The Likelihood of European Monetary Union [*]

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1. Introduction

In the Treaty of Maastricht, the governments of the European Union member states solemnly laid down that January 1, 1999 will be the starting date for transition to a single currency, when some of the 15 member states will replace their currencies with the euro. With this crucial date rapidly approaching a lively public debate about the desirability of EMU and the potential "ins" and "outs" has emerged. This paper attempts to measure the markets' assessment of the likelihood that EMU will in fact come about. It also seeks to detect which countries the markets believe will be participating. This exercise is not only interesting in itself, but also because the prospect of EMU presumably affects inflation expectations today. Expected inflation rises with the likelihood of EMU if the future European Central Bank enjoys less credibility than the national central banks. This may be the case for "hard-currency countries" such as Germany and the Netherlands.

2. About probabilities

Let P_l denote the probability that country l will adopt the single currency. For further analysis it is necessary to decompose P_l in the probability that country l will belong to the "ins" assuming that EMU is realized, $P(l \in core|EMU)$, times the probability that EMU will come about, $P(EMU)$:

$$P_1 = P(1 \in core | EMU) P(EMU) \qquad (1)$$

Putting it this way illustrates the important difference between core and periphery. As EMU without Germany is not conceivable, $P(DEM \in core | EMU)$ is close to one and $P_{DEM} \approx P(EMU)$.[1] Conversely, nowadays countries like Spain and Italy are far from meeting the Maastricht criteria and cannot be considered likely candidates. Thus $P(l \in core | EMU)$ for these countries should be very small. Note that the relevant variable, e.g. for reactions of expected inflation in country l, is P_l and not $P(EMU)$.

3. Forward interest rates and EMU

The basic idea is that interest rates with settlement time after January 1, 1999 should be equal for those currencies which join EMU. The probability of EMU can thus be calculated using forward interest rates, i.e. nominal interest rates agreed upon today for an investment period starting in the future. Of course, due to the assumptions to be made below, the numerical values shown have only indicative significance. Note that one of the implicit assumptions is that EMU starts on January 1, 1999, or not at all.

De Grauwe (1996) follows a similar tack to calculate $P(EMU)$. His approach to computing the P_l's, however, differs in two important aspects: first, he does not resort to the – I believe – essential decomposition of P_l into the conditional probability times $P(EMU)$. As a result the – for the weak currencies important – possibility that EMU realized without currency l is neglected. Second, to calculate P_l for countries other than Germany he uses the spread between currency l and the DEM. Unfortunately, and in contrast to the case where the spread between currency l and the ecu is used, no "theoretical" value for the spread is available if EMU does not come about. De Grauwe conjectures a constant spread equal to the mean of 1990. This arbitrary normalization implies that whenever the spread between

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[1] In this paper the currencies are denoted by their standard international abbreviations. Thus, DEM denotes the Deutsche Mark, NLG the Dutch guilder, FRF and BEF the French and Belgian Franc, GBP the British pound, DKK the Danish kroner, ITL the Italian lira and ESP the Spanish peseta.

currency l and the DEM reaches its 1990 level, P_l is zero. Given the exceptional character of the year 1990, this choice seems debatable.

Altogether, this leads to estimates of P_l being larger than those for $P(EMU)$, which according to equation (1) should be impossible. Furthermore, the probabilities exhibit implausible jumps: P_{NLG} for example increases from 0% to 100% within a few months. Another surprising results is the probability of the pound sterling being in EMU which is about 70% and hence higher than that for the Belgian franc. The present approach tries to avoid these shortcomings.

To begin with, let $s_t^{ecu,f,m}$ denote the observed spread between ecu and DEM forward interest rates with settlement time $t + f$, and $s_t^{ecu,m}$ be the spread between ecu and DEM interest rates of maturity m at time t. Thus, one can write:

$$s_t^{ecu,f,m} = P_t(EMU)\, E(s_{t+f}^{ecu,m} | EMU) + (1 - P_t(EMU))\, E(s_{t+f}^{ecu,m} | \overline{EMU}) \qquad (2)$$

where $E(\cdot | EMU)$ stands for the expectation operator conditional on the realization of EMU, whereas $E(\cdot | \overline{EMU})$ for the like conditional on the fact that EMU does not come about. In this context, $P(EMU)$ should be thought of as the markets' assessment of the likelihood of EMU.

Equation (2) simply defines the observed forward interest rate spread as expected interest rate spread over an appropriately chosen period. Assuming that EMU without Germany is inconceivable, the probability that Germany belongs to the "ins" given that EMU comes about equals one and thus $P_{DEM} = P(EMU)$. This is also in accordance with recent opinion polls (see Table 1 below). Moreover, supposing that EMU starts on January 1, 1999, the spread is zero for $t + f >$ 1999:1:1 as the ecus will be converted into euros and the DEM will be part of this single currency. Hence, equation (2) becomes:

$$s_t^{ecu,f,m} = P_t(EMU)\, 0 + (1 - P_t(EMU))\, E(s_{t+f}^{ecu,m} | \overline{EMU}) \qquad (3)$$

or equivalently,

$$P_t(EMU) = 1 - \frac{s_t^{ecu,f,m}}{E(s_{t+f}^{ecu,m} | \overline{EMU})} \qquad (4)$$

Since $E(s_{t+f}^{ecu,m}|\overline{EMU})$ is unobservable, it has to be proxied. Conditional on the basket definition of the ecu remaining unchanged from now on, $E(s_{t+f}^{ecu,m}|\overline{EMU})$ equals the weighted mean of the DEM-spread over all basket currencies, where the weights simply correspond to the actual weight of the respective currency in the ecu basket.[2] Figure 1 depicts weekly averages of the probability of EMU computed accordingly for the period January 1, 1994 to October 25, 1996, using forward interest rates with a maturity of 5 years and settlement date 5 years ahead. Note that although data on forward contracts before 1994 are available, probabilities based on these data have ambiguous significance as these contracts have a settlement date before the start of EMU and therefore only partly reflect the probability of EMU.

FIGURE 1

PROBABILITY OF EMU
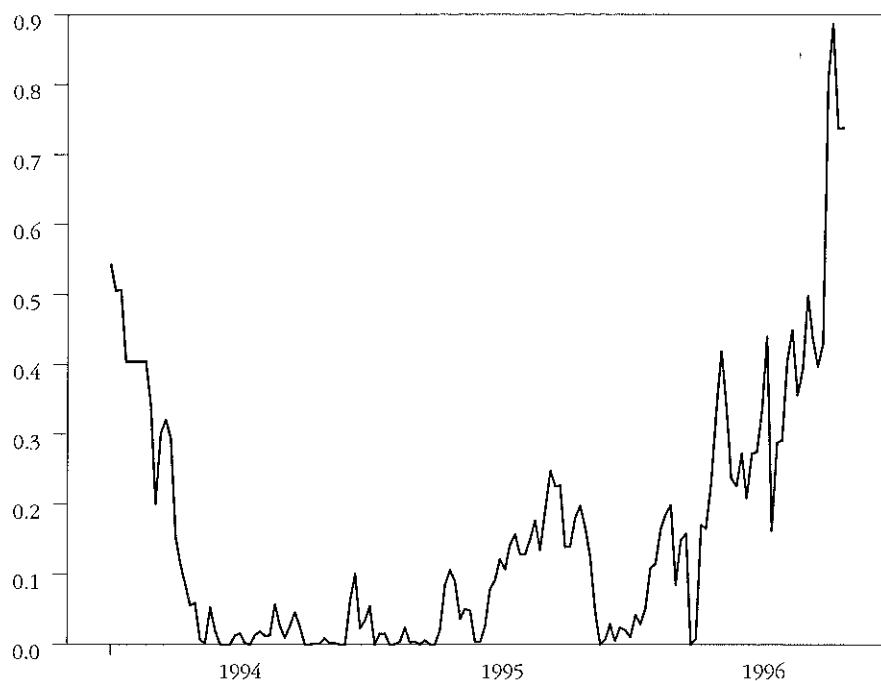
² As the weights depend on the exchange rates, they vary with time. For convenience, I continue with constant weights using the exchange rates of June 22, 1996.

Figure 1 suggests that as from the beginning of 1994 the likelihood of EMU continuously declined. Between mid-1994 and mid-1995 the markets judged EMU to be highly unlikely. Afterwards optimism about EMU revived. Since then, $P(EMU)$ continuously rose with the exception of a sharp decline at the end of 1995. Very recently the probability of EMU made a large leap upwards and now oscillates around 80%.

These patterns coincide fairly well with the occurrence of EMU-related political events. In 1994, the general feeling against Maastricht gained strength leading to appreciable victories of anti-Maastricht groups at the European elections of June 1994. Subsequently, autumn 1995 brought a succession of favorable news related to the commitment of the French government to meet the Maastricht criteria. Some months later, however, the reform plans in France led to extensive strikes. These strikes concurred with further events making EMU less likely, notably Mr Waigel's (the German secretary of Treasury) proposal of a stability pact and the strict interpretation of the Maastricht criteria by various German officials. Taken together, these statements can be held responsible for the new decline in $P(EMU)$ at the end of 1995.

At this point, however, the EU Madrid summit in December 1995 reaffirmed the political will to embark upon EMU as envisaged in the Maastricht Treaty, thus reinforcing public optimism about a single currency by 1999. This result is also in line with casual evidence from two recent Eurobarometer opinion polls, revealing that support for the single currency increased strongly after the Madrid meeting of the European council (see European Commission 1996). Finally, the large increase in the probability of EMU at the end of the sample coincides with the meeting of finance ministers and central bankers in Dublin (September 21 and 22, 1996), which is generally regarded as having achieved significant progress towards EMU.

I shall now derive P_l for the countries other than Germany. Following the logic outlined above, it is useful to start with an equation for the forward interest rate spread between currency l and the ecu:

$$_l s_t^{ecu,f,m} = P_t(EMU)\, E(_l s_{t+f}^{ecu,m}|EMU) + (1 - P_t(EMU))\, E(_l s_{t+f}^{ecu,m}|\overline{EMU}) \quad (5)$$

Index l indicates that the spread has to be taken with respect to currency l and not the DEM as above. Since now $P(l \in core|\text{EMU})$ < 1, it follows that $E(s_{t+f}^{ecu,m}|EMU) \neq 0$ as the possibility that EMU be realized without country l has to be accounted for. Consequently, equation (5) becomes:[3]

$$_l s_t^{ecu,f,m} = P_t(\text{EMU})(\hat{P}_{t,l} \, 0 + (1 - \hat{P}_{t,l}) \, E(_l s_{t+f}^{ecu,m}|\text{EMU} \wedge l \notin \text{core}))$$
$$+ (1 - P_t(\text{EMU})) \, E(_l s_{t+f}^{ecu,m}|\overline{\text{EMU}}) \quad (6)$$

where a hat stands as a shorthand notation replacing the somewhat cumbersome conditional probability $P(l \in core|\text{EMU})$. In equation (6) the expected spread in the case that EMU is achieved is simply decomposed in the expected spread if country l belongs to the "ins" and the expected spread if country l belongs to the "outs", both weighted with their corresponding probability. Readjustment of equation (6) gives:

$$P_t(l \in core|\text{EMU}) = 1 - \frac{_l s_t^{ecu,f,m} - (1 - P_t(\text{EMU})) \, E(_l s_{t+f}^{ecu,m}|\overline{\text{EMU}})}{E(_l s_{t+f}^{ecu,m}|\text{EMU} \wedge l \notin \text{core}) \, P_t(\text{EMU})} \quad (7)$$

Note that the nominator is identical to the expected spread under EMU times the likelihood of EMU. Thus, the probability for country l to belong to the "ins" given that EMU starts on January 1, 1999 is one if the expected spread with EMU obtaining equals zero. Conversely, the conditional probability is zero whenever the expected spread between currency l and the ecu should EMU start without country l is equal to the expected spread with EMU.

Unfortunately, the two expected spreads in equation (7) are unobservable. As above, I take $E(s_{t+f}^{ecu,m}|\overline{\text{EMU}})$ to equal the theoretical spread, i.e. the weighted mean over the spreads between currency l and the remaining basket currencies. Finally, it remains to find a proxy for the spread should EMU start without currency l. In the present situation a currency excluded from EMU is likely to come under devaluative pressure with respect to the newly created euro. Consequently, interest rates in this country have to rise relative to

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[3] However, note that for France and the Netherlands the probability of belonging to the "ins" conditional on EMU being realized is expected to be very close to one. This conjecture is corroborated below, see Figure 2.

those on the euro. I will therefore assume that $E(s_{t+f}^{ecu,m}|EMU \wedge l \notin core)$ equals the spread between the weakest currency among those considered, i.e. ESP and the DEM. Note that the more general assumption that $E(s_{t+f}^{ecu,m}|EMU \wedge l \notin core)$ equals the spread between ESP and the DEM plus/minus a constant would not change the picture essentially, but only shift the probability series slightly up or down. Hence, the results shown in Figure 2 should be viewed as reflecting a ranking among potential candidates without placing too much weight on the exact numerical values.

FIGURE 2

CONDITIONAL PROBABILITY OF COUNTRY l IN EMU
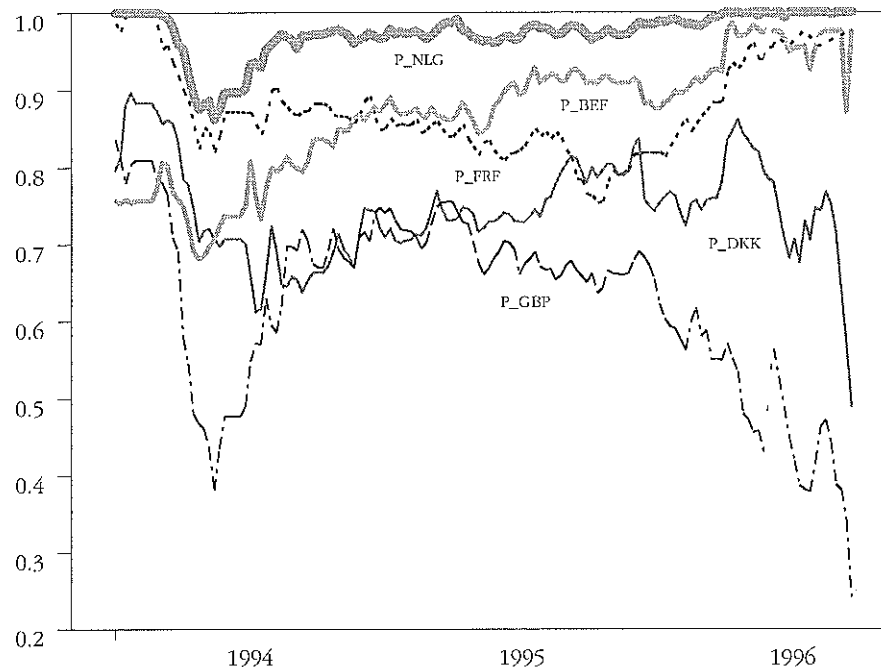
Taken overall, the results are consistent with *a priori* beliefs. The Dutch guilder, the Belgian franc, the French franc, and the Deutsche Mark form the core with probabilities almost equal to one as from 1996. While the markets were always convinced that the guilder would participate in a monetary union, at the beginning of the sample they apparently were less optimistic with respect to the Belgian franc. Since then the probability of the Belgian franc belonging to the "ins"

increased continuously, and eventually the Belgian franc caught up with the Dutch guilder in early 1996. The probability of the French franc being in EMU oscillates around 85% during most of the sample. Since autumn 1995, however, this likelihood has risen to nearly 100%. Presumably, this evolution is rooted in the French commitment to comply with the Maastricht criteria.

During most of the sample the markets attached a rather high probability of over 60% to the Danish kroner entering EMU. Only very recently has this probability declined sharply. Conversely, the markets believe that the pound sterling is an uncertain candidate for EMU. Recently, the likelihood that it will be melted into the euro reached a low of about 30%. This result is in sharp contrast to De Grauwe (1996) who finds that, with probabilities of over 80%, the pound sterling is more likely to enter EMU than the Belgian franc, for example. Finally, and not surprisingly, the Spanish peseta and the Italian lira are not expected to participate in EMU. The probabilities of these events are almost zero and thus not depicted in Figure 2.

TABLE 1

OPINION POLL: EXPECTATIONS THAT COUNTRY i WILL BE
PART OF EMU IN 1999

Country	Germany	France	Belgium	Netherlands	Denmark	UK	Spain	Italy
% of respondents	100	97	79	76	50	22	7	2

Source: Bank for International Settlements (1996). The results for the countries considered in this study are shown only.

A recent opinion poll among market participants (Bank for International Settlements 1996, Table 1) corroborates these findings. The vast majority of the interviewees expect Germany, France, Austria, Belgium and the Netherlands to form a monetary union in 1999. Only 50% of the respondents think that Denmark will be part of EMU, and of the countries depicted in Figure 2 the United Kingdom is seen as the most unlikely candidate. Furthermore, and also in accordance with the computations shown in this paper, Spain, Italy, Portugal and Greece are clearly outsiders; very few interviewees believe that they will be part of the single currency project.

4. Conclusions

In this note I have used forward interest rates to derive a measure of the probability of EMU coming about and to assess which member countries of the EU are the most likely to participate in the single currency. Although the numerical values have only indicative significance, this exercise allows us to draw several conclusions: the probability of EMU is subject to large fluctuations, which are broadly consistent with political events and opinion polls. The general anti-Maastricht feeling prevailing at the European elections of 1994 is reflected in pretty low probabilities during the first year of the sample. Subsequently, optimism about EMU gained ground after the Madrid summit. More recently, the informal meeting of central bankers and finance ministers in Dublin boosted the likelihood of EMU. As expected, Germany, the Netherlands, France and Belgium are believed to form the core of the monetary union, while Italy and Spain are expected to stay outside.

Further research seems necessary. For example, it would be of interest to learn which variables determine the probability of EMU and how the latter influences inflation expectations. Finally, note that the – admittedly simple – method used above can be applied in a straightforward manner to various related problems, such as the probability of debt failure and bail-out of European governments.

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