

European Financial Integration and EMU Expectations

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With the lifting of remaining capital controls inside the EU in 1990, an essential step towards EMU was taken. This raises the questions of whether on the one hand there is an observable convergence of interest rates inside the EU and on the other if alongside this financial integration, EMU expectations are mirrored. This paper has presented a theoretical argument and empirical justification that in order to determine the extent of capital market integration and measure EMU expectations, an analysis of RIP is insufficient. By splitting RIP into its component risk premia, we could draw a more detailed picture of the situation. The outcome is that we have found that certain countries are still burdened with country and/or currency risk premia which are not reflected in the evolution of real interest differentials. Thus our study points to the necessity of doubting the validity of RIP as a proxy for EMU expectations.

I. Introduction

Since 1985, a progressive easing of capital controls took place in EC countries. But some countries, such as Belgium, France and Italy, maintained capital account controls until the end of the eighties.¹ In France, the purchase of foreign assets by French residents became illegal from 1981 and remained so until 1986. Capital controls were then gradually reduced and finally removed in December 1989. In Italy, the introduction of a heavy tax on the purchase of foreign securities, which lasted until May 1987, made the acquisition of foreign assets practically impossible for Italian residents. Controls then became gradually less severe, but remained in place until June 1990. In Belgium, capital controls were implemented by a dual exchange rate system consisting of a freely floating financial exchange rate for capital account transactions and a pegged commercial rate used in current account transactions.

All of these remaining controls were scheduled to be lifted by July 1990 when the EC Directive on Capital Market Liberalization entered into force. Complete capital account liberalization was brought about mainly as a result of the decisions to move toward a fully integrated internal market. The free movement of capital was seen as an essential part of complete market integration² and of the first stage of the transition to EMU.

The question, then, that needs to be examined is whether or not capital market liberalization has resulted in perfect capital mobility between EU Member States – or at least initiated a trend towards it. In other words, is there an observable convergence of European interest rates that is related to financial integration? And if so, does the convergence apply to all or only some Member States? Does the extent of such convergence reflect the EMU expectations as well as the probable members of the new euro zone? Do the financial markets of the potential EMU members allow for lower interest rates than those who will not

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join? Lastly, is the degree of convergence of particular interest rates an appropriate method for measuring increased international capital mobility?

Although the theme of this paper in many respects follows that of earlier studies, it differs on one decisive aspect: its methodology. For we argue that the convergence of the nominal and real interest rates is an effect of capital market liberalization, and not especially of EMU expectations, thus contradicting the position taken by others in the literature who have concluded that this phenomenon can be interpreted as such an indicator.³ Hence, there are serious doubts to be raised about the validity of the econometrics that have been used to justify and corroborate the interest rate-EMU expectations hypothesis.

Our approach, then, is based on the proposition that if EMU expectations are discernible, they will be found in the components of interest rates and not in particular interest rate parities. In order to discover if this is the case, we dismantle specific risk premiums in order to filter out effects of those expectations.

The paper is organized as follows: section two considers possible criteria for measuring EU capital market integration; section three discusses the effects of European capital market liberalization and EMU expectations; section four is an empirical analysis in order to see how far the hypotheses that are argued for and examined can be corroborated; and lastly section 5 is a summary of the argument.

II. Criteria for Financial Integration

Given that there are a variety of ways to measure perfect international capital mobility,⁴ it is essential to choose a method that is appropriate for the task set in this paper. There are two options:

Firstly, there is the nominal interest parity condition (NIP). Here perfect capital mobility exists in the EU if there is equality between the returns on an asset denominated in DEM and a comparable asset denominated in another EU currency. The NIP condition can, however, be met in the form of the covered interest parity (CIP) or open interest parity (OIP) conditions. With CIP, perfect capital mobility exists if the forward premium (fp_j) or forward discount (fd_j) on the DEM against currency j (EU currencies other than DEM) is equal to the foreign less German interest-rate differential ($i_j^* - i$):

$$i - i_j^* - fd_j = 0$$

or

$$i_j^* - i - fp_j = 0. \tag{1}$$

While with the OIP condition perfect capital mobility exists when – independent of exposure to exchange risk – equality between the expected returns on an asset denominated in DEM and a comparable asset denominated in another EU currency is achieved, so that the expected (E) rate of change (g) of the DEM exchange rate vis a vis currency j (e_{jDEM}) is equal to the foreign less German interest-rate differential:

$$i_j^* - i - E(g e_{jDEM}) = 0. \tag{2}$$

The OIP condition can be expanded to the expression:

$$(i_j^* - i - fp_j) + (fp_j - E(g_{e_{jDEM}})) = 0 \quad (3)$$

Clearly the OIP condition is stricter than the CIP condition. OIP is met if the covered interest differential in the first bracketed expression is zero and, if in addition, the exchange risk premium⁵ in the second bracketed expression is also zero.

