The equilibrium exchange rates of European currencies and the transition to euro

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The introduction of the euro raised two questions: what was the appropriate exchange rate of the European currencies for entry in the EMU? What were the main determinants of the external value of the euro? To bring some insight in the matter, the concept of equilibrium exchange rates was used, which illustrated the divergence between exchange rates and long run fundamentals. For each country, the equilibrium exchange rate was calculated from a simplified model of external trade which, in its reduced form, allows one to explicitly represent the structural determinants of exchange rates. To obtain supplementary results we also make an analysis of unit cost levels. The results suggest that although the central parities in force within the EMS were rather satisfactory and ought not to give rise subsequently to intra-European tensions, the European currencies were overvalued in terms of their equilibrium exchange rates and the dollar was undervalued. This misalignment thus provides support to justify the depreciation of the euro since its launch.

I. INTRODUCTION

The introduction of the euro raised two questions concerning exchange rates. First, would the rates at which European currencies are converted into the euro be appropriate? Second, what would be the exchange rate of the euro against other currencies, notably the dollar and the yen? To put in another way, would the euro be strong or weak? And, what is not the same thing, would it be overvalued or undervalued? These are difficult questions, but misalignments, that is, departures from 'correct' exchange rate levels, would have serious consequences.

Badly chosen conversion rates for European currencies would lead in the future to intra-European imbalances which could only be narrowed with great difficulty. To correct a bad initial choice of conversion rates, pressures on wages and employment would be, in practice, the only method available to member states. Similarly an exchange rate of the euro overvalued *vis-à-vis* the dollar or the yen

would tend to a slowdown in European growth, although in this case the situation would not, as in the first case, be irreversible because there is a regime of floating exchange rates which allows a depreciation of the euro. Nevertheless, the risk remains that an accumulation of European current accounts surpluses as against US deficits could push up the euro exchange rate.

To get an idea of the scale of such misalignments, some notion of the equilibrium exchange rate must be used. Two approaches can be envisaged:

First, a normative approach defines the fundamental equilibrium exchange rate (Feer) as the real effective exchange rate consistent with the simultaneous achievement of internal and external balance. Internal equilibrium refers to non-accelerating-inflation potential growth path, external equilibrium to the sustainability of the current account balance (Williamson, 1994).

A second approach, with a positive character, analyses the fundamental determinants of the exchange rate, that is

the negative feedbacks which tend to bring the exchange rate back towards its 'equilibrium value' or rather, towards its medium term value (the Natrex[1] approach of Stein, 1994, 1995 and the Beer[2] approach of Faruqee, 1995).

The aim of this article is to estimate misalignments for the main industrialized countries over the period 1970–1998. The approach is partly inspired by the work of Williamson (1994) on the fundamental equilibrium exchange rate but departs from it to the extent that the equilibrium exchange rate was calculated only on the basis of the specific imbalances in each country. To derive a set of consistent equilibrium exchange rates, estimates of equilibrium exchange rates are derived from a multilateral framework.

Section II presents the Behavioural Equilibrium Exchange Rate approach to equilibrium exchange rates. Section III describes the analytical framework chosen. A simplified model is offered to specify the structural determinants of exchange rates and then present the procedures used to derive a consistent set of equilibrium exchange rates. Section IV presents the equilibrium exchange rate estimates, for the period from 1970 to 1998. To obtain supplementary results, in Section V estimates of unit cost levels are displayed.

II. THE BEHAVIOURAL EQUILIBRIUM EXCHANGE RATE APPROACH

Aglietta *et al.* (1997) have applied the BEER approach to the case of European currencies and the euro by specifying three feedback forces: the net external position, the ratio of prices in the sheltered and exposed sectors and an indicator of non-price competitiveness (Box 1). Several interesting results have been obtained (Fig. 1).

As regards, first of all, the euro – or more precisely an approximation to the euro from a combination of the mark, the franc and the lira – they find that the deviation from the real equilibrium exchange rate of the dollar *vis-à-vis* the euro increases strongly in the first half of the 1980s. In 1985 the dollar was overvalued by around 40% against the euro in real terms. This deviation subsequently decreased rapidly and changed sign. In spite of some fluctuations the dollar appeared on average to be undervalued by around 10% between 1987 and 1996. Finally, the real equilibrium exchange rate of the dollar against the euro declined after 1985 under the impact of accumulated current account deficits; this leads Aglietta *et al.* to conclude that in the medium run the euro will be strong.

