA and the current balance. On the other hand, the debt cycle theory supposes that a country with a positive NFA exports its capital and gets the investment income from that capital. A positive relation is expected, therefore, between NFA and the current balance. In this paper, we favoured the second relation with a consideration of the specific role of the FDI. As long as improvement of a potential productivity is expected in the future from the FDI inflows, FDI permits in the short-term a current account deterioration and a negative sign is expected. The degree of openness turned out to be significant as an explanatory variable for the industrialised as well as for the emerging countries. Nevertheless, we tested this variable only for the emerging economies because in the case of the industrialised countries there is no reliable theoretical justification for a relation between this variable and the current account. Lastly, the output gap (GAP) is included as a short-term business cycle variable; an intensive utilisation of production capacity contributes to a deterioration of the current account.

\[
CUR_{it} = \mu_t + GOV_{it} + \alpha_2 DEP_{it} + \alpha_3 Y_{it} + \alpha_4 FDI_{it} + \alpha_5 NFA_{it} + \alpha_6 OPEN_{it} \\
+ \alpha_7 GAP_{it} + b_i + c_t + u_{it}
\]

The equation has been estimated with panel data for the period 1981-2000 on two groups of countries. Panel data are more appropriate than time series as the purpose of the equation is to capture the main determinants of the current balance on an average for a group of relatively homogeneous countries. The estimated

1. We tested stationarity using panel data unit root tests. We applied the “standardized t-bar statistic” proposed by Im, Sesar and Shin (2002) that can be applied to the more general case where the errors may be serially correlated. Test results allow us to conclude that most of variables are stationary for the industrialised country group and the emerging country group, except for OPEN for the emerging country group.

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equation for the group of 19 industrialised countries will give the equilibrium current account for the United States, Japan, the Euro zone and South Korea. The equation obtained with the group of 18 emerging countries will be used for China. The inclusion of a temporal dummy could be justified as long as it represents temporary shocks occurring for a given year that have important effects on the current account and the financing mode of that year. This dummy could be, however, redundant with the output gap that represents the short-term effects. The inclusion of fixed effects is more questionable. A number of studies utilised these fixed effects for specific countries in order to capture specific effects that are not represented by the common variables. These fixed effects, however, can be source of bias.

Table 2. Estimation of the determinants of the current account for the group of industrialised countries and the group of emerging countries

<table>
<thead>
<tr>
<th></th>
<th>Industrialised countries</th>
<th>Emerging countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pooled least squares</td>
<td>Time effect</td>
</tr>
<tr>
<td>GOV</td>
<td>0.19</td>
<td>0.17</td>
</tr>
<tr>
<td>(4.84)</td>
<td>(3.85)</td>
<td>(4.14)</td>
</tr>
<tr>
<td>DEPyoung</td>
<td>– 0.13</td>
<td>– 0.094</td>
</tr>
<tr>
<td>(– 5.27)</td>
<td>(– 2.97)</td>
<td>(– 1.38)</td>
</tr>
<tr>
<td>DEPold</td>
<td>– 0.08</td>
<td>– 0.063</td>
</tr>
<tr>
<td>(– 2.18)</td>
<td>(– 1.66)</td>
<td>(– 2.50)</td>
</tr>
<tr>
<td>Y</td>
<td>0.001</td>
<td>0.008</td>
</tr>
<tr>
<td>(0.13)</td>
<td>(0.66)</td>
<td>(1.84)</td>
</tr>
<tr>
<td>NFA</td>
<td>0.07</td>
<td>0.071</td>
</tr>
<tr>
<td>(10.92)</td>
<td>(11.00)</td>
<td>(2.76)</td>
</tr>
<tr>
<td>FDI</td>
<td>– 0.29</td>
<td>– 0.31</td>
</tr>
<tr>
<td>(– 2.76)</td>
<td>(– 2.83)</td>
<td>(– 1.85)</td>
</tr>
<tr>
<td>OPEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAP</td>
<td>– 0.50</td>
<td>– 0.54</td>
</tr>
<tr>
<td>(– 9.19)</td>
<td>(– 8.84)</td>
<td>(– 9.96)</td>
</tr>
<tr>
<td>Constant</td>
<td>7.90</td>
<td>4.19</td>
</tr>
<tr>
<td>(3.97)</td>
<td>(1.51)</td>
<td>(1.8)</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.47</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Results of panel data unit root tests

<table>
<thead>
<tr>
<th></th>
<th>CUR</th>
<th>GOV</th>
<th>DEP</th>
<th>DEP</th>
<th>Y</th>
<th>NFA</th>
<th>FDI</th>
<th>GAP</th>
<th>OPEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrialised</td>
<td>– 7.4</td>
<td>– 11.5</td>
<td>6.9</td>
<td>1.96</td>
<td>5.3</td>
<td>4.8</td>
<td>9.8</td>
<td>12.1</td>
<td></td>
</tr>
<tr>
<td>Emerging countries</td>
<td>– 10.0</td>
<td>– 12.9</td>
<td>4.4</td>
<td>2.3</td>
<td>5.6</td>
<td>9.9</td>
<td>14.2</td>
<td>16.8</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Note: critical values are – 1.96 (at 5%) and – 1.65 (at 10%).

For the group of industrialised countries, the coefficients are on the whole significant with the expected signs (table 2). The government budget surplus is positive and significant in the different specifications. The ratios of dependency for the young and the old were estimated with negative effects. As expected, the net inflows of FDI mean a larger current account deficit while the NFA exercises a positive influence through the income on capital they generate. On the other hand, the GDP per capita produces little significant results.
On the whole the results with the different specifications are rather close. The inclusion of time effects brings too marginal an improvement to be retained. In the same way the inclusion of fixed effects seems to reduce the role of NFA, the evolution of which contrasts significantly between countries. Finally it is the specification of pooled least squares that was chosen for the calculation of the medium term equilibrium current account.

The results for the group of emerging economies are significant as well, though, not as much as for the industrialised countries (table 2). The main variables play in the same way as for the industrialised countries, except for a few variables. The per capita income representative of the development level plays positively, which does not hold well if we turn only to the initial phase of the debt cycle theory, but could be explained by the rather advanced phase of these countries compared to the initial state. The openness ratio plays negatively. For developing economies, the openness means a repayment capacity of their debt in the future due to export growth, which allows international capital to be attracted. As before, the net foreign assets exercise a positive effect while the net inflows of FDI permit a deterioration of the current balance. The inclusion of fixed effects seems to produce bias, notably with regard to the role of dependency variables and net foreign assets, which recommends not taking these effects. Similarly, the time effects is likely redundant with the output gap.

Figure 2. Observed, corrected and equilibrium current accounts
Figure 2 represents the equilibrium current account for the industrialised countries. That of Japan progressed from −0.7% of GDP to more than 2% of GDP on average during the 1990s due to the improvement of the net external position, despite the negative effects of the deterioration of the public balance at the end of the period. The rapidly increasing dependency ratio of the old was more than compensated by the decreasing dependency ratio of the young. Similarly, the equilibrium current account of South Korea experienced a vigorous increase from −5% of GDP to a situation close to equilibrium during the 1990s. The main reason can be found in a lesser dependency of the young. The improvement of the net foreign assets brought also a positive contribution at the beginning of the 1990s. The US equilibrium current account declined from −0.5% to −1.5% of GDP due to the reduction of their net foreign assets, before recording a weak recovery at the end of 1990s because of the public deficit improvement. Finally, the equilibrium current account of the Euro zone progressed from −1.3% to 1.5% of GDP at the end of the period under the effects of several factors: growth of the net foreign assets, lesser dependency of the young and reduction of the public deficit.

The equilibrium current account for China, calculated with the specification of pooled least squares, is close to −0.5% of GDP until the beginning of the 1990s. It seems to be coherent with the policy pursued by the Chinese authorities that wanted to avoid the resort to large external debt. The downward shift of the equilibrium value to between −1% and −1.5% of GDP since 1992-1994 could be explained by the start of massive inflows of FDI but also by the effects of higher openness. The improvement of net external position played in the opposite direction whereas the reversed evolution of the two ratios of dependency compensated each other.

The internal equilibrium estimation

The internal equilibrium is defined as the full utilisation of the resources of one country without provoking inflation pressures. For the sake of simplifica-

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1. It should be noted that in the external bloc of Japan, the United States and the Euro zone, the equation of imports volume was estimated with the internal demand rather than the GDP. A simple regression can be established between internal demand and GDP. From this relation, the gap of internal demand in comparison with the equilibrium can be calculated for these three countries. The South Korean trade bloc model has been estimated with GDP.
A restrictive approach is adopted, limited to the measure of the potential output that provides, however, a useful indicator of the general supply capacity. Different methods can be employed in calculating potential production or trend production and the corresponding output gap. For the United States, Japan, the euro zone and Korea, we took the values estimated with production function by the OECD [2001] and the Bank of Korea [2000]. This approach consists of estimating the potential production with the estimated production function and available production factors in the country. It demands more information and more hypotheses regarding economic mechanisms than other simpler approaches but is less mechanical and more pertinent theoretically.

For China, we calculate the equilibrium level of industrialised production by using the Hodrick-Prescott filter. This Hodrick-Prescott filter is a technique intended to determine trend GDP by calculating the weighted moving average throughout the time. Figure 3 reproduces the observed current accounts and the corrected ones. It shows well that China is affected by the largest delayed correction, particularly between 1987 and 1994. These figures give also the equilibrium current accounts calculated and commented on previously, highlighting the gap between the corrected current account and the equilibrium one ($h_t$).

South Korea readjusts its trade the most rapidly to changes of parity whereas the Euro zone and China show more pronounced delayed effects, especially due to the slow reaction of imports. Figure 2 reproduces the observed current accounts and the corrected ones. It shows well that China is affected by the largest delayed correction, particularly between 1987 and 1994. These figures give also the equilibrium current accounts calculated and commented on previously, highlighting the gap between the corrected current account and the equilibrium one ($h_t$).

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1. The Chinese trade bloc model of Dées was estimated with industrial production instead of GDP.
THE ESTIMATION OF THE EQUILIBRIUM EXCHANGE RATES

With internal and external equilibrium gaps previously estimated, the misalignment of nominal exchange rate \( e_i = (E_i - E_f)/E_f \) and of the real effective exchange rate \( r_i = (R_i - R_f)/R_f \) can be calculated, which allows to determine the situations of undervaluation \((e_i > 0 \text{ and } r_i > 0)\) or of overvaluation \((e_i < 0 \text{ and } r_i < 0)\) in nominal and real terms for the different currencies (figure 4). The misalignments in nominal bilateral terms and in real effective terms are often of the same sign, but of different magnitude. On the whole they are larger during the first part of the 1980s and at the end of the 1990s, before and after the Asian crisis.

As regards the Asian currencies, the yen appeared undervalued compared to the dollar during the 1980s and in real effective terms as well (around 20% in the middle of the 1980s). This situation, which reflects the massive current account surplus in the context of sustained growth, came to an end in 1990 following the revaluation of the yen and the reduction of the Japanese current surplus. At that time, the yen was close to its equilibrium value. This situation continued despite the appreciation of the yen compared to the dollar and in 1995 the yen was always estimated as being only slightly overvalued. The equilibrium exchange rate had continued to appreciate due to the current surplus which, despite its reduction, remained slightly superior to the current balance target. The following downwards turn of the yen led to a weak undervaluation (10% compared to the dollar) despite the low utilisation of the potential production at the end of the 1990s.

In a context of recovery from crisis and of current deficit, the Korean won seemed to be close to its equilibrium value at the beginning of the 1980s. Then, with the economic boom and increasing current surplus, the equilibrium exchange rate of the won appreciated in nominal terms compared to the dollar, but also in real terms, and the won became undervalued (19% in real terms and 60% compared to the dollar) as from the middle of the 1980s. This situation came to an end in 1990 with the disappearance of the current surplus and the deterioration of the economic situation. However, the real effective exchange rate remained close to its equilibrium during the first part of the 1990s. An overvaluation appeared however before the Asian crisis (14% in real terms and 25% compared to the dollar). The devaluation of the won in 1998 went beyond the nominal and real depreciation of the equilibrium level and ended in a remarkable undervaluation compared to the dollar in spite of the correction in 1999, the massive current surplus compensating the breakdown of the production.

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 and that was controlled strongly by government. However, the yuan seemed to be strikingly overvalued in the middle of the 1980s (20% in nominal terms compared to dollar, 30% in real terms) with the massive current account deficit. The introduction of an exchange rate determined by the swap centers led to de facto devaluation that permitted a reversal of this situation until the stabilisation of 1990 when the yuan was close to its equilibrium parity, with a significant current surplus contrasting with the slowing down of the economic activity. Renewed devaluations and the increasing usage of the swap exchange rate allowed a subsequent nominal and real depreciation of the equilibrium exchange rate in a
context of deterioration of the current account and of considerable inflation, so that in 1994, the year of the unification of the exchange rate system, the yuan was always close to its equilibrium parity in nominal and real terms. The second half of the 1990s marked a turning point. The economic boom and the return of a current account surplus, while the FDI inflows permitted more deficits in the current account target, led to a revaluation of the equilibrium level of the yuan. The maintenance of the nominal parity of the yuan meant then an increasing, and afterwards persistent, undervaluation of the Chinese currency, before and after 1997, in nominal (around 60%) and in real terms (around 33%). This framework could help to explain the resistance of the yuan facing the Asian crisis.

The bilateral exchange rate of the won and the yuan compared to the yen shed light on the evolution of the three major Asian currencies. From the beginning of the 1980s until 1995, the won and the yuan depreciated compared to the yen on a regular basis, making the overvaluation of the yuan disappear in the middle of 1980s or making appear the undervaluation of the won in the second half of the 1980s, but the misalignment remained relatively limited. Since 1995 a change seemed to occur with the appearance of a more important and durable undervaluation (more than 20%) of these two Asian currencies compared to the yen. That undervaluation resulted from the significant depreciation of the won facing a stable equilibrium exchange rate and from a too limited appreciation of the yuan compared to the equilibrium rate appreciation. In 2000 the parity of the yen, close to its equilibrium in real effective terms, would be marked by a contrast between a weak undervaluation compared to the dollar and an overvaluation compared to the two other big Asian currencies.

Lastly, the dollar appeared overvalued against the euro and the Asian currencies in bilateral nominal terms as well as in real effective terms during the beginning of the 1980s. Then, with the fall of the dollar since the second half of the 1980s, this situation was mitigated and the dollar was close to its equilibrium level in bilateral and effective terms in the 1990s. The misalignment remained limited until the middle of the 1990s. After the Asian crisis the dollar became overvalued in nominal bilateral terms against the euro and the Asian currencies and also in real effective terms due to the deterioration of the American current account and in spite of the solid American growth.

**Sensitivity tests**

Considering the existing uncertainties in the estimation of external and internal equilibrium and in the measure of trade elasticities, three kinds of sensitivity tests have been conducted: an increase of the target current account by 1% of GDP; an increase of the potential production by 1%; an increase of the export price elasticity by 20%. Finally, a new simulation of the model is tried by getting rid of the debt service terms in order to discern the importance of that element in the determination of equilibrium exchange rates. Several conclusions can be drawn from the results:

– The sensitivity to the export price elasticities turns out to be small. On the whole, higher export price elasticity leads to smaller changes in exchange rates to absorb the same amount of current account imbalance. This result is reassuring considering the existing uncertainties in the estimation of these parameters.
The sensitivity to internal equilibrium gap is also limited. A higher potential GDP and, consequently, an increased under-utilisation of production capacities lead to a more significant real overvaluation of the currency. The elasticity is close to –1 on average, meaning that an additional under-utilisation of 1% results in an increased overvaluation of –1%.

The sensitivity to the current account target is moderate, except for the United States. Unsurprisingly, an increase in the current account target, that is, a reduction of the gap $b$, leads to an overvaluation of the currency. The effect is all the more weak as the share of exports in GDP and the elasticity of the current account to the real exchange rate are higher, which explains the relatively small effect for the Asian countries and, to a lesser extent, for euro zone.

Debt service plays a small role in the determination of the equilibrium exchange rate. The change in comparison with the baseline simulation is around 1%.

Figure 4. Observed and equilibrium exchange rates in effective and bilateral terms (1995 = 1)
LESSONS FOR ALTERNATIVE EXCHANGE RATE REGIMES IN EAST ASIA

Since the outbreak of the financial crisis in 1997-1998, short term responses have been reduced, in most of the East Asian countries, to a de facto dollar peg policy in a less rigid way. After the withdrawal of the more ambitious project of the Asian Monetary Fund, informal co-operation forms have been developed. The Chiang Mai Initiative in May 2000 adopted the principle of swap agreements and repurchasing facilities between the participant countries (ASEAN + 3). Such arrangements are useful and may be complemented by more formal procedures of supervision and emergency intervention in order to provide a first safety net. But, facing increasing imbalances, they are unable both to organise the necessary adjustments and to fight the financial instability. Although the dollar peg policy permits avoidance of competitive depreciation strategies that are counterproductive for highly integrated and close competitor countries in world markets, it is not sufficient to prevent the risks of monetary misalignments. Stabilised bilateral exchange rates between Asian developing countries do not mean
an equilibrated exchange rate regime and new imbalances might appear, especially with Japan facing large fluctuations in the yen-dollar rate. To protect themselves, it would be in the interests of the Asian countries to peg their currencies closer to the yen. Different institutional arrangements could be considered with that aim in mind (common basket, yen bloc, ACU) and could be adapted to each country according to the extent of economic integration and the similarity in economic structures.

From the Japanese point of view, things have also changed since the end of the 1980s with financial deregulation. The Japanese authorities are more in favour of promoting the yen as an international currency and more concerned by the yen’s exchange rate with Asian currencies since Asia has replaced the United States as Japan’s largest trading partner, which does not mean that they are no longer interested by the dollar-yen parity. In this perspective a yen bloc could be promoted in order to stabilise the Asian currencies’ exchange rates against the yen with an effect on the yen-dollar rate difficult to forecast as forces would play in opposite directions. More generally the yen bloc strategy could be seen as attractive from a Japanese point of view as it would help to stabilise the value of the Japanese overseas assets and give new opportunities to the Japanese financial sector.

In a broader perspective, the consolidation of the European Monetary Union and the forthcoming polarisation effects around the euro form supplementary motivation for the Asian countries, and especially for Japan, to develop regional monetary co-operation in order to form a more autonomous area and avoid the risk of marginalisation against the two other monetary blocks. Together with the euro area, the emergence of an organised Asian monetary zone could contribute in the future to a new arrangement of the International Monetary System where the domination of the dollar would be questioned and where more discipline could be imposed on US policy.

All these arguments call for the search of a new exchange rate regime in East Asia. This regime would have to provide sufficient stability of exchange rates between participants, but also the possibility of adjustments faced with both internal misalignments and the consequences of large fluctuations between the three main world currencies. It would take into account the differences in the extent of economic integration and the huge heterogeneity of the economic structures of the partner countries. It would also include short term guarantees with anti-speculation mechanisms and flexible ways of management at the regional level. But the problems would not be only technical. They are mainly political in many respects. Most of the Asian countries are reluctant to give Japan a more dominant position in the region, as a consequence of the past history during the 1930s and 1940s. The political will of China to join a more extensive regional monetary form of co-operation appears very questionable and China may prefer to preserve its full autonomy. Lastly rather strong opposition might come from the United States if an Asian monetary zone is seen as a challenge to the status of the dollar.

Three schemes are generally proposed to go beyond the simple dollar peg policy: the common basket peg policy, the yen bloc and the creation of an ACU. Whatever the solution adopted for the future, the new regional exchange rate regime will come from progressive arrangements, step by step, with a pragmatic approach, starting with a limited number of countries. In this perspective, al-
though only a few sets of arguments can be used to evaluate the exchange rate regime with our approach, two kinds of lessons can be learned from the equilibrium exchange rate analysis. One concerns the nature and the amplitude of the misalignments observed in the past and which could occur in the future. The other highlights the implementation of the different institutional arrangements.

Concerning the misalignments, three results must be underlined. Firstly, the estimation of the equilibrium exchange rates clearly shows that they are changing in the medium term in accordance with shocks and with the evolution of structural parameters, such as the net external position, the FDI inflows or the dependency ratios. A simple dollar or yen peg policy or even the stabilisation of the real effective exchange rate may then lead to misalignments and cannot be regarded as a well-founded basis for a stable exchange rate regime. The possibility of periodic adjustments must be preserved in order to take into account the impact of these shocks or changes in structural parameters. This can justify the settlement of sufficiently elaborated monetary forms of co-operation in spite of the difficulty.

Secondly, the case of the yuan should be emphasised. The devaluation of 1994, which is often considered as important shock and would have put strong constraints on Asian economies, appears rather limited using the de facto nominal rate. The introduction of swap centers and their increasing usage led to a large, but progressive, devaluation as from the middle of the 1980s which was coherent with the depreciation of the equilibrium exchange rate. Consequently, the misalignments remained limited during this period and in 1994 the yuan was still close to its equilibrium parity in nominal and real terms. The second half of the 1990s marked a turning point. The economic boom, the return of the current surplus and the increasing FDI inflows led to a revaluation of the equilibrium level of the yuan. With a stable nominal parity against the dollar, the yuan became and remained undervalued, before and after 1997, in real effective terms and in bilateral terms compared to the dollar and the yen. In this framework the resistance of the yuan during the Asian crisis can be better understood and the fear of a next devaluation of the yuan just after the crisis, which was noticed in some studies, reflects a wrong appreciation of the fundamentals. This statement is important for a better understanding of the second half of the 1990s, but also for any reflection about the future of a regional monetary arrangement, even if the yuan stays outside the formal exchange rate regime.

Thirdly, the cases of the yen and of the won, which constitute a couple of key currencies at the regional level, can also be noted. The yen has been close to its equilibrium parity in real effective terms during the 1990s but is marked by a contrast between a weak undervaluation compared to the dollar since 1998 and an overvaluation compared to the two other big Asian currencies, the yuan since 1995 and the won since 1998. In contrast, the won has also remained close to its equilibrium during the 1990s, without significant misalignment, including in the year before the Asian crisis. But, since 1998, a remarkable undervaluation appeared compared to the dollar and to the yen.

Concerning the implementation of new institutional arrangements, the equilibrium exchange rate approach can be used in the three different schemes.

In the common basket peg policy, proposed especially by Williamson [1999], each participant Asian currency is pegged to a common basket composed of the dollar, the yen and the euro and weighted by the average structure of the extra-
regional trade of the participant countries. With this exchange rate mechanism the parity of each Asian currency against the dollar is related by the same proportion to the variations of the yen and the euro against the dollar. This mechanism allows a considerable stabilisation of the effective exchange rates. As, according to our estimations, the real effective equilibrium exchange rate is more stable than the bilateral one, the risks of misalignment would probably be less important in the case of a common basket than in the case of a dollar peg, but they remain.

The equilibrium exchange rates in effective terms could be used at the launching of the system to appreciate the misalignments and highlights the necessity of monetary adjustments. Furthermore, if needed, adjustments could be periodically realised in order to take into account the changes in the bilateral equilibrium exchange rates and allow the target zone to remain around the equilibrium exchange rate. In order to be able to resist speculative attacks, it would be important to preserve enough flexibility thanks to “monitoring bands” where there would be no strict obligation to defend the currency if the limits of the target zone were reached.

On the whole this exchange rate mechanism would be a first step toward East Asian monetary co-operation in spite of the practical difficulties to implement it. But Japan would stand outside this system. The two other alternatives can be explored to progress towards regional monetary co-operation with the participation of Japan.

In the yen bloc strategy (Kwan [2001]), the partner countries peg their currencies to the yen. As in the previous case, the peg would operate in a flexible way. Due to their trade structure, their level of income and their propensity to inflation the Asian newly industrialised countries, followed by Malaysia and possibly Thailand, would be more appropriate candidates for joining a yen bloc than China and the less developed countries of the ASEAN. The formation of a yen bloc could be progressive by gradually increasing the weight assigned to the yen in a basket of currencies used by the Asian countries to peg their currencies. The attractiveness of the yen as an international currency would have to be increased through specific measures but the recovery of the Japanese economy appears a prerequisite.

The estimation of bilateral equilibrium exchange rates could be used to prevent misalignments. Particularly during the launch period the specific exchange rate configuration of the early 2000s, marked by the potential appreciation of the yuan and overvaluation of the yen compared to the other two Asian major currencies, would have to be integrated. Later on, periodical adjustments could be carried out in order to prevent misalignments.

But the yen peg policy appears a very asymmetric construction for the other Asian countries, even if Japan tries to keep the yen close to the equilibrium parity. As China would remain outside this exchange rate mechanism, an important

1. If \( a_1 \), \( a_2 \) and \( a_3 \) represent the weighting coefficients of the common basket composed of the dollar, the yen and the euro, the variation of the bilateral exchange rate \( E_i \) against the dollar of the currency i participating in the arrangement is determined by \( d \log E_i = d \log E_d + a_1 d \log E_d + a_2 d \log E_e \) where \( E_d \) and \( E_e \) represent the bilateral exchange rate of the yen and the euro.

In the case of a yen peg and also in the case of a monetary system based on the ACU, the variation of \( E_i \) would be given by \( d \log E_i = d \log E_e \). In case of a dollar peg, the rate of variation of \( E_i \) is, of course, \( d \log E_i = 0 \).
factor of potential desequilibrium would also remain. Lastly, the strong commitments which would be necessary from the partner countries and the underlying hierarchy between the participants would make this proposition rather difficult to settle.

With the creation of an ACU a more balanced co-operation, at least in theory, could be searched with the inspiration of the EMS experience. The ACU would be composed of Asian currencies including the yen. The exchange rate mechanism would provide for a mutual pegging mechanism among the participating currencies with rather large bands (+/- 15% , for example, like in the SME after 1993 where the enlargement of the fluctuation bands was used to preserve relative stability of the system in an unstable environment). In this scheme, each country would intervene to defend its bilateral exchange rates against the other participating currencies but, in the defence of parities against the outside, the partner countries would intervene collectively. This would imply strong commitments between the partner countries like anti-speculation mechanisms, support commitments at the regional level which would be difficult to obtain. Lastly the functioning must prevent the asymmetric operation which characterised the EMS experience and which could happen once again in favour of the yen.

For the definition of the rate of conversion of each participating currency, the estimated bilateral equilibrium exchange rates could also be used, taking into account the exchange rates of the dollar and euro and enlarging the scope to the other Asian countries. To avoid the appearance of misalignments, generating destabilising speculations, the feasibility of periodic adjustments of the rates of conversion would be identified, following the evolutions of the equilibrium exchange rates and of the structural parameters of each economy. The EMS experience has shown that, after the monetary adjustments of 1992-1993 and in spite of a rather unstable international environment, it has been possible to defend the reference parities in a flexible way which has been summarised by the term “elastic policy” (Davanne [1998]). That does not mean that the East Asian countries have got to the stage where the EMS experience could be easily replicated.

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STATISTICAL SOURCES

CEPII, Database of CHELEM,
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