It should be noted that CIP implies the simultaneous fulfilment of the OIP condition, if two conditions are met,⁶ such that

$$i_j^* - i = fp_j = E(g_{e_{jDEM}}) \quad (1a)$$

if (1) the foreign exchange markets are efficient in the sense that the bilateral forward exchange rates are unbiased predictors of spot rates and, (2) agents are risk neutral and therefore do not request a foreign exchange risk premium. The second condition is, however, not generally compatible with risk averse behaviour. That is, if risk aversion leads to an exchange rate premium, the fulfilment of the CIP condition will harm that of the OIP condition – although this does not mean that the foreign exchange market is inefficient. The condition $fp_j = E(g_{e_{jDEM}})$ is neither necessary nor sufficient for market efficiency when agents are risk averse.⁷

The second option is the real interest parity condition (RIP). As RIP is a measure not only of capital mobility but also market integration and macroeconomic convergence, this is the strictest of the two options: a deviation from it implies a lower degree of capital mobility, market integration, and convergence. RIP says that for international capital flows under perfect capital mobility the ex ante real interest rates (r, r_j^*) between Germany and EU Member States – the result of the difference between the nominal interest and expected inflation rate – must be adjusted, such that:

$$r_j^* - r = (i_j^* - E(gP_j^*)) - (i - E(gP)) = 0. \quad (4)$$

Again, this expression can be split into its components and expanded, such that:

$$r_j^* - r = (i_j^* - i - fp_j) + (fp_j - E(g_{e_{jDEM}})) + (E(g_{e_{jDEM}}) + E(gP) - E(gP_j^*)) = 0. \quad (5)$$

Here the RIP condition is met if at the same time the CIP is met, the exchange rate premium is annulled, and the expected real DEM revaluation in the third bracketed expression is zero. Deviation of the covered interest differential from zero is taken as the country risk premium, the level of which is determined by transaction costs, capital controls, and other political risks.⁸

The political risks – that are caught in high country risk premiums – can be brought about by divergent fiscal policies that result in excessive budget deficits and government debts (relative to gross domestic product). The effects of such policies will be particularly felt if they lead to expectations of a debt dynamic in which problems with servicing an

excessive and escalating debt cannot be excluded. The reverse conclusion with regard to the future EMU does not necessarily hold true. Even if the no-bailout clause is not credible, the interest rates under certain conditions could still converge. Faced with a crisis by an unsustainable debt burden for one country, the rest of the EMU-members could have an incentive to bail it out. The problem to be solved is, therefore, making the no-bailout provision credible and dynamically consistent.⁹ Nor will the different tax rates on capital gains within Europe result in a deviation from interest-rate parity. As capital gains in the EU are taxed on the basis of residence, interest yields from foreign assets are taxed at the same rate as yields from domestic assets. If we in this case ignore transaction costs, the country risk premium (ρ_{1j}) is expressed as:

$$\rho_{1j} = i_j^* - i - \dot{f}_j. \quad (6)$$

Now, if for a currency j the value in the second and third bracketed expressions in equation (5) deviates from zero, there exists a currency risk premium (ρ_{2j}):

$$\rho_{2j} = (\dot{f}_j - E(\dot{g}e_{jDEM})) + (E(\dot{g}e_{jDEM}) + E(\dot{g}P) - E(\dot{g}P_j^*)), \quad (7)$$

that is composed from the exchange risk premium and the expected rate of change of the real exchange rate.

Hence, there is the need to clarify whether or not the process of financial integration is accompanied by a reduction of the country risk premia ($d\rho_{1j}/dt < 0$, $\rho_{1j} \neq 0$) and/or currency risk premia ($d\rho_{2j}/dt < 0$, $\rho_{2j} \neq 0$).

III. Financial Integration, EMU-Expectations and Interest Rate Convergence

By removing capital controls, financial integration is achieved because the country risk premia are reduced and thus encouraging perfect capital mobility by approximation to the CIP condition. This process, however, does not necessarily imply a trend towards zero in real interest differentials because currency risk premia remain and even increase where currencies are free floating or freely moving within fixed band widths (the actual situation of EMS) in times of increasing exchange-rate volatility. Even in highly integrated financial markets the exchange rate premia and expectations of real exchange rate changes do not vanish: diminishing covered interest differentials are compatible with the continuance of significant real interest differentials.

European financial integration that has been encouraged by capital market liberalization has to be measured by CIP criteria (i.e. the decrease in the deviation from covered interest parity), so that the country risk premium ρ_{1j} will indicate a convergence trend to zero (integration test). Likewise, the deviation from real interest parity is also reduced if the currency risk premia remain constant. Despite, however, the financial integration, deviations from RIP can also increase as a result of increasing exchange rate volatility and uncertainty.

From the perspective of the monetary convergence criteria of the Maastricht Treaty (inflation, exchange rate) the proposition that expectations that a currency j that is linked to the DEM will be a full member of the new euro zone can be discerned in the cancelling of its

currency risk premia is plausible. The deviation from the RIP condition will get smaller and the currency risk premium ρ_{2j} will show a convergence towards zero, if it is expected that the currency will join the EMU (convergence test). As the monetary convergence criteria of the Maastricht Treaty prohibit significant differences in inflation and grant only moderate exchange-rate swings within the fixed bandwidths, it is not unlikely that financial market actors expect those countries to become an EMU member that could hold the real exchange rate of their currency against the DEM relatively stable and keep the exchange risk premia low. If in addition EMU expectations result in the values of the second and third bracketed expressions of the RIP equation to not significantly deviate from zero, then effectively CIP and RIP coincide.

Thus we need to examine the appropriateness of RIP as an instrument to measure EMU expectations in the course of advanced capital market integration. These deliberations point to the following question: for an EU country with currency j , do the financial markets signal an expectation of EMU membership when the CIP and RIP deviations are tending towards zero because at the same time the country risk premia ρ_{1j} and currency risk premia ρ_{2j} are being reduced? Accordingly the convergence of real interest rates is a necessary but not sufficient condition for this development, as the real interest differential can also be reduced if the country risk premia fall and the currency risk premia remain stable. Nor can it be excluded that ρ_{1j} will show a tendency to fall and ρ_{2j} to rise with the net effect that both part effects will cancel each other out and an approximation to CIP and RIP would be observed.¹⁰ Such a case would confirm the proposition of financial integration but not that of EMU expectations (integration test passed, convergence test failed). If a convergence of real rates of interest would be observed and taken as an indicator of EMU expectations,¹¹ faulty conclusions would be drawn from faulty interpretations.

Consequently, in order to establish whether capital market liberalization and EMU expectations or merely the capital market integration can be exposed by the process of interest rate convergence, we propose the following method: assuming rational expectations to be valid, then $E(gP) = gP$ and $E(gP^*_j) = gP^*_j$, so that ex post and ex ante real interest correspond:¹²

$$r^*_j - r = (i^*_j - gP^*_j) - (i - gP) = (i^*_j - i) - (gP^*_j - gP) = \rho_{1j} + \rho_{2j}. \quad (8)$$

Such that:

$$\rho_{1j} = i^*_j - i - fp_j \text{ (country risk premium),} \quad (6)$$

and

$$\rho_{2j} = fp_j + gP - gP^*_j = fp_j - (gP^*_j - gP) \text{ (currency risk premium).} \quad (7)$$

Although deviations from the real interest parity cannot directly be split into the ρ_{1j} and ρ_{2j} components, it is possible to check if only the country risk premia fall (integration test) or if in addition the currency risk premia fall (convergence test) and these then can be interpreted as the indicator of EMU expectations.

Another method, although not used in this paper, is to take exchange rate volatility as an approximation of currency risk premia¹³ and to examine whether deviations from the

covered interest parity and the exchange rate volatility or merely the CIP deviations are reduced. The trouble here, however, is that this raises the problem of whether increasing stability of real exchange rates reflects EMU expectations.

IV. Empirical Analysis

A. Data and Methodology

Our theoretical deliberations need empirical verification. While the usual procedure for convergence tests is the econometric estimation of real interest parity,¹⁴ the above analysis has demonstrated that there is no compelling reason to use RIP either as a direct or approximate indicator of EMU expectations. What remains to be done, then, is to separately examine the country risk and currency risk premia.

The empirical analysis of the interest parity deviations can be carried out by using short-term (or three month) interest rates. We use end-of-month, monthly data for treasury bill rates (if not available, three-month interbank market rates), spot and three-month forward exchange rates against the DEM. In order to grasp the effects of capital account liberalization and to specify country risk premia, we use national (onshore) interest rates. Offshore interest rates (eurocurrency-rates) should be relatively free of political risk.¹⁵

The sampling period is May 1986 through April 1997. All data are taken from the Deutsche Bundesbank, IMF-Financial Statistics and OECD Main Economic Indicators. Presuming short term interest rates as an indicator of EMU-expectations is based on the following reasons: firstly, this allows for a comparison of the analysis presented in this paper with estimations of real interest parity, which are also based on short-term interest rates. As the date for EMU entrance nears, the convergence process should be increasingly indicated in short-term interest rates – although it must be remembered that these rates are in part determined by a weak exogenous component in the form of the central banks, which can influence their level more than that of the long-term rates. A convergence at the short-end of the interest-rate structure curve is also a necessary part of EMU and therefore in the run-up to its inception should be observable. If the financial markets expect a country to be an EMU member, the central bank of concern has the potential to reduce interest rates against the DEM as high short-term interest rates as a defence against speculative attacks in the currency markets become unnecessary. And should conditions require it, an adjustment of the short-term DEM interest can follow suit. Lastly, it ought to be possible to detect if the central banks are following the same course towards EMU membership.¹⁶

The real short-term interest rate is a three-month interbank market rate or yield on three-month treasury bills minus annual consumer inflation. If the financial markets expect a country to join the EMU, the short and long-term interest rates must adjust internationally. With the impending entrance date and the speculations concerning who will join, the above defined convergence of short-term interest rates must follow. From a theoretical standpoint, the country risk premia for short-term interest can be notably smaller than for the long-term interest. Yet, for countries that have to pay high country-risk premia for medium and long-term loans, this should also show up in the short-term interest.¹⁷

In order to take into account the structural breaks and significant shocks, the period under analysis is divided into three sub-periods so that the analysis can get hold of the most important phases of the European Monetary System. The first sub-period begins in May 1986 and ends in June 1990. We have chosen 1986 as the start-date for our analysis because (1) it was in this year that the purchase of foreign financial assets by French residents was legalized and, (2) until this year most of the EMS-currencies experienced large and frequent realignments. The second sub-period begins in July 1990 and ends in July 1993. This subperiod might be called "the crisis period" of the EMS. Both the September 1992 and July 1993 crises, the latter of which led to the widening of the bandwidths, fall within this period. The third sub-period is from August 1993 to April 1997. This is the period following widening the fluctuation bands. Lastly, for comparative purposes the analysis will also consider the entire May 1986 to April 1997 period.

The EMS countries that are included are France, Italy, the Netherlands and, as the reference country, Germany. The United Kingdom as a part-time EMS-member is also included. Outside of the EMS (i.e. the EU), Switzerland will be considered because of her prominent European (stability) position as well as USA for obvious reasons. It should be noted that by taking Germany as the reference country no specific direction of causality between European interest rates is implied.¹⁸

The EMU expectations hypothesis cannot be rejected if for a particular group of countries there is significant reduction of risk premia with simultaneous convergence of real interest rates. Other countries would have to show a corresponding trend of deviation in the data-set.

B. Interest Rates and Risk Premia in the EU: Empirical Results

The results for the sub-periods are presented in Table 1, which includes nominal and real interest rate differentials, country risk and currency risk premia, and mean and standard deviations.¹⁹

The evolution of the differentials of the nominal interest rates in the EU appears above all to be an integrated effect of capital market liberalization and EMU expectations. Apart from Italy, there is a diminishing of nominal interest rate differentials against Germany. This is particularly true for American interest rates. But the analysis reveals no real evidence that the approximation of the real interest rates reflects specific EMU expectations. Both for EU and non-EU countries alike, a convergence of real interest rates is apparent. As for the observed approximation of CIP (reduction of country risk premia), this is a result of the increased capital market integration and thus does not necessarily point to the existence of EMU expectations.

What we see from the time-series data is that we can reject without any difficulty the commonly used hypothesis that the reduction of RIP indicates specific EMU expectations. For the complete period is characterized by highly volatile real interest differentials. While we see an increasing reduction of these differentials for nearly all countries and a convergence of real interest rates that is especially marked for France, Netherlands, and Switzerland,²⁰ we can see a renewed divergence towards the end of the period being examined. With the exception of the Netherlands and Switzerland, the differentials increase

in the first quarter of 1997. The proposition that EMU expectations can be derived from isolated RIP criteria is not convincing.

Table 1
Empirical results on interest rate convergence and risk premia

	1986.5-1990.6		1990.7-1993.7		1993.8-1997.4		1986.5-1997.4	
	mean	std. dev.						
Differential of nominal interest rates								
France	3.15	0.99	0.97	0.98	0.93	0.82	1.78	1.42
Italy	5.99	1.09	3.64	1.71	4.59	1.41	4.85	1.70
Netherland	0.61	0.48	-0.14	0.23	-0.22	0.19	0.12	0.51
Switzerland	-0.78	0.78	-1.48	0.97	-1.50	0.37	-1.22	0.81
UK	5.79	0.91	1.36	2.58	1.52	1.39	3.09	2.70
US	1.46	0.95	-4.00	1.86	0.57	1.87	-0.37	2.79
Deviations from RIP with Germany								
France	1.40	0.94	1.81	1.54	1.36	1.07	1.50	1.20
Italy	2.82	2.18	1.71	2.40	2.64	0.66	2.45	2.17
Netherland	1.39	0.79	0.24	0.70	-0.16	0.81	0.54	1.04
Switzerland	-1.76	0.72	-2.60	0.97	-0.58	1.28	-1.59	1.29
UK	1.48	0.77	-0.03	1.81	1.11	0.74	0.93	1.09
US	1.12	0.81	-4.22	0.91	0.02	1.00	-1.60	1.93
Deviations from CIP with Germany (Country risk premium)								
France	6.37	2.27	1.94	2.18	2.02	1.77	3.64	2.98
Italy	11.96	2.39	6.81	3.16	9.04	2.92	9.52	3.50
Netherland	1.29	0.91	-0.25	0.44	-0.42	0.38	0.28	1.03
Switzerland	-0.45	0.89	-1.78	1.15	-1.75	0.48	-1.27	1.07
UK	11.82	1.61	2.50	5.03	3.08	2.79	6.23	5.46
US	3.85	2.24	-7.99	3.69	1.32	3.74	-0.33	5.87
Currency risk premium								
France	-4.97	2.27	-0.13	1.64	-0.66	1.54	-2.14	2.90
Italy	-9.14	3.20	-5.10	3.35	-6.40	2.93	-7.07	3.25
Netherland	0.10	1.08	0.49	1.08	0.26	0.89	0.26	1.03
Switzerland	-0.72	1.19	0.30	2.32	2.30	0.91	0.59	2.00
UK	-10.33	1.73	-2.53	5.87	-1.97	2.66	-5.30	5.36
US	-4.97	1.82	3.77	3.44	-1.29	2.84	-1.27	4.43

Figure 1

Deviation from RIP between EU-countries and Germany

Figure 2

Deviation from RIP between non-EU-countries and Germany

Figure 3

Deviations from CIP between Germany and EU-countries
(Country risk premium)

Figure 4

Deviations from CIP between Germany and non-EU-countries
(Country risk premium)

Figure 5

Currency risk premium between EU-countries and Germany

Figure 6

Currency risk premium between non-EU-countries and Germany

With the help of the above defined risk premia, a still more differentiated picture can be drawn. Here we see that from a historical standpoint the Netherlands and Switzerland have had only minor country risk premia and even notably smaller currency risk premia against Germany. For the other countries, the swings have been bigger and the deviations from zero for risk premia more significant.

For France, we see from 1995 onwards a reduction in both risk premia. This is similarly the case for Italy starting in 1996, although the Italian Lira is, in comparison to the French Franc, still burdened with high risk premia. The convergence process is, however, significant: Italy passes both the convergence and integration tests for the recent past. Thus it appears that the financial markets expect Italy to be among the first EMU members. Yet, an analysis of the RIP between Italy and Germany indicates no such EMU expectation. For France the convergence process is discernible in the RIP criterion.

The results for the Netherlands and Switzerland are hardly surprising as on the one hand Germany and the Netherlands have formed a *de facto* currency union (supported by the data), while on the other the German and Swiss central banks have pursued a very similar monetary policy.²¹ As for France, its fulfilment of all the convergence tests indicates both its well advanced capital market integration as well as EMU expectations. The entry of France at the starting date of EMU will be a political move and on the present analysis also seen as necessary by the financial markets.

In comparison, the calculations and the time-series considerations confirm the proposition of a possible compensation of both risk premia. This is clearly the case for the British pound where the data indicates that for the subperiods the compensation of risk premia lead to an approximation to the RIP. Yet, despite meeting the RIP criteria, but with regard to EMU entrance, UK passes neither the convergence nor integration tests. With this, the argument that an analysis of the convergence of real interest rates does not lead to evidence of EMU expectations stands, the crux being the separation of the risk premia that enables us to at once analyse both the capital market integration and EMU entrance hypotheses.

V. Summary and Conclusion

With the lifting of remaining capital controls inside the EU in 1990, an essential step towards EMU was taken. This naturally raises the questions of whether on the one hand there is an observable convergence of interest rates inside the EU and on the other if alongside this financial integration, EMU expectations are mirrored.

This paper has presented a theoretical argument and empirical justification that in order to determine the extent of capital market integration and measure EMU expectations, an analysis of RIP is insufficient. By splitting RIP into its component risk premia, we could draw a more detailed picture of the situation. The outcome is that we have found that certain countries are still burdened with country and/or currency risk premia which are not reflected in the evolution of real interest differentials. Thus our study points to the necessity of doubting the validity of RIP as a proxy for expectations of a country's membership of EMU.

This paper should now be used to gain additional empirical insight into the issue of financial integration: an understanding of international capital market integration requires that we pay attention not only to interest rate parities, but also to the risk premia. Further econometric tests, however, still need to be carried out, in particular of the expectations of the financial markets over the entrance of individual countries into EMU.

NOTES

1. Caporale/Kalvytis/Pittis (1996).
2. De Grauwe (1994), p. 121.
3. See, for example Moosa/Bhatti (1996).
4. See, for example, Frankel (1992); Herz (1995).
5. See Frankel (1992).
6. See Ayuso/Restoy (1996).
7. Ayuso/Restoy (1996); Caporale/Kalvytis/Pittis (1996).
8. Frankel (1992).
9. For the discussion on the bailout-provision see Hutchison/Kletzer (1995); Kenen (1995b).
10. In this way the general insecurity of the financial markets in periods of high volatility can lead to high currency risk premia for particular countries while at the same time the country risk premia can be reduced due to political stability.
11. This conclusion is drawn by Moosa/Bhatti (1996).
12. This follows, if the stochastic term reflecting inflation differential expectation errors is serially uncorrelated with zero mean. Ex post real interest rates differ from ex ante real interest rate only by a random term with zero mean.
13. This approach is taken by Artis/Taylor (1988); Herz (1995).
14. For empirical analysis of real interest rate parity see Ayuso/Restoy (1996); Caporale/Kalvytis/Pittis (1996); Camarero/Tamarit (1996); Holmes/Wu (1997); Moosa/Bhatti (1996); Wolters (1995).
15. For a comparative econometric analysis of onshore and offshore interest differentials and the interpretation of the deviations, see Artis/Taylor (1988); Caporale/Kalvytis/Pittis (1996); Holmes/Wu (1997).
16. See also Scheide/Solveen (1997).
17. In order to check the rejected thesis in terms of long-term interest rates, a rational expectations model has to be developed and estimated. This will not be done in the context of the present analysis.
18. In this case there should also be no renewed discussion over the anchor role of the DEM in Europe.
19. In the calculations, the interest and inflation rates are also yearly rates, the three-month forward discount/premium is adjusted to the 12 month period.
20. On this basis the EMU would have to be formed by Germany, France, Netherlands, and Switzerland.
21. This result is also arrived at by Moosa/Bhatti (1996) in the context of an estimation of the validity of the RIP inside the EMS.

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