As regards the European currencies, a roughly similar state of affairs was found as for the approximated euro,
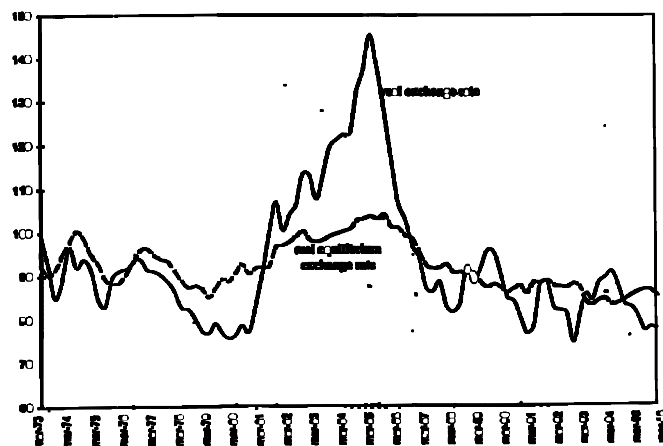
Fig. 1. *Real equilibrium exchange rate of the dollar/euro*

Box 1.

The real equilibrium exchange rate is determined by the following long-term equation:

$$q_t = \alpha_1 RAPRI_t + \alpha_2 F_t + \alpha_3 Z_t + c + \varepsilon_t$$

q_t: real bilateral exchange rate between the dollar and the currency of country i, the country under study

$RAPRI_t$: the ratio of the prices of tradable goods to those of non tradable in the US, relative to country i

Z_t: an indicator of non-price competitiveness for the US minus that for country i.

The error correction model gives the short-run dynamics of the exchange rate towards its equilibrium value:

$$\Delta q_t = b_1 q_{t-1} + b_2 RAPRI_t + b_3 \Delta F_t + b_4 \Delta r_t + b_5 \varepsilon_{t-1} + c + \mu_t$$

r_t: difference between real long run interest rates in the US and in country i

ε_t: estimation residual of the long-term equation.

Box 1. *the Analytical framework of Aglietta* et al. (*1997*)

but it is not possible to draw exact conclusions about intra-European parities. At most, we can note that over the period 1986–1996 the dollar is significantly more undervalued relative to the franc (by about 15%) than relative to the mark (the actual exchange rate being close to its equilibrium value). The lira is in the same position as the franc, but only up to 1992 when the real undervaluation of the dollar reached 15%. Devaluations of the lira thereafter reversed this situation.

Beyond these first results, the method could be controversial because the equilibrium exchange rate is calculated without reference to full employment and this leads the

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[1] Natural Real Exchange Rate.
[2] Behavioural Equilibrium Exchange Rate.

authors to support the idea of a trend appreciation of the real equilibrium exchange rate of the euro against the dollar. This result seems to us to be highly debatable since it does not take into account the situation of mass unemployment which has characterized the European countries since the end of the 1970s. This is why it seemed to us to be preferable to adopt the first, more normative, approach inspired by the work of Williamson.

III. THE FUNDAMENTAL EQUILIBRIUM EXCHANGE RATE APPROACH

A simplified model

For each industrialized country, the equilibrium exchange rate was calculated from a simplified model of external trade which, in its reduced form, allows us to explicitly represent the structural determinants of exchange rates (price differential, external performance, growth differentials, structural aspects of specialization summarized through volume and price elasticities). For given objectives with respect to full employment growth and to an export/import ratio consistent with a sustainable position on the current account, the real equilibrium exchange rate can be calculated as a deviation from the observed exchange rate.

In keeping with these methodological options, the equilibrium exchange rate is determined on the basis of a country's current account. The description of external exchange is at the most aggregate level, dealing only with total exports and total imports of all goods and services.[3]

$$TC = P_x X / P_m M$$
$$X = X_0 . e^{\lambda' t} . D^{*\lambda} . (EP^* / P_x)^\alpha \qquad P_x = (EP^*)^{\alpha_x} p^{1-\alpha_x}$$
$$M = M_0 . e^{\mu' t} . DI^\mu . (P / P_m)^\beta \qquad P_m = (EP^*)^{\alpha_m} p^{1-\alpha_m}$$

where:

D^*: world demand; P^*: world prices
DI: domestic demand; P: production prices
TC: export/import ratio in
  value terms P_x: export prices
X: volume of exports; P_m: import prices
M: volume of imports; E: exchange rate (1 unit of
 foreign currency) $= E$ units
 of the national currency.

Differentiation and rearrangement of terms allows us to write the growth of the real exchange rate $r (x = dX/X)$ as:

$$r = e + p^* - p = \frac{1}{\alpha(1 - \alpha_x) + \beta \alpha_m - \alpha_m + \alpha_x}$$
$$\times [tc + (\mu di + \mu' - \lambda d^* - \lambda')]$$

with tc the growth rate of external performance and $(\mu di + \mu' - \lambda d^* - \lambda')$ the growth differential.

This is a reduced form equation from the usual set of external transaction equations. It specifies a positive relationship between the growth rate of the real exchange rate, the growth of internal demand and the growth rate of the export/import ratio. More generally, its brings out the structural determinants of the real exchange rate: external performance, growth differential, and structural characteristics of international specialization summarized in the volume and price elasticities of foreign trade.[4]

Corresponding to the Williamson's framework, the growth rate of the equilibrium exchange rate (r_e) is calculated on the basis of a path for domestic demand (di_e) corresponding to non-inflationary full employment output and of a rate of change of the export/import ratio (tc_e) consistent with a sustainable position on the current account.

$$r_e = \frac{1}{S} [tc_e + \mu di_e + \mu' - \lambda d^* - \lambda']$$

with

$$S = \alpha(1 - \alpha_x) + \beta \alpha_m - a_m + \alpha_x$$

Using Δ to denote the deviation between equilibrium and observed magnitudes $\Delta r_e = r_e - r$, we have:

$$\Delta r_e = \frac{1}{S} [\Delta tc_e + \mu \Delta di_e]$$

with: $\Delta tc_e = tc_e - tc$ and $\Delta di_e = di_e - di$.

Using R_t and R_{et} to denote respectively the observed and the equilibrium real exchange rate at date t, we can express these two variables relative to an observed exchange rate at an initial date R_0:

$$R_t = R_0 (1 + r)^t$$
$$R_{et} = R_0 (1 + r_e)^t \qquad \text{with: } \Delta r_e = r_e - r$$

The deviation of the observed real exchange rate from its equilibrium value at date t can thus be written as:

$$\frac{R_{et}}{R_t} = \frac{R_0 (1 + r_e)^t}{R_0 (1 + r)^t} = \left(\frac{1 + r + \Delta r_e}{1 + r} \right)^t \Rightarrow$$

$$\frac{R_{et}}{R_t} = \left(1 + \frac{\Delta r_e}{1 + r} \right)^t$$

The deviation relative to the equilibrium exchange rate $(R_t - R_{et}) / R_{et}$ corresponds to a real overvaluation (< 0) or a real undervaluation (> 0) of the country's currency at date t.

These indicators are not intended however to be fully consistent with each other because they are calculated on the basis only of the specific employment disequilibria in

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[3] Factor incomes are supposed exogenous.
[4] This procedure follows that proposed by Rollet (1987) while making it more exact.

each country, although the targets for the export/import ratio have been made consistent. Although the method departs here from the strict procedures of Williamson, who seeks to determine equilibrium exchange rates consistent at a world level, it is still interesting to examine the results country by country because they correspond to a key question which arises at the level of each country: what policy should be adopted to return to full employment while maintaining a sustainable current account balance?

A multilateral framework

Subsequently, equilibrium exchange rates are estimated for the main industrialized countries as a whole in a multilateral framework. For each country i, the same method was used as before for calculating equilibrium exchange rate (using deviation relative to observed magnitudes $\Delta re_i = re_i - r_i$). However, the rate of change of the world demand for each country's goods (Δde_i^*) induced by imports changes of partners' countries j (Δme_j) is taken into account.

Using the same writing as before, the deviation in terms of growth between the equilibrium and the observed exchange rate can be derived, for each country i, from the following equations:

$$\begin{cases} \Delta re_i = \dfrac{1}{S_i}(\Delta tce_i + \mu_i \Delta die_i - \lambda_i \Delta de_i^*) \\[2mm] \Delta de_i^* = \displaystyle\sum_{j \neq i} \mu_{ij} \Delta me_j \\[2mm] \Delta me_j = \mu_j \Delta die_j - \beta_j \alpha_{mj} \Delta re_j \end{cases}$$

with μ_{ij}: weight of country j in world demand for country i's goods.[5]

A system of n equations (n is the number of countries examined) with n unknown (Δre_i) exist, which are function of deviations from domestic demand targets (Δdie_t) as well as current-account balance targets (Δtce_i):

$$\Delta re_i = \frac{1}{S_i}\left[\Delta tce_i + \mu_i \Delta die_i - \lambda_i \left[\sum_{j \neq 1} \mu_{ij}(\mu_j \Delta die_j \right.\right.$$
$$\left.\left. - \beta_j \alpha_{mj} \Delta re_j) \right]\right]$$

with: $\Delta tce_i = tce_i - tc_i$ and $\Delta die_i = die_i - di_i$

This method does not provide a set of consistent real effective exchange rates. In theory, their weighted sum should be zero. In practice, this is not the case given that we just take into account the leading industrialized countries. The effective exchange rate for the rest of the world is thus assumed to ensure global consistency.

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[5] We use the weights of the multinational model Nigem.

IV. EQUILIBRIUM EXCHANGE RATES OF THE EUROPEAN CURRENCIES AND OF THE EURO

Table 1 presents the main results, that this to say, the percentage overvaluation or undervaluation of the currencies of the large industrial countries for the five years, 1979, 1985, 1990, 1995 and 1998. Although the method departs from a multilateral framework, results don't show any inconsistency with for example, all currencies overvalued or undervalued.

Table 2 presents estimates derived from the multilateral framework. These results are broadly in line with those from the simplified approach, which suggests that macro-economic linkages passing through world demand can be considered secondary relative to effects induced by changes in export/import ratios and in domestic demand.

Some initial conclusions can be drawn on the conditions which have affected the transition to the euro.

In 1979, misalignments were still limited, with the most striking feature being an undervaluation of the yen – still relatively modest – with an overvaluation of certain European currencies such as the pound sterling, and to a lesser extent, the franc and the lira. The dollar does not appear to have been undervalued in spite of its substantial nominal depreciation during the 1970s.

Table 1. *Overvaluation* (−) *or undervaluation* (+) *of the currencies of the large industrial countries in real terms* (%) – *a simplified model*

	1979	1985	1990	1995	1998
Dollar	−6.4	−35.1	11.2	17.5	12.1
Yen	9.9	24.1	7.4	−0.8	−5.0
Mark	0.0	18.3	19.2	−7.9	−2.7
Franc	−4.0	−14.7	−16.3	−9.9	−8.4
Lira	−4.4	−8.0	−17.3	−5.0	−2.8
Pound	−12.1	−19.8	−11.2	−7.1	−10.0
Peseta	4.6	−5.7	−21.9	−7.1	−5.9

Table 2. *Overvaluation* (−) *or undervaluation* (+) *of the currencies of the large industrial countries in real terms* (%) – *a multilateral framework*

	1979	1985	1990	1995	1998
Dollar	−6.3	−34.0	10.9	19.6	13.4
Yen	9.3	18.6	8.9	2.3	−2.2
Mark	0.2	17.7	16.1	−2.5	1.1
Franc	−3.8	−14.0	−17.2	−7.5	−6.5
Lira	−4.3	−7.1	−17.7	−3.7	−1.8
Pound	−12.5	−20.8	−11.6	−4.7	−8.3
Peseta	4.3	−6.2	−22.0	−6.0	−4.1

The first half of the 1980s was marked by a violent change as the dollar appreciated dramatically. By 1985 the overvaluation of the dollar, reflecting a high rate of unemployment at the same time as a big current deficit, had as its counterpart an undervaluation of the mark and the yen which expressed the scale of these countries' current surpluses. The franc, the lira and above all the pound were also overvalued – a reflection of high levels of European unemployment in the context of equilibrated current accounts.

A second break took place in the late 1980s with the fall of the dollar between 1985 and 1987. In 1990 the overvaluation of the dollar vanished and gave way to an undervaluation in the context of virtual full employment in spite of the persistence of a certain remaining current deficit. After its revaluation in nominal terms, the yen was closer to its equilibrium exchange rate while the mark remained undervalued in consequence of the scale of German surpluses and the relatively low unemployment rate. On the other hand, the other European currencies were overvalued, especially the lira and the peseta, in the context of big current deficits and high rates of unemployment. This analysis of real exchange rates, which demonstrates the undervaluation of the dollar and the mark with, as a counterpart, the overvaluation of the other European currencies, needs to be completed by a study of the exchange rates of the Asian NICs which contributed substantially to the American deficit at the end of the 1980s. But it remains the case that the disequilibria, which characterized the structure of European currencies, widened, notably as regards the lira and the peseta. This led to the dislocation of the EMS in 1992–1993.

German unification, the crisis of the EMS and the crisis in Japan all contributed to a reduction in current account imbalances at the start of 1990s and this, therefore, reduced the deviations from equilibrium exchange rates. European currencies as a whole appeared to be overvalued in 1995, but to a relatively limited extent. The very high levels of unemployment, which more than compensated for significant current account surpluses, explain this overvaluation. The yen was close to its equilibrium exchange rate. As for the dollar, it continued to be undervalued, the American economy having practically returned to full employment but being affected by a persistent deficit on the current account.

Two results should be underlined as regards the launching of the euro. First, the disequilibria, which affected European parities until the beginning of the 1990s, with an undervalued mark facing the overvalued European currencies, have vanished. European currencies as a whole seemed to be overvalued by proportions of 5% to 10% with however a more limited overvaluation in the case of the mark. This result suggests that the central parities currently in force within the EMS were rather satisfactory and ought not to give rise subsequently to intra-European ten-

sions. Several factors go to explain this state of affairs. The devaluations of 1992–1993 and then the control of inflation in the countries concerned allowed the overvaluation of the lira, the peseta and the pound to be corrected. France arrived at the same result thanks to the resolution with which the strategy of 'competitive disinflation' was carried out, a strategy, which has made France one of the countries with tightly controlled unit wage costs at the expense of a further increase in unemployment. Lastly, in Germany the unification shock put an end to current account surpluses and led to a big rise in unemployment. There resulted a sharp decline in the real equilibrium exchange rate of the mark, bringing its undervaluation to an end. This new configuration of exchange rates, however, obviously does not rule out adverse developments in any of these economies in the context of the euro, in particular asymmetric shocks, which could lead to tensions within Europe.

Second a contrast emerges between the European currencies, overvalued in terms of their real equilibrium exchange rates by about 5% to 10% and the dollar, which was undervalued by about 12%. Some disequilibrium with respect to the dollar remained, even though it was smaller than in 1990. This misalignment thus provides support to justify the depreciation of the euro since its launch.

V. LEVELS OF UNIT PRODUCTION COSTS IN THE LARGE INDUSTRIALIZED COUNTRIES

Further indications of exchange rate conditions can be obtained through a comparison of the levels of unit production costs in the large industrial countries. To assess levels of production costs we need to use a PPP exchange rate so that international comparison of unit production costs becomes meaningful and the 'units of production' which are used are indeed comparable (Box 2). We can envisage various methods for the calculation of PPP (Purchasing Power Parity). Different methods were used in a recent study (Couharde and Mazier, 1997, 1999) and the main results of this study are presented.

International comparisons based only on unit wage costs give a biased picture of cost-competitiveness, for two reasons. On the one hand, wage costs as a whole only represent about 30% of total costs, with intermediate input representing between 60% and 70%. On the other hand, this division into wage costs and intermediate input costs depends on the degree of vertical integration for the activities concerned and thus on the greater or lesser use which is made of subcontracting and networking among enterprises. For these reasons, the calculation of relative unit costs based on total costs, that is, on the sum of wage costs and intermediate input costs, give us a clearer picture of cost-competitiveness levels.

Box 2.

Final expenditure PPP rates correspond to the first established approach, beginning with the first studies of Kravis, Heston and Summer (1982), and have given rise to regular publication of series by the OECD. The use of these rates to value output or value added presupposes, however, that corrections are made to take indirect taxes and trade margins into account.

The "industry of origin" method, recently developed by Pilat (1996) rests on the calculation of unit values by product, but is only valid for a limited number of homogeneous products.

The "mixed" method combines the two foregoing methods by using "industry of origin" for homogeneous products and corrected final expenditure rates for differentiated products (Pilat, 1996).

The method used in previous studies (Mathis, Mazier and Rivaud-Danset, 1988) also relied on final expenditure PPP rates, corrected for trade margins and VAT and using a specific hypothesis on intermediate products. This last method has been used again here to calculate PPP rates for manufacturing output in 1990, but results obtained with the "mixed" method have also been used in order to have an interval for estimating unit production costs. The widest gap between the two estimates is in the case of Japan.

These PPP rates having being calculated, it is possible to compare productivity and unit costs for different countries. Output volumes, in 1990 prices, are expressed in dollars at PPP and correspond to comparable measures of output. The unit cost indicators are the current dollar costs per unit of production, with the units of production having roughly the same meaning in each country because PPP rates have been used. These indicators are calculated as levels, but have no real significance except in relative terms, that is, in relation to other countries, or to an average for partner countries.

Box 2. *PPP exchange rates and the measurement of unit cost levels*

Relatively durable regimes can be distinguished: certain countries enjoy cost-advantages, that is to say unit costs persistently below the average cost levels of their trading partners; other countries suffer from cost-disadvantages, that is unit costs above these of their competitors. But these cost patterns do evolve and regime changes do take place (Figs 2 and 3).

Until the mid 1980s Japanese industry functioned within a regime of cost advantages, a position which should be related to the undervaluation of the yen during this period. Subsequently, however, Japan suffered from increasing cost problems as the undervaluation of the yen ended. In the USA, a cost advantage regime has clearly dominated since the move to floating exchange rates at the start of the 1970s, especially in the second half of the 1980s, and with exception of the drastic revaluation of the dollar between 1980 and 1985.

It is valuable to examine the case of the European countries in the context of the euro. European countries are in fact characterized by a trend towards unit cost convergence, beginning in the 1980s.

This convergence is clearly important in the context of the EMU. It involves contrasting lines of development. Convergence is pronounced for countries in the D-mark zone, with which France can perhaps be grouped. These countries have unit costs close to the average of their competitors, although Belgium and the Netherlands experienced significant cost-disadvantages during the 1970s.
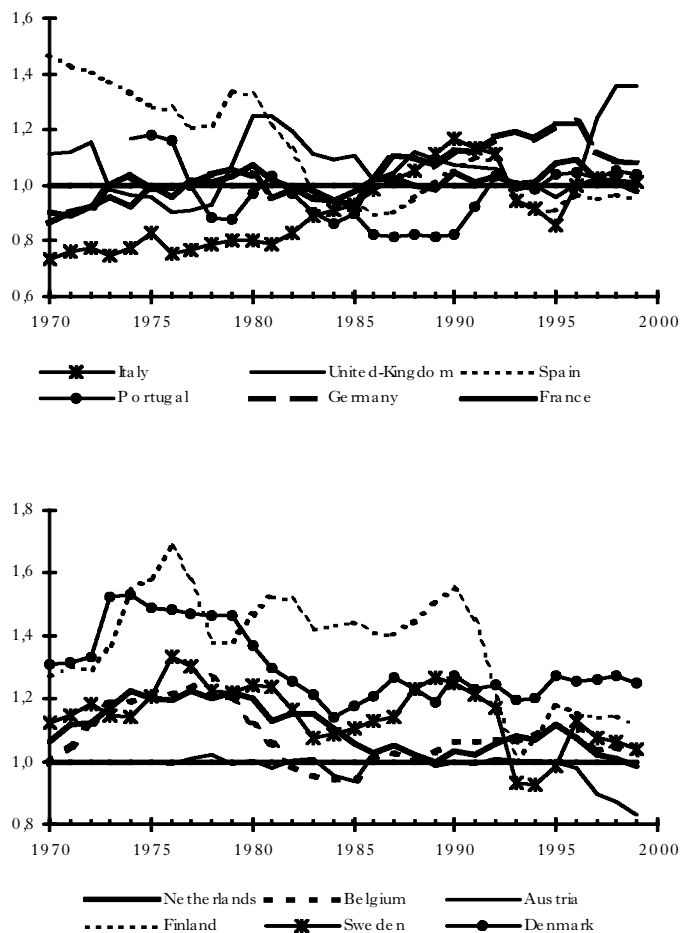

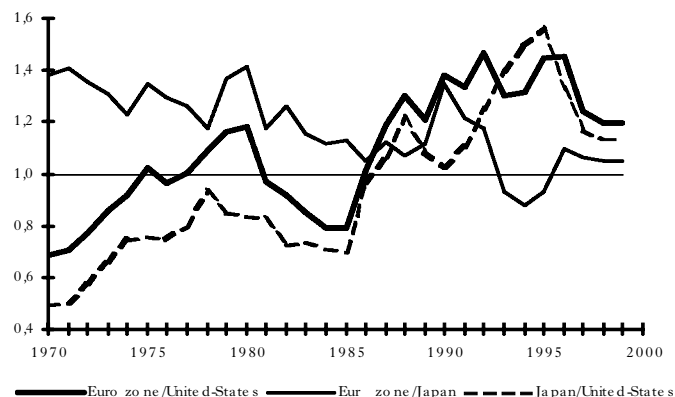Fig. 2. *Relative total unit costs in industry – European Countries*

Fig. 3. *Relative total unit costs in industry – Japan, USA, euro zone*

Italy gave up its cost advantages during the 1980s. Spain and Portugal did the same but later, having emerged from a period of transition marked by restructuring and normalization of their costs of production. The Nordic countries carried significant cost-disadvantages until the beginning of the 1990s.

VI. CONCLUSION

To get an idea of the misalignments following the introduction of the euro, we used the concept of the equilibrium exchange rate which illustrates the divergence between exchange rates and long-term fundamentals. A first approach following the Beer model was criticized, mainly because the equilibrium exchange rate was calculated without reference to full employment. This tended to support the idea that the accumulation of American current account deficits as against European surpluses would push up the euro exchange rate, which appeared to be wrong.

In a second approach corresponding to Williamson's framework, the fundamental equilibrium exchange rate was defined as the real effective exchange rate consistent with the simultaneous achievement of internal and external balance. In a first step a simplified model of external trade was used for each industrialized country. In a second step the equilibrium exchange rates were estimated with a multilateral framework linking the main industrialized countries. To obtain complementary results, a comparison was made with unit production cost levels.

These estimates of fundamental equilibrium exchange rates allowed us to analyse the misalignments, first between the dollar and the main European currencies, second between the European currencies engaged in the EMS and the euro. During the second half of the 1980s, following the Plazza agreements, the dollar became undervalued and the yen was close to its equilibrium level. This was consistent with the low US unit production costs and with the vanishing Japanese cost advantages. On the other hand the structure of the European parities was characterized by huge imbalances with an undervalued mark facing the overvaluation of the other European currencies. The convergence of the European unit production costs was hiding disequilibria, which widened with the financial liberalization, notably as regards the lira and the peseta, leading to the dislocation of the EMS in 1992–1993. German unification, the collapse of the EMS and the crisis in Japan all contributed to reduce the deviations from equilibrium exchange rates. The European currencies as a whole appeared to be overvalued in 1995, to a relatively limited extent while the dollar continued to be undervalued, giving a permanent cost-advantage to the USA. The yen was close to its equilibrium exchange rate.

In 1998 the central parities currently in force within the EMS and used for the introduction of the euro were rather satisfactory and might not give rise subsequently to intra-European tensions. But some disequilibrium with respect to the dollar remained. The dollar was undervalued in terms of its equilibrium exchange rate, although to a lesser extent than in 1990. This misalignment thus provides support to justify the depreciation of the euro since its launch. In spite of huge uncertainties concerning the computation, the equilibrium exchange rate might be not far from the parity of one dollar for one euro.

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