A STRATEGY FOR LAUNCHING
THE EURO

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ABSTRACT

This paper analyzes the constraints European Union law places on the 1 January 1999 choices of irrevocably fixed conversion rates between the Euro and the currencies of EMU member states. Current EU legislation, notably the Maastricht treaty, requires that the bilateral currency conversion factors implied by the 1 January 1999 choices equal closing market exchange rates on 31 December 1998. Given that legal constraint, there still exist several strategies for choosing the relative prices of EMU member currencies against the Euro. Unfortunately, most of these have potentially damaging side effects. One approach, based on official Stage 2 offers of contingent Euro forward contracts with value dates at the start of Stage 3, allows a highly credible preannouncement of the bilateral currency conversion factors to be set at the start of EMU. That approach assumes, however, that no prospective EMU members can withdraw between their selection in May 1998 and the start of Stage 3.

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1. Introduction

On 1 January 1999, a core of European Union (EU) members is scheduled to adopt a unified monetary policy and payments system based on a new European currency, the Euro. That event will initiate the third (and final) stage in the creation of an economic and monetary union (EMU). The transