

Problems of transition and initialization of the EMU

Paul De Grauwe*

Summary

This paper describes the convergence dynamics toward the EMU. There are two main arguments:

- Convergence dynamics lead to pressures for postponement mainly due to a German cost-benefit calculus, which gives Germany strong incentive to wait.
- Maastricht convergence dynamics will split the EU. So countries not accepted into the EMU on January 1, 1999 will probably stay out for a long time, if the Maastricht convergence game is maintained, which creates tension between the *ins* and *outs*.

This paper also suggests an alternative strategy toward monetary unification. It is based on the idea that to guarantee a low-inflation monetary union, which is necessary to incite Germany to join, future European monetary institutions should be strengthened. This enables the application of more flexibility in convergence criteria so that more countries that wish to join find this possible. This can reduce the risk of an EU split and allay German inflation fears.

A final analysis presents two arguments about the possibility of speculative movements during the approach to Stage Three and during 1999-2002, when national currencies will continue to circulate albeit with irrevocably fixed exchange rates:

1. The approach to Stage Three can be smoothly organized if the participating countries agree to set up tight procedures for joint monetary decision-making before January 1, 1999.
2. The 1999-2002 period can be speculation-free for participating currencies if Germany clearly commits to abandoning the mark, regardless of what happens with government debts and deficits during this period.

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Problems of transition and initialization of the EMU

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The Maastricht Treaty provided a blueprint for EU members for moving into a monetary union. The striking aspect of Maastricht is that countries are asked to provide evidence of good macroeconomic behavior before they are allowed into the monetary union. In Treaty jargon, they must satisfy convergence criteria (referring to inflation rates, long-term interest rates, stable exchange rate, and fiscal policies).

This idea that countries should satisfy macroeconomic standards of good behavior is surprising on two counts:

1. Historically, it is certainly the first time such an approach was taken. No previous attempts to create monetary unions have followed this road. The latest example, the German monetary unification of 1990, did not use this approach. If it had, the monetary union between East and West Germany would not have happened.
2. The traditional economic theory concerning conditions that countries must satisfy to enter a monetary union (the optimum currency-areas theory) does not list the Maastricht macroeconomic conditions. In contrast, traditional economic theory stresses microeconomic conditions that countries should fulfill if they want to form a monetary union. These conditions are summarized as follows:¹

When countries are different in economic structure, they probably face *asymmetric shocks*. In the absence of the exchange-rate instrument, they will need a lot of flexibility in their labor markets (for example, wage flexibility, labor mobility) to adjust to these asymmetric shocks and to prevent these shocks from leading to permanent unemployment. So this theory stresses that countries should converge in economic structures. If they do not, they will need a lot of flexibility in

¹ The *loci classici* are Mundell (1962), McKinnon (1963), and Kenen (1969). For a recent survey see Tavlas (1994). This theory has also led to burgeoning empirical literature. See, for example, Bayoumi and Eichengreen (1992), Neumann, M. and von Hagen, J., (1991), De Grauwe and Vanhaverbeke (1993).

their respective labor markets. So according to traditional theory, the conditions for a successful monetary union are micro-economic in nature. They have nothing to do with the macroeconomic conditions *à la* Maastricht.

If anything, the optimum currency-areas theory stresses the need for budgetary flexibility—rather than convergence (see Bayoumi and Masson, 1994). Countries that enter a monetary union will lose an important instrument of economic policy, that is, their national monetary policy. As a result, when they face an asymmetric shock, they may need to use their fiscal policies more intensely. Thus, national fiscal policies should be allowed to diverge (at least temporarily) from the average fiscal policies of the union as a whole.

A failure to allow countries to pursue divergent fiscal policies will put more pressure on the European central bank to do something about these asymmetric shocks. So according to the traditional theory, too little flexibility of national fiscal policies may endanger the stability of monetary policy-making at the European level.

The need for convergence criteria has been justified by two claims:

1. Convergence criteria are needed to guarantee that the future monetary union will produce low inflation. This claim has been made both in connection with the inflation convergence criterion and the budgetary criteria.
2. Budgetary convergence criteria are necessary to avoid spill-over effects of fiscal policies from one country to the other. These spill-over effects are deemed to be more pronounced inside than outside the union, and they threaten its stability. Rules on budgetary policies are then seen as a means to guarantee stability of the monetary union.

Subsequent sections provide detailed analyses of these claims.

1. Convergence criteria and monetary stability in the EMU

The argument that the inflation convergence criterion is a necessary entry condition to guarantee low inflation in the future EMU can be formulated like this:

Countries have different inflation reputations. Germany, for example, has established a reputation of low inflation, whereas a country like Italy has acquired a less favorable reputation concerning inflation. When these two countries form a monetary union, the new union's inflation reputation will reflect an average of Germany's and Italy's reputations. As a result, the union's inflation rate is likely to be higher than the one observed in Germany but lower than the one in Italy. (Appendix A presents a simple model that establishes these propositions.)

Clearly, the monetary union could live with that. The problem is that Germany is unhappy with this outcome because it must accept a higher inflation rate. So Germany will insist that the future monetary union should not have an average inflation that exceeds the German inflation. Germany will probably make its participation conditional on this outcome.

The inflation convergence criterion can now be understood as a mechanism that requires Italy to establish a more favorable inflation reputation before entry. Italy should do this by reducing its inflation rate outside the union—on its own. If this is costly for Italy, this is all the better, because it shows that the Italian authorities are willing to change their priorities to acquire a better reputation. Once Italy has achieved a better reputation, it can be let into the union without endangering the reputation of the other member countries. The monetary union can then develop into a low inflation zone.

A similar argument can be developed to justify the budgetary norms (3 percent budget deficit and 60 percent debt-to-GDP ratio). The authorities in countries with high government debt ratios have incentives to create surprise inflation to reduce the real burden of the government debt. If these countries are accepted into the union, they will push for higher inflation rates than countries with lower debt ratios, and thereby increase the average inflation rate in the union. To

avoid this, the high debt countries will have to reduce their debt-to-GDP ratios before entering the union.²

So an argument can be made for imposing prior convergence of inflation and of budget deficits and government debts to ensure that the future monetary union will exhibit low inflation rates. However, a critical evaluation is important because, as argued in this paper, an evaluation helps explain why Maastricht convergence dynamics are running into problems.

A first point to note was mentioned earlier: in the absence of convergence requirements, the inflation rate in the union will probably reflect an average of individual countries' inflation rates. Table 1 shows the average inflation rates in the EU and compares them with Germany's inflation rates during the 1980s and 1990s.

Table 1. Average yearly inflation rates in the EU and Germany

	EU	Germany
1980s	6.5	2.6
1990s	4.1	3.4

Source: European Commission, European Economy.

During the 1990s, the average yearly EU inflation rate was 4.1 percent. Germany's was 3.4 percent. During the 1980s, the respective yearly inflation rates were 6.5 percent and 2.6 percent. There is no reason to believe that an EMU with 4.5 percent inflation (or 6.5 percent for that matter) will not be workable.

The problem is that some countries deem such an inflation rate to be unacceptably high. So the convergence requirements have little to do with conditions that must be fulfilled to have a workable monetary union. They have everything to do with differences in countries', preferences concerning inflation.

A second criticism is more fundamental and can be formulated as follows: the convergence criteria provide no guarantees for lower inflation in the future EMU. The reason is because the convergence dynamics can be seen as a game in which countries are rewarded by following a painful disinflationary policy. Failure to reduce inflation carries a harsh punishment, that is, exclusion from EMU. This gives countries strong incentives to comply and to institute disinflationary

² Note that this does not yet establish the need for the numbers 3 and 60. The arbitrariness of these numbers has been justly criticized (see Buiter et al., 1993).

strategies (at least those countries who deem the permanent benefits of joining EMU to exceed the temporary costs of a disinflationary strategy).

But once these countries are admitted into the EMU, the nature of the game, that is, its reward/punishment structure, changes fundamentally. Suddenly the punishment vanishes. This must have important effects on countries' behavior once they are in the union. In particular, those countries that initially were *softer* on inflation will probably exhibit these same preferences in the EMU.

Of course, one can argue that the convergence process that they had to go through before entry may have changed their preferences and may have converted them to low inflation preferences. But this is a very tenuous assumption. It is more realistic to assume that these countries will revert to their prior preferences. So the convergence criteria *per se* do not guarantee low inflation in the future EMU. The only guarantee can come from the nature of the institutions that will be set up in the future EMU and that may give more or less incentives to maintain low inflation. (See Section 7 for more discussion on this issue.)

The lack of guarantees provided by the convergence criteria to ensure low inflation in the EMU has important implications for Germany. It will lead to a strong pressure in Germany to postpone the union. Appendix B presents a simple model that applies the theory of options and concludes that Germany's welfare can be improved by waiting and postponing the start of the union. The intuition of this result can be explained as follows:

The costs and benefits of monetary union for Germany are asymmetric. The benefits consist of the usual gains of a monetary union (lower transactions costs, elimination of exchange-rate uncertainty and of misalignments of exchange rates). The costs consist of the (uncertain) higher future inflation in the EMU than in Germany.

If these costs are subtracted from the gains, results are obtained on the return from the EMU for Germany. But there is another component to the costs. When Germany enters the union, it loses its power to determine monetary conditions in Europe. In addition, abandoning the German mark can be seen as abandoning a brand name that has been costly to establish. Both the loss of monetary hegemony in Europe and the loss of a brand name can be considered as sunk costs for Germany. These sunk costs are carried up front, that is, at the start of the union. But the benefit from the EMU is a yearly

(uncertain) return. This cost-benefit structure creates the conditions in which waiting has a positive value for Germany.³

To envision this, suppose Germany enters the EMU on January 1, 1999. This implies an immediate and irreversible loss of power and brand name (the sunk costs) for Germany. Assume that the present value of the future net return of the EMU exceeds this cost. One may think that this is a sufficient reason for Germany to enter the union on January 1, 1999. But this is unlikely to be the case. The yearly future return is uncertain. By waiting, say, two years, Germany obtains more information about the commitment of the other potential members towards low inflation, and therefore about the net return of EMU for Germany. If it turns out that this return is high enough, the fact of having waited two years implies a loss of only two years of return. If instead, it turns out that the return is low (because of a weak commitment to low inflation and low government debt by the other members), Germany will have avoided the large sunk cost by waiting. This means that waiting has a positive value for Germany. As a result, this country will have a strong incentive to postpone the start of EMU.

Here, one may object that Germany cannot decide to postpone the start of EMU because the dates and the procedures for starting were set in the Maastricht Treaty. But this is a superficial objection. The Treaty provides a lot of leeway in interpreting these procedures. Take, for example, the debt-to-GDP ratio. According to the Treaty, the debt ratio should decline "sufficiently" and approach the reference value (60 percent) at a "satisfactory pace". Such wording was introduced to allow for some flexibility. But it can also be used to argue for postponement. Most countries will not have reached the 60 percent reference value, and it will be possible to argue that the decline is not sufficient or has not proceeded at a satisfactory pace.

From the German authorities' viewpoint, waiting a little longer to see how the debt ratios evolve makes perfect sense, given that this country attaches so much importance to the budget indicators as signals of a commitment to low inflation policies. In addition, by postponing EMU it can prolong the monitoring of the others so as to re-

³ It could be argued that other countries also face an asymmetric costs-benefits structure. For they also lose their monetary policy instrument when joining the union. But the situation for other countries is different, because most countries have already lost monetary control to the benefit of Germany. In addition, they do not face the same loss of brand name when they abandon their currency.

duce the risk that they will act opportunistically. Behind this calculus lies the view that prolonging the *suffering* increases the stake these countries have in maintaining a low-inflation reputation.

The previous analysis thus leads to the conclusion that the convergence requirements have built-in dynamics that lead to strong incentives to postpone the start of the EMU. These dynamics, in turn, have important implications for the countries with weak reputations for monetary and budgetary stability. The next section develops this point.

2. The dynamics of convergence for countries with weak reputations

Countries with weak reputation suffer from a double problem as they try to converge. Take Italy (the same could be said about Spain), which is forced to reduce its inflation rate before entering the union. And it must do so while carrying the burden of a low reputation. As a result, economic agents will be skeptical, so that inflationary expectations do not decline easily. This forces the Italian authorities to move the economy along a downward sloping short-term Phillips curve. Unemployment increases. In this strategy, ultimate success is not guaranteed. The Italian authorities will probably fail to acquire the same low inflation reputation as the German authorities. As a result, Italy never quite reaches the same low inflation equilibrium as Germany.

Because the Maastricht Treaty also requires Italy to peg its exchange rate, the lira experiences an increasing real appreciation during the transition, which leads to doubts that this disinflationary process can be sustained.⁴ Speculative crises are set in motion, forcing devaluations of the lira. These devaluations lead to renewed divergencies of inflation. To qualify for entry, Italy will have to start a new process of disinflation. The cycle can start all over again.

A similar problem arises with budgetary convergence. Countries, which start a process of budgetary restriction aimed at reducing the government debt, will find that this can be made difficult if at the same time they try to reduce their inflation rate and they lack the credibility to do so. This can be explained as follows:

⁴ See De Grauwe (1994) for evidence about the difficulties of disinflation by pegging the exchange rate. Many countries have encountered these problems of real appreciation during the disinflation process.

Assume a country with a high debt-to-GDP ratio. It also has a high inflation rate to start with, and starts a policy of disinflation. If this policy lacks full credibility the *expected* inflation rate will not (or only slowly) decline. Typically, the observed inflation rate declines faster than the expected rate. This creates the following problem for the public finances of that country:

As expected inflation does not decline, the nominal interest rate (which reflects prevailing inflation expectations) does not decline either. But the observed inflation rate declines so that the ex-post real interest rate (that is, the nominal interest rate minus the observed inflation rate) increases. The latter then increases the burden of the debt. This will force the government to either raise taxes or to reduce spending to prevent the debt-to-GDP ratio from increasing. So debt-reduction policies are made more difficult when governments engage in disinflationary policies that lack credibility.

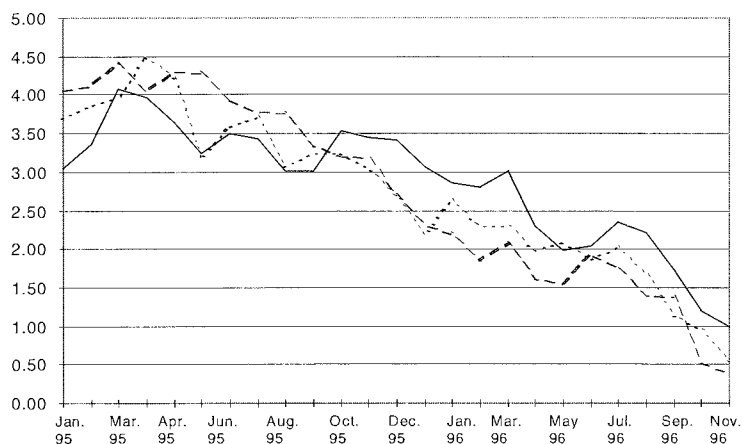
Interaction between the interest-rate convergence requirement and debt dynamics compound the previous problem. When the speculators have doubts that the high-inflation country will be accepted into the EMU, they will incorporate a devaluation premium into the long-term bond rate. These doubts may arise from a belief that the authorities will not manage to reduce the budget deficit. In that case the devaluation premium, which is built into the long-term bond rate, will make the budgetary convergence more painful and more difficult.

Here, the interest rate convergence criterion has a self-fulfilling aspect. If the market believes that a country will not be accepted into the EMU, this raises the long-term interest rate. This, in turn, increases the government budget deficit and the debt-to-GDP ratio, which brings the country farther away from the budgetary norms, thereby validating the expectation that the country will not be admitted. In this process, the country may be pushed into a *bad equilibrium* of increasing debt and deficits (see Obstfeld, 1986; Gros, 1995).

But given the self-fulfilling nature of the interest-rate criterion, the reverse is also possible so that a *good equilibrium* becomes possible. This may have happened during 1995-96. As a result of increasing political commitments of the governments of Italy, Portugal, and Spain to join EMU and their willingness to introduce tough budgetary measures, the markets have become optimistic about the entry of these countries into the EMU on January 1, 1999. This has led to a dramatic drop in the long-term interest rates in these countries. Figure 1 shows the size of this drop; it shows the spread between these

countries' long-term bond rates and the German bond rate. At the end of 1996, this spread had declined to less than 100 basis points. This is bound to make budgetary convergence easier, because the reduction in interest payments reduces the government budget deficits.

Figure 1. Spread of long-term bond rates for the Spanish peseta, the Portuguese escudo, and the Italian lira with the German mark



Legend: ... Spanish peseta, _____ Italian lira, ___ Portuguese escudo

Source: JP Morgan

The risk implicit in these self-fulfilling convergence dynamics is that a change in the market's evaluation of the probability of entry by an individual country can move the country back into a bad equilibrium of high-interest rates and high-interest payments, which lead to high deficits, and a renewed budgetary divergence that makes it impossible for the country to join EMU. It cannot be excluded that such a sudden reversal occurs for several countries with weak public finances—as we approach the date of entry into the EMU.

So the Maastricht convergence requirements carry the risk of splitting the EU apart. If applied strictly, the Maastricht convergence criteria may ban some countries from entry for a prolonged period and against their wishes. This is bound to create political and economic conflicts between the *ins* and *outs*. So paradoxically, the Maas-

tricht treaty, which aimed at deepening the EU, may actually contribute toward disunity.

3. Budgetary convergence requirements and spill-over effects

The previous sections covered the rationale for the convergence requirements—based on the idea that these are necessary to guarantee low inflation in the future EMU. The achievement of the budgetary norms has also been justified on the grounds that too large budget deficits and debt levels create externalities, which harm the other members of the union.⁵ To avoid these negative externalities, it is in the interest of all the member countries to prevent too high budget deficits and debt levels from arising in the first place.

Where do these externalities (spill-over effects) come from? Several have been stressed:

- When a country issues too much debt to finance budget deficits, it raises the interest rate in the union, and thereby increases the burden of the government debt in the other member countries.
- Higher interest rates produced by the excessive debt issue of one member country leads to crowding-out effects in the whole union.
- When one member country issues too much government debt, the risk of default increases. If default occurs, the pressure exerted on the other countries to bail out the defaulting government will be overwhelming. To avoid being put in a position where they must organize a costly bailout, the other governments have an interest in preventing this from happening by imposing Maastricht-type limits on the budget deficits and the government debt levels.

Although there is no question that in a monetary union, spill-over effects of fiscal policies from one country to the others must be taken care of, it is easy to overestimate the importance of these spill-over effects. There are several reasons that support this conclusion.

⁵ This view was heavily criticized by, among others, Buiters et al., (1993). These authors insisted that the term *externality* is misplaced and that it has nothing to do with the concept of externalities used in economics.

First, world capital markets are increasingly integrated, so that long-term, real interest rates tend to be equalized.⁶ This has important implications for the spill-over effects within a monetary union. It implies that the excessive debt issue by, for example, the Italian or the Swedish authorities can only influence the real interest rate in the union—if it changes the world real interest rate. But this is highly unlikely because Italy and Sweden (or any of the future EMU members) are too small to have an appreciable influence on the world real interest rate. So one can conclude that the spill-over effects on real interest rates within the future monetary union are likely to be quantitatively small.

Second, capital markets are increasingly sophisticated. As a result, the ability to price bonds, which are issued by different governments (depending on differences in risk), increases. This also implies that the spill-over effects are reduced. Because when one government increases its debt exposure, the market (more easily than before) will attach a risk premium to this debt and thereby insulate the debt issued by other governments. This then also has the effect of putting the burden of the excessive debt issue on the issuer.

Third, the risks of bailouts can be easily exaggerated. Here, two questions arise:

1. If a highly indebted country is accepted into the union, does this increase the probability of default?
2. When a country defaults, does this lead to greater pressure to bail out the country when it is in the union than when it remains outside?

Consider these two questions consecutively. Proponents of tight budgetary entry conditions have argued that in a monetary union, the budgetary discipline is looser, because national governments can now borrow in a larger *domestic* capital market—without incurring an exchange risk. This then will stimulate them to borrow too much, so that the default risk increases. It must be admitted that the possibility to borrow more without exchange risk makes the government budget constraints *softer* in a monetary union. But there is another feature of

⁶ For evidence, see Barro and Sala-i-Martin (1991), Obstfeld (1993), Helbling and Wescott (1995). Of course, there is the contrary evidence from Feldstein and Horioka (1980). Today, the consensus is that the Feldstein-Horioka econometric evidence is not in contradiction with high capital mobility.

monetary unions which *hardens* the budget constraint of national governments. In a monetary union, there are several national governments and one central bank. So when entering the monetary union, the national governments have less direct access to a central bank compared to the situation before they entered the union. So the possibilities for each national government to finance budget deficits by issuing money are reduced considerably once they are in the union. As a result, the government budget constraints become harder, which reduces the incentive to run large budget deficits.

When comparing these two effects (the larger access to borrowings free of exchange risk and the reduced possibility of monetary financing), it is unclear which one prevails *a priori*. So it is also impossible to conclude that budgetary discipline becomes looser in a monetary union that requires additional constraints on budget deficits and debts—to reduce the risk of default.⁷

Eichengreen and von Hagen (1995) have recently added another dimension to this discussion. They argue and provide evidence that member countries of a monetary union, who maintain control over a large domestic tax base, face a low default risk compared to members of a monetary union with little fiscal responsibilities.

Because the EMU will consist of countries maintaining large domestic taxing powers, the risk of default will probably be small, compared to the risk faced by, say, the American states or the Canadian provinces which, compared to the EU countries, have limited taxing powers. Eichengreen and von Hagen conclude that the need to impose tight rules on government budgets of member countries in the EMU because of possible default risks has been overemphasized.

Does risk of a bailout increase in a monetary union? The standard argument to answer positively runs as follows.

In a monetary union, financial integration increases. As a result, the bonds issued by the different national authorities will be more widely distributed across different member countries. So when one government defaults on its debt, this will affect more individuals and financial institutions outside the defaulting country than if the country had not been in the union. The result is that the pressure exerted on the other governments to bail out the defaulting government will be

⁷ But there is some evidence that cutting the link between the central bank and the government does lead to lower debts and deficits. See De Grauwe (1994) and Moesen and Van Rompuy (1990).

stronger when that government is in the union than when it stays outside.

Although it cannot be denied that the strong financial integration in a monetary union provides the potential for a lot of pressure to bail out defaulting governments, this is not the only relevant consideration. There is also the exchange-rate issue. When a country such as Sweden is not allowed in the union, one can expect that a default will also put a lot of pressure on the other EU members to bail out the Swedish government. This pressure comes from the fact that when Sweden is outside the monetary union while it defaults, the crown is likely to collapse in the foreign exchange market, which produces a lot of pressure from industrialists in the rest of the EU to support the crown to avoid the loss of competitiveness following this collapse.

This exchange-rate effect is absent when Sweden defaults while it is a member of the monetary union. So keeping Sweden outside the union may not necessarily reduce the risk for the other EU members of a future bailout operation. The two effects (the financial integration and the exchange-rate effects) operate in opposite directions. It cannot be known *a priori* whether in a monetary union the pressure to bail out a defaulting EU country will be stronger than when this same EU country is left outside the EMU. It could very well be the other way around.

4. Convergence criteria and social consensus about the EMU

In previous sections, it was argued that the convergence criteria carry the risk of leading to a prolonged division of the EU. There is another risk that has become more apparent only recently. This is the risk that the strenuous application of the (budgetary) convergence requirements is gradually eroding the social consensus in the EU concerning the desirability of EMU.

There is certainly a need for a reduction of government budget deficits and government debt in many European countries, not the least in Sweden. The problem arises when budget cutting is linked to the start of the EMU. Budgetary restrictions are unpopular in most countries because they involve reductions in spending programs and/or increased taxes. These policies hurt many people and are therefore resisted. By making the start of EMU conditional on successful policies of budgetary contraction, the hostility of large seg-

ments of the population against these policies is deflected toward the EMU. In addition, when national politicians justify budget cutting policies by referring to the EMU, the popularity of the EMU is negatively affected. As a result, the social consensus, which may have existed toward the desirability of a single European currency, is undermined. All this is quite unfortunate because, as argued earlier, the case for imposing budgetary norms as a condition for entry into the EMU is weak. By linking the budgetary reform to the start of the monetary union, the latter has been greatly endangered.

There is an additional reason why the link between monetary unification and budgetary reform endangers monetary union. Budgetary reform is not only unpopular, it is also a process that will take much time in many countries. For example, some countries such as Belgium and Italy will need 10 to 20 years to bring their debt-to-GDP ratios close to the 60 percent norm. A monetary union can start much faster. The technical problems of setting up the necessary institutions for the operation of the union require only a few years—not decades. And as argued earlier, the early startup of the union would greatly facilitate the policies of budgetary restrictions and debt reductions in countries with unfavorable initial conditions.

5. The prospects for monetary union

This section contains analyses of what the markets' expectations are concerning the EMU. To study this question, the forward interest rates of currencies that are candidates to become EMU members are analyzed. As a general principle one can state that forward interest rates with a settlement date after January 1, 1999 should be equal among currencies that are expected to be in the monetary union. This is because currencies, which are expected to be in the union, will not be subject to exchange-rate uncertainty anymore.

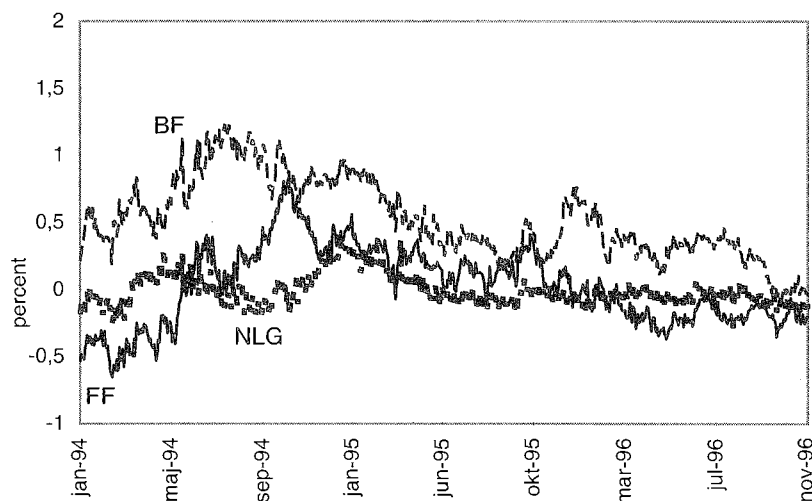
So today, if an investor buys a forward contract to lend one million German marks in 2001, this will translate into a contract to lend 3 million French francs in 2001 (if the conversion rate between the mark and the franc chosen in 1999 was 3:1). If the EMU exists in 2001, the interest earned on this mark contract should be identical to the interest earned on contracts expressed in francs, at least if these two currencies are expected to be in the EMU. Because in that case, the exchange rate between the franc and the mark will have been irrevocably fixed.

The same holds for all other currencies expected to be in the EMU. The exchange rate, which will have been chosen on January 1, 1999 to convert the mark into the franc, will have become irrelevant in 2001 and in all contracts with a settlement date after January 1, 1999. Any differential between the forward interest rates on such contracts creates the scope for risk-free arbitrage if the market believes that EMU will be in existence at that time.

Conversely, if a differential is observed in the interest rates on forward contracts with a settlement date after January 1, 1999, this can only be interpreted to mean that the market is not certain that the EMU will be in existence after that date. (Appendix C formally illustrates these propositions.)

The data were organized as spreads of forward interest rates regarding the German-mark, forward interest rates. Figures 2a and b show the results. The most striking feature is the sharp decline of the spread since the end of 1995 for most currencies concerned. The decline is most spectacular for the southern European currencies (lira, peseta) and for the Swedish crown. At the end of 1996, the spread was about 100 basis points. This implies that the market substantially revised upward its forecast about the probability that these currencies would be in the EMU in 2001.

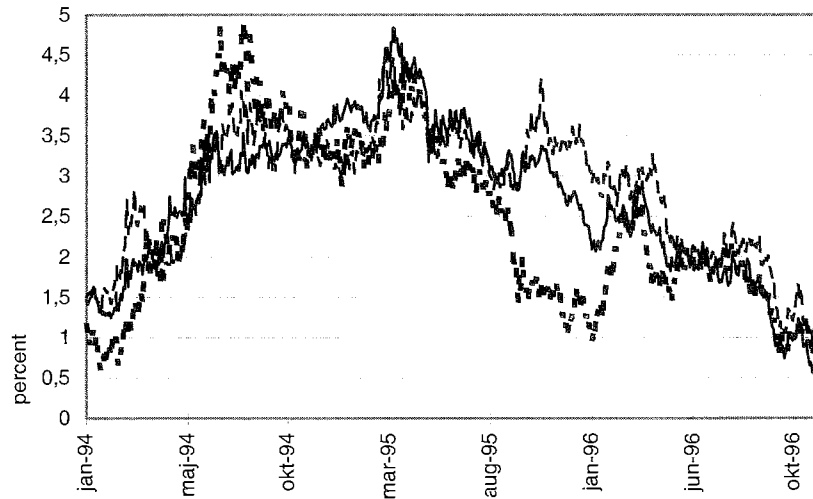
Figure 2a. Forward spread of the Belgian franc, the French franc, and the Dutch guilder with the German mark



One can derive more explicitly the implied probabilities for entering EMU. De Grauwe (1996) describes this procedure. Figures 3 and

4 show the results. At the end of 1996, the market set the probability of an EMU, which includes Germany, France, Belgium, the Netherlands, Austria, and Ireland (the latter two are not shown) equal to 100 percent.

Figure 2b. Forward spread of the Swedish crown, Italian lira, and Spanish peseta with the German mark



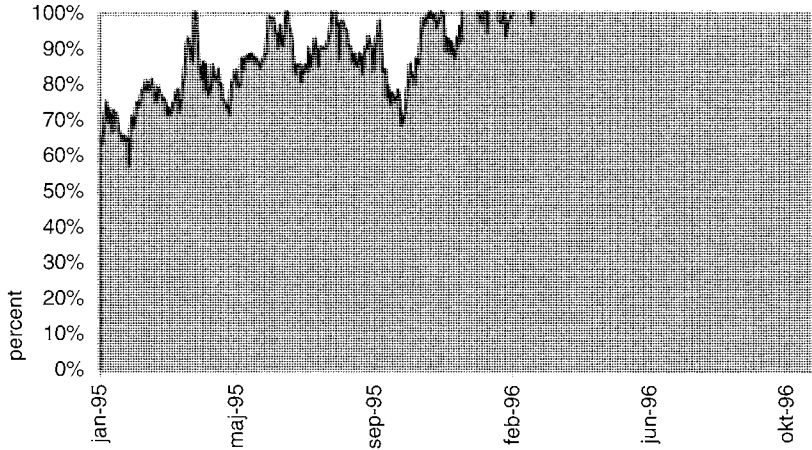
Legend: _____ Spanish peseta, Swedish crown, - - - Italian lira

The most significant change has occurred with the Southern European countries and Sweden, which at the end of 1995, were given a probability of joining the EMU of close to zero. At the end of 1996, this probability had reached levels of 70 to 80 percent in Spain and Italy (For Portugal, not shown here, the probability reached 90 percent.) For Sweden, this probability fluctuated around 60 - 70 percent at the end of 1996. One can interpret these results as follows:

At the end of 1995, the prevailing opinion in the market was that the EMU would start with a core group of countries. In this view, the peripheral countries had no chance to be included in the EMU. One year later, this view had completely changed. Now the peripheral countries are given very high probabilities to be in the EMU at the end of the century.

Figure 3. Probabilities of French franc, Belgian franc, and Dutch guilder in the EMU (Jan. 1995 - Nov. 1996)

Probability of FF in EMU (Jan. 95 - Nov. 96)



Probability of BF in EMU (Jan. 95 - Nov. 96)

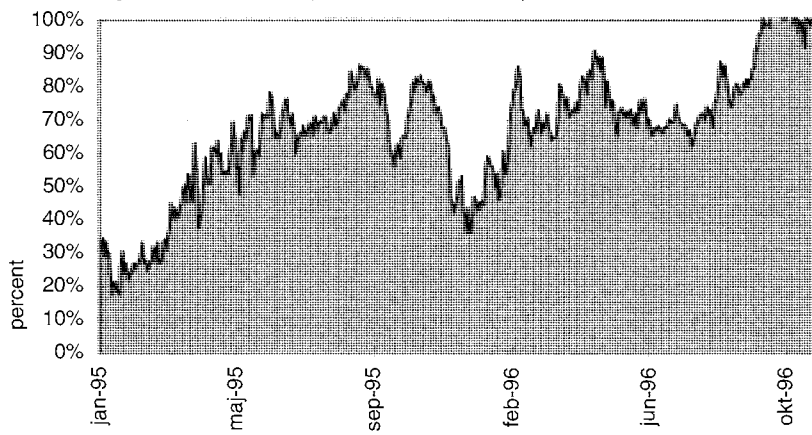


Figure 3. Continued ...

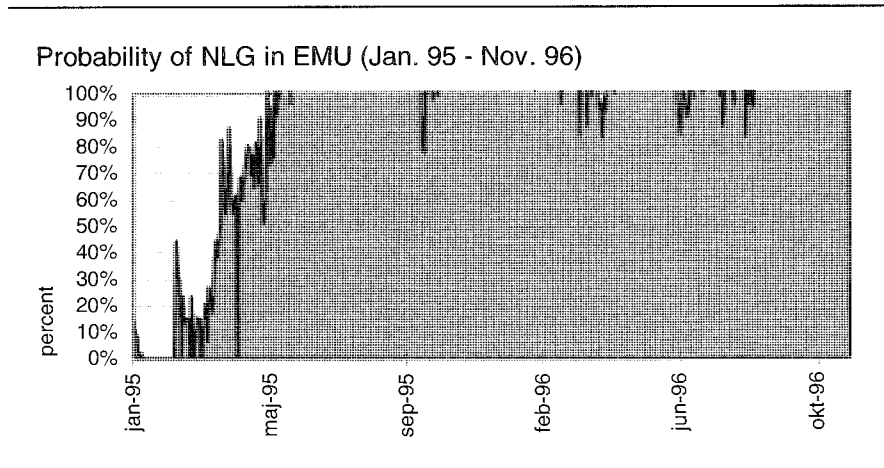


Figure 4. Probabilities of Spanish peseta, Swedish crown, and Italian lira in the EMU (Jan. 1995 - Nov. 1996)

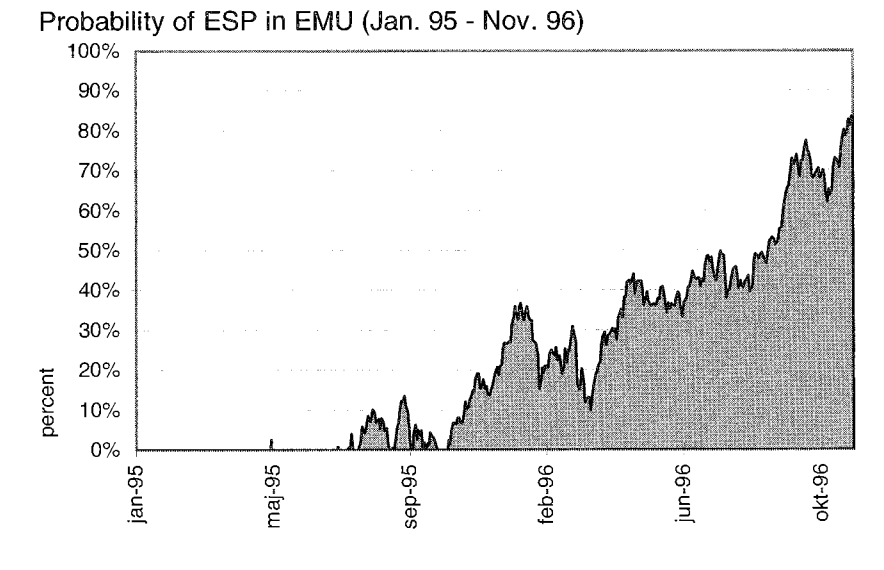
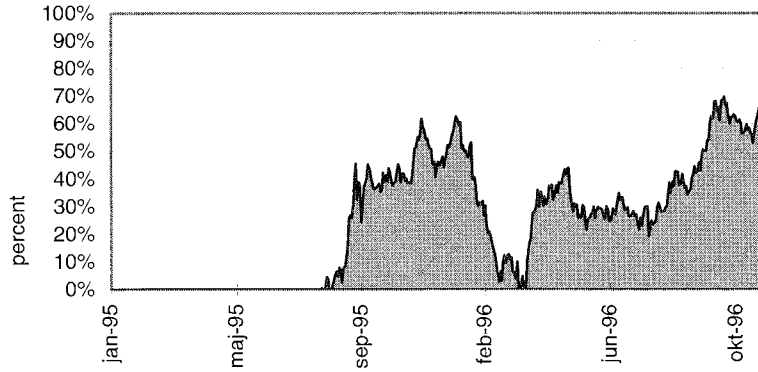
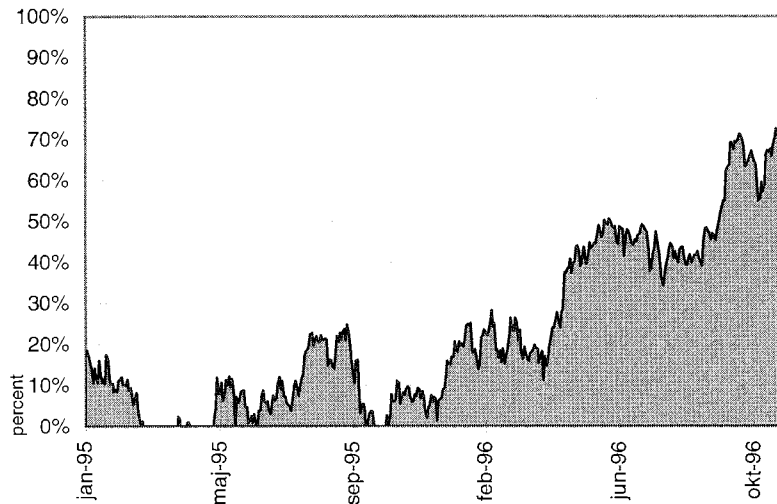


Figure 4. Continued ...

Probability of SEK in EMU (Jan. 95 - Nov. 96)



Probability of ITL in EMU (Jan. 95 - Nov. 96)



This change in perception is due to several factors:

- The convergence of the peripheral countries has improved. At the same time, the convergence of several core countries has been disappointing. As a result, the difference between the core and the periphery regarding convergence has narrowed.
- The better-than-expected performance of the peripheral countries may have led these countries to enjoy the positive self-fulfilling dynamics of the convergence process, which are described earlier: better prospects for entry lower the interest rates, thereby facilitating the budgetary convergence.
- The market may have become aware of the politics of deciding about membership. Peripheral countries have made it clear that their overriding objective is to start the EMU with the core countries. The qualified majority rule that will have to be used to decide the membership issue will give the power to a small group of countries to block entry of others—if they themselves are not accepted. Because the difference between the core countries and the peripheral countries has narrowed considerably, it will be very difficult to exclude the peripheral countries without creating severe political tensions and a deadlock in the decision process.

Much of the pressure will be on Germany, which has insisted most on the strict interpretation of the Maastricht convergence criteria. If Germany maintains its position, a political deadlock cannot be excluded. So the postponement of the start of the EMU cannot be excluded either.

6. Alternative transition processes

Analyses in previous sections suggest several reforms in the transition toward monetary union. The general principle that should guide this reform can be formulated as follows:

The transition to EMU should put less emphasis on convergence requirements and more on strengthening the future monetary institutions of the union. More emphasis should be put on ensuring that the future European central bank delivers on its mandate to produce price stability. This can be achieved by strengthening the institutions of the future monetary union. This, in turn, allows the convergence criteria to be used more flexibly.

This general principle could be achieved in several ways. Daniel Gros⁸ proposed one, which foresees that countries, which fail to satisfy the budgetary norms, would not obtain a voting power on the board of directors of the ECB. So countries such as Italy, Belgium, and Sweden, would be accepted into the union. But as long as their budgetary house is not in order, these countries would not be allowed to take part in the decision process of the ECB. As a result, there should be no fear that heavily indebted countries may push the ECB to pursue too expansionary monetary policies.

The paradox discussed in the previous sections can be resolved. By allowing highly indebted countries into the union, debt reduction targets become easier to achieve. At the same time, the fear is allayed that these highly indebted countries may induce an inflationary bias to the union. This fear has been one of the main stumbling blocks for low-inflation countries to allow countries that follow unorthodox fiscal policies in the union.

A second institutional strengthening consists of defining and enforcing a procedure for removal of the board of directors of the ECB—should it fail to maintain price stability. Such a procedure would do much more to ensure price stability in the union in, say, the year 2010 than the insistence that countries reduce their inflation rates and their budget deficits in the second half of the 1990s—before the union starts.

Such a reform also goes some way in making the future European Central Bank more accountable. In this context, inflation targeting could be useful. Many central banks, including the Swedish central bank, now follow inflation targeting procedures. The ECB could similarly be required to use such a procedure.

The budgetary process in different EMU countries should be reformed to make it more transparent and less prone to lead to unsustainable budget deficits. Recently, Eichengreen and von Hagen (1995) formulated proposals aimed at making the budgetary process more streamlined in the EU. In addition, they proposed to institute National Debt Boards in each country, whose responsibility would be to monitor the evolution of the national debt and to propose remedial action when particular targets are not met.

These are only a few proposals that follow the general principle formulated earlier, that is, that less emphasis should be put on con-

⁸ See Gros (1995).

vergence criteria and more on strengthening the future monetary institutions in the union. It is important to see this as a *quid pro quo*. By strengthening the institutions of the future EMU, the German public can be convinced that the future monetary union will provide for low inflation. This then makes it possible to relax the convergence requirements (which, as argued, provides few guarantees for Germany). The relaxation of the convergence requirements then reduces the risk that the EU will split into two parts, producing great economic and political strains.

Note that this shift in emphasis can be achieved within the framework of the Maastricht Treaty. It does not require a renegotiation of the Treaty. As mentioned earlier, the wording of the Treaty allows for a lot of flexibility in the interpretation of the convergence criteria (especially the budgetary ones). So if the political will is present, a flexible interpretation of the convergence criteria is certainly possible. At the same time, the institutional strengthening proposed here can be achieved by reaching agreement on additional protocols, much in the same way as the Stability Pact, initially proposed by the German Minister of Finance and agreed upon at the Dublin summit meeting of December 1996.

7. Problems of initialization of the EMU

Two important problems associated with the start of the EMU deserve attention:

1. Between the membership decision (foreseen in early 1998) and the start of Stage Three (January 1, 1999), potential for speculative crises may be created.
2. During the first three years of Stage Three (1999-2002) when the national currencies will continue to circulate, albeit with irrevocably fixed exchange rates, a potential for speculative crises also exists.

The following analyses illustrate the seriousness of the two problems.

7.1. Conversion rates and speculation

When the membership issue will be settled in early 1998 (if at all), the conversion rates that will be used on January 1, 1999 will not be known with certainty. This creates a problem in that a potential for speculative crises arises.

These crises could originate for two reasons.

1. During 1998, large asymmetric shocks occur, which are perceived to create a need for making exchange-rate adjustments before the start of EMU to avoid locking exchange rates into values that no longer correspond to equilibrium.
2. A second source of speculative crises may arise as a result of what has been called the *end-game* problem. This can be explained as follows:

At the start of Stage Three, countries lose their ability to change the exchange rate. As a result, a situation arises in which countries can devalue for the last time. So if a country decides to devalue, it can reap the benefits of such a devaluation (for example, improved competitiveness, reduction of the real burden of the government debt) without creating expectations of a new devaluation in the future. The latter typically raises domestic interest rates and makes a devaluation less attractive. So the incentive to devalue “for the last time” may be very strong in many countries. When speculators are aware of this, a speculative crisis is likely to erupt.

How important are these problems? The end-game problem is discussed first.

In the beginning of 1998, when countries are selected to enter the EMU, they will at the same time have to comply with article 109 l of the Treaty, which states that the decision concerning the conversion rates will be taken by unanimity. At the moment a country is accepted into EMU, it will also abandon its sovereignty concerning its exchange rate. This is quite important because it eliminates the end-game problem, which arises when countries can exercise their option to devalue a last time before entry into the union. This option will simply not exist for the countries that will enter into the union. The end-game problem ceases to be a problem.

The other problem, the possible occurrence of large shocks during 1998, cannot be excluded. So the issue is how the participating countries should deal with this problem.

One possible response consists of announcing the conversion rates at the same time as the membership decision is taken. But such an announcement must be made credible to be capable of withstanding a speculative storm should this arise. To do so, a *commitment technology* should be put into place. This consists of steps toward centrali-

zation of the monetary policies of the countries that will participate in EMU.

So monetary policies of the countries accepted into the EMU should already be decided upon jointly during 1998. Another part of this commitment technology consists of declaring that each participating central bank will supply its own money in unlimited amounts in exchange for the currency under pressure. Such a solemn declaration, if credible, can beat back any amount of speculation for the simple reason that central banks that support another currency can create unlimited amounts of their own currency to be sold in the market. In a multilateral exchange-rate system such as the EMS, there is no constraint on the amount of foreign exchange the central banks can supply in the market. Once this is known by speculators, they will not find it worthwhile to undertake a speculative attack.

If the countries accepted into the EMU fail to set up such a commitment technology, they will take a risk. Here, it will be necessary to allow for a sufficient amount of flexibility in the exchange rates. The ± 15 percent fluctuation margin should then be maintained to absorb speculative shocks that may arise. The authorities can strengthen the stability of this fluctuation margin by declaring that the central rates will be the conversion rates. Even if the speculators do not fully believe this (because of the absence of a commitment technology), there would be sufficient uncertainty about this, so that large deviations of the exchange rates from the central rates would create a high risk of large losses for those speculators betting against a currency. This would help to stabilize the exchange rate within the band.

7.2. Irrevocably fixed exchange rates and speculation

From January 1, 1999, exchange rates of the participating currencies will be irrevocably fixed. During three years, these currencies will continue to circulate. Only from 2002 will they be replaced by the euro.

When this additional stage in the transition process was initially proposed it met a lot of skepticism from many observers. The main reason for this skepticism was to be found in the past experience of fixed exchange rates. Sooner or later these fixed exchange rates come under pressure. In addition, in a world of perfect capital mobility, this pressure is likely to come soon. So according to the skeptics, this additional transition stage was superfluous and could only create more problems on the road to full monetary union.

The European authorities have defended this additional transition period on technical grounds. It was deemed to be necessary to allow for the necessary technical preparations for the final switch-over to the single currency. If this is the correct interpretation of why the additional transitional stage was instituted, then it may not really lead to problems of speculative crises. The reason is that from January 1, 1999, the European Central Bank will take over monetary policies from the national central banks. This has important implications for the stability of the system when large changes in the demand for national currencies arise.

Suppose, for example, that French residents massively wish to convert their holdings of francs into German marks. This will necessitate that the ECB supplies the additional marks and retires the franc. The ECB can do this, in principle, until the last franc has disappeared from circulation. Because this would involve the substitution of franc for mark, it would not affect the system-wide money supply target that the ECB is likely to pursue. So technically, there is no problem for the ECB to adjust to any desire of the public to move out of one currency into another one.

But there is another possible interpretation of why the additional stage in the transition was instituted. This has to do with the desire of Germany to maintain its valuable option to postpone the start of the EMU (see Section 1). If the additional stage in the transition to EMU is there to allow Germany to keep this option, then the stability of this transitional stage is not at all assured. Here, the market may come to expect that Germany will continue to have an incentive to postpone. Such an expectation may lead to great turbulence in the markets. It may occur if, for example, budget deficits widen again or debt ratios increase after 1999. As is well known, the German Constitutional Court has ruled that Germany should be allowed to pull out of the EMU if it does not provide for stability. An increase in the government budget deficits and debt levels could be interpreted as such and may lead to calls for Germany to exit from the EMU. During the transitional stage between 1999 and 2002, such a pull-out would still be possible at minimal costs. It is precisely the existence of this low-cost exit that could make this stage in the process toward the EMU unstable.

To avoid this, at the start of 1999, a strong commitment from Germany will be necessary to indicate that it is irrevocably engaged in the process of monetary union. This will be necessary to avoid having

the Constitutional Court's ruling hanging as Damocles' sword over this last stage towards monetary union.

8. Conclusion

This paper describes the convergence dynamics toward monetary union in Europe. These dynamics carry two risks:

1. They lead to pressures for postponement mainly because of a German cost-benefit calculus, which gives that country a strong incentive to wait.
2. They will lead to a division of the EU (a more important risk). So countries that are not accepted into the EMU on January 1, 1999 are likely to stay out for a long period, which creates great tensions between the *ins* and *outs* (at least if the Maastricht convergence game is maintained).

This paper presents an alternative strategy toward monetary unification. It is based on the idea that to guarantee a low inflation monetary union (a condition necessary to incite Germany to join), the future European monetary institutions should be strengthened. This then makes it possible to apply more flexibility in the convergence criteria so that more countries that wish to join the union find this possible. In so doing, the risk of splitting the EU apart can be reduced while at the same time, the German fears of inflation can be allayed.

This paper also analyzes the possibility of speculative movements during the approach to Stage Three and during 1999-2002, when national currencies will continue to circulate albeit with irrevocably fixed exchange rates. It concludes that the approach to Stage Three can be smoothly organized if the participating countries agree to set up tight procedures of joint monetary decision making before January 1, 1999. The period between 1999-2002 can be made speculation free for the participating currencies, if it is made very clear that Germany is fully committed to abandoning the mark, regardless of what happens with government debts and deficits during these years.

Appendix A. The economic rationale for convergence before EMU

This appendix contains a simple model that formalizes the argument that convergence before entry into the EMU is necessary to obtain low inflation in the future EMU. The inflation convergence requirement is the focus.

Elsewhere, a similar analysis was performed regarding the budgetary convergence requirement (De Grauwe, 1996). Figure A.1 illustrates the central insight of the theory. It shows the short-run Phillips curves of Germany and Italy. These countries are assumed to be identical except for the preferences of the authorities.

The German authorities put heavy weight on reducing inflation, the Italian authorities put low weight. This is shown by flat indifference curves for the German authorities and steep ones for the Italian authorities.

The natural unemployment rate, u_N , is the same in the two countries, and so is the target unemployment rate of the authorities, u^* .

Inflation equilibrium is achieved in E_G in Germany and E_I in Italy. So inflation is on average higher in Italy than in Germany without any gain in unemployment for Italy. This has to do with the assumption that economic agents have rational expectations. When setting their inflation expectations, they consider the preferences of the authorities. They will set these expectations high enough to eliminate the incentive the authorities have to create surprise inflation.

A monetary union between the two countries implies that a common central bank takes over, so that the preferences of the authorities become identical. Two propositions can now be easily established:

1. The low inflation country (Germany) always reduces its welfare by forming a monetary union with the high inflation country.⁹ This is because the union central bank will reflect the average preferences of the participating countries.¹⁰ As a result, the union inflation rate will be located between E_G and E_I . The high inflation country, Italy, gains from monetary union.

⁹ Of course there are other sources of gains of a monetary union, for example, lower transactions costs and lower risk. These efficiency gains must then be compared with the welfare losses resulting from a higher inflation.

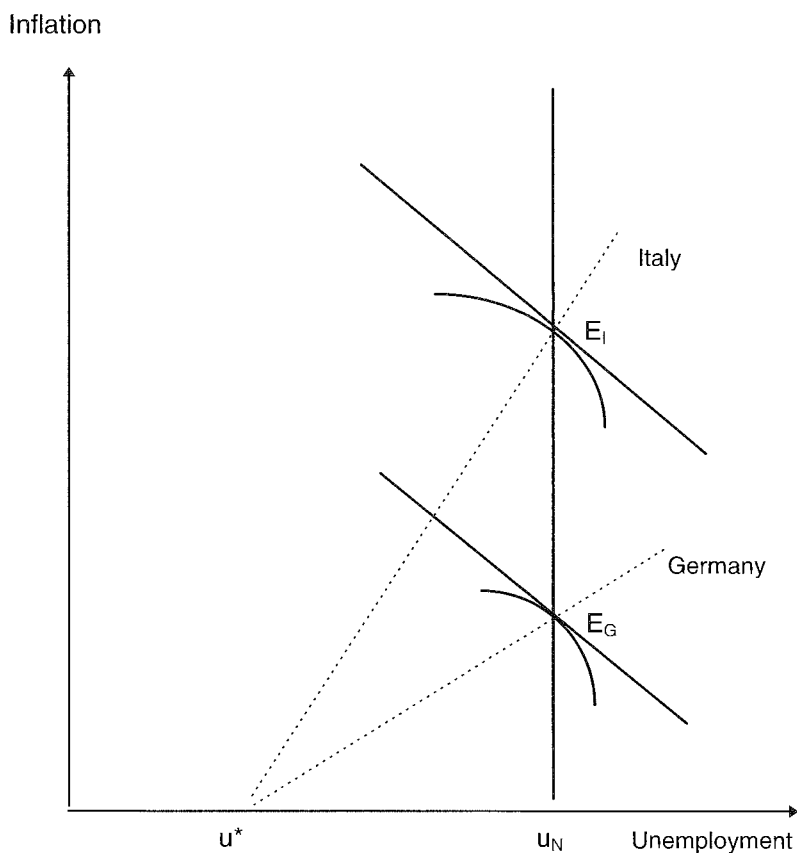
¹⁰ In principle, the statutes of the ECB require the central bank to pursue price stability. But one cannot exclude the possibility that the representatives of different countries, with different inflation experiences, maintain their own preferences.

2. From the first proposition it follows that, because the low inflation country, Germany, loses when it joins the union, it will not want to do so—unless it can impose conditions. It is clear from the analysis of Figure A.1, that this condition must be that the union central bank should have the same preferences as the German central bank. Note that Italy will be glad to accept. So this analysis provides the intellectual underpinnings for the Maastricht decision to institute a European Central Bank, which is a close copy of *Bundesbank* (with political independence and price stability as the sole objective of monetary policy).

What about the Maastricht entry conditions? Can these equally be derived from the analysis underlying Figure A.1? At first sight, they can. The European Central Bank will be composed of representatives from participating countries. Even if the ECB is made independent, these representatives may still have different inflation preferences. Majority voting in the Board may then put the German representative in a minority position, so that the equilibrium inflation rate in the union would exceed the German inflation rate. To avoid this outcome, Germany will want to control the entry into the union, so that only those countries with the same preferences join the union (Morales and Padilla, 1994; Winkler, 1995). The Maastricht entry conditions can now be interpreted in this perspective. Before the union starts, the candidate member countries are asked to provide evidence that they care about a low-inflation rate in the same way that Germany does. This they do, by bringing down their inflation rate to the German level.

During this disinflationary process, a temporary increase in the unemployment rate will be inevitable (a movement along the short-term Phillips curve). This self-imposed suffering is added evidence for Germany that countries such as Italy are serious about fighting inflation. Once the proof is given, these countries can be let in safely.

Figure A.1. Inflation and unemployment in a two-country model



Appendix B. The incentives to postpone EMU

The decision to enter the monetary union by Germany as an investment decision is considered in this appendix. Here, R is the net yearly (uncertain) return from monetary union. It consists of two components, that is:

$$R = S - P, \quad (A1)$$

where S is the traditional benefit from monetary union (lower transactions costs, less exchange risk) and P is the loss for Germany arising

from expected higher yearly inflation rates in EMU than in Germany. Assume that this cost is uncertain. But Germany acquires more information about the size of this expected inflation as time goes on. This information is obtained from the trends in budget deficits and debt ratios.

Germany also bears another cost when entering the monetary union. This is the loss of its brand name, the German mark, and the loss of power in determining monetary affairs in Europe. This cost can be considered as a sunk cost. This cost is K and it is borne at the moment Germany enters the union.

For EMU to be interesting for Germany the following condition must be satisfied:

$$R/r - K > 0, \quad (A2)$$

where r is the discount rate, so that R/r is the present value of the future expected yearly returns of the monetary union.

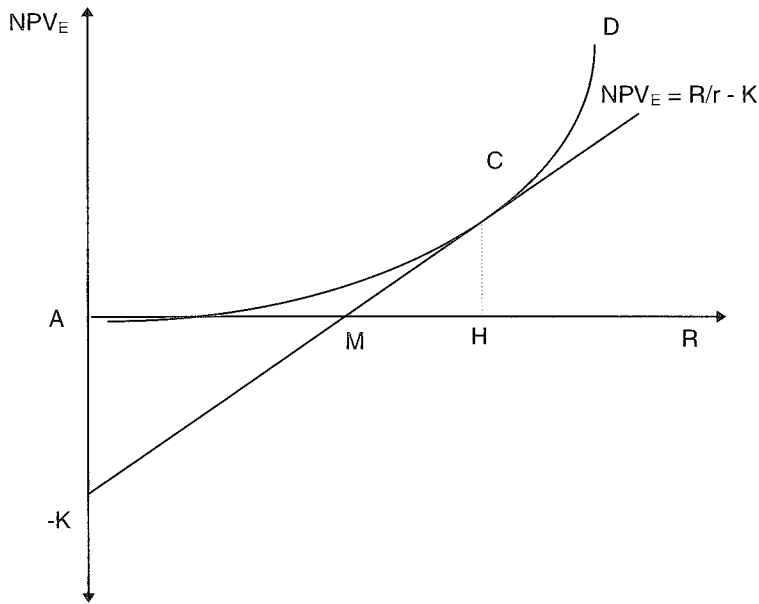
$(R/r - K)$ can then be interpreted as the net present value of the EMU for Germany (NPV_E). This should be positive to induce Germany to enter the monetary union.

Figure B.1 shows this German cost benefit calculus graphically. The vertical axis exhibits the net present value of EMU as defined in (A2). The horizontal axis represents the expected yearly rate of return of EMU. The upward sloping line is the graphical expression of equation (A2).

When R exceeds M , monetary union is profitable for Germany. It is assumed that this is the case. So suppose that R slightly exceeds M . Does this mean that it is in the interest of Germany to start the monetary union immediately? The answer is negative.

If Germany has the option to wait before making its final decision, the cost benefit calculus changes. Because by waiting one period, Germany obtains better information about R . If after one period, R exceeds M , then the net present value of EMU is positive and Germany starts the union. If R is below M , then Germany does not start the union so that the net present value of the union is zero.

Figure B.1. The option value of waiting for Germany



Therefore, this waiting strategy has a higher net present value today than starting the union immediately as soon as R exceeds M .

The curved line ACD ¹¹ shows the net present value of this waiting strategy. So even if today, R slightly exceeds M , it pays for Germany to wait. Only when R exceeds H will it be optimal for Germany to start the union immediately. Put differently, the expected rate of return must exceed the minimum required rate of return by a wide margin. This margin ($H-M$) depends on the uncertainty of the expected return R . The greater this uncertainty, the greater is this margin and therefore the value of waiting for Germany.

Readers who are familiar with option theory will have recognized this formulation as just an application of option pricing. Germany has the option to enter the union. The exercise price of this option is K (the sunk cost). But it would not be optimal for Germany to exercise this option when R remains below H , because the value of this option

¹¹ See Dixit (1992) for a derivation of this curve in the context of an optimal investment policy.

is higher than the intrinsic value of the project (the net present value NPV_E). So it is not rational for Germany to start the monetary union immediately even if the net benefit of EMU is positive.

Appendix C. Forward interest rates as predictors of the EMU

This appendix displays an analysis of how the information embodied in the forward interest rates can be used to find out whether the markets expect the EMU to start on January 1, 1999. This analysis is applied to the ECU and the German mark interest rates. Any other pair of potential EMU-members could also be selected.

To start, the well-known interest parity theorem is used, which can be expressed as

$$\frac{\left(1 + RE_{t,t',T}\right)^{T-t'}}{\left(1 + RD_{t,t',T}\right)^{T-t'}} = \frac{F_{t,T}}{F_{t,t'}}, \quad (A3)$$

where $RE_{t,t',T}$ is the forward ECU interest rate observed in period t for contracts with settlement time t' and with a maturity time T .

In general, $T > t'$. $RD_{t,t',T}$ is the forward German mark interest rate observed in period t for contracts with settlement time t' and with a maturity time T . $F_{t,t'}$ and $F_{t,T}$ are the forward exchange rates of the ECU (units of ECU per unit of German mark) observed in period t for contracts with settlement time t' and T , respectively. Note that if $RE_{t,t',T}$ and $RD_{t,t',T}$ are the spot interest rates, then $t = t'$. In that case $F_{t,t'}$ is the spot exchange rate, and (A3) is the conventional interest parity relation.

These forward exchange rates can also be expressed as

$$F_{t,t'} = E_t(S_{t'}) (1 + \pi_{t,t'}) \quad (A4)$$

and

$$F_{t,T} = E_t(S_T) (1 + \pi_{t,T}), \quad (A5)$$

where $E_t(S_{t'})$ and $E_t(S_T)$ are the expectations held in period t about the exchange rate of the ECU relative to the German mark at time t' and T respectively; $\pi_{t,t'}$ and $\pi_{t,T}$ are the risk *premia* involved.

If the EMU starts on January 1, 1999, two things will happen:

1. The exchange rate between the euro (previously the ECU) and the German mark will be irrevocably fixed from that date on. This irrevocably fixed exchange rate is represented by \bar{S} .
2. The fluctuation margins around this irrevocably fixed exchange rate will be eliminated. This implies that the exchange risk between the euro and the German mark will vanish. The same applies to all pairs of currencies, which will participate in the EMU.

The previous discussion implies that after January 1, 1999, equations (A4) and (A5) can be rewritten as:

$$F_{t,t'} = F_{t,T} = \bar{S} \quad (A6)$$

for all t' and $T \geq$ January 1, 1999. This follows from the fact that in the monetary union, the exchange rate cannot be changed anymore, and thus the future expected exchange rate is invariably \bar{S} .

In addition, because the exchange risk disappears, $\pi_{t,t'}$ and $\pi_{t,T}$ in (A4) and (A5) must be equal to zero. Using (A6) to substitute in (A3), this gives

$$1 + RE_{t,t',T} = 1 + RD_{t,t',T} \quad (A7)$$

for all t' and $T \geq$ January 1, 1999.

The forward interest rates on ECU and German mark contracts with settlement time after January 1, 1999 are equalized if the market is confident that the EMU will start on January 1, 1999.

Note that the irrevocably fixed-exchange rate, \bar{S} , does not appear in equation (A7). Put differently, whatever choice is made about the conversion rate between the euro and the mark on January 1, 1999, this does not alter equation (A7) and the conclusion that if the EMU is expected to start on that date, the forward interest rates of the ECU and the German mark must be equal.

Conversely, if today, a deviation is observed between these forward-interest rates, this can only mean that the market has doubts

that the EMU (that is, irrevocable fixing of exchange rates and elimination of fluctuation margins between the euro and the mark) will start on January 1, 1999.

Note that the previous conclusion does not apply to the forward rates with settlement time before January 1, 1999. These incorporate the risk relating to the uncertainty about the conversion rate (even if the market has no doubts that EMU will start on January 1, 1999). Forward rates for $t' < \text{January 1, 1999}$ can be expressed as:

$$F_{t,t'} = E_t(S_{t'}) (1 + \pi_{t,t'}), \quad (\text{A8})$$

which is the same expression as (A4), and

$$F_{t,T} = E_t(\bar{S}) (1 + \pi_t), \quad (\text{A9})$$

where $E_t(\bar{S})$ is the expected conversion rate and π_t is the risk associated with making a wrong forecast about this conversion rate.

Substituting (A8) and (A9) into the interest parity condition (A3) leads to the conclusion that the forward rates with a settlement date before January 1, 1999, will generally not be equalized even if the market is certain that EMU will start on that date. The spreads then reflect the uncertainty concerning the conversion rate that will be chosen between the ECU and the German mark.

From the previous discussion, the conclusion is that to obtain the market's expectations of the occurrence of EMU on January 1, 1999, forward-interest rates with settlement time after January 1, 1999 should be used. These reflect the pure EMU probabilities because they are cleared from all uncertainties about the conversion rates that will be used at the start of EMU.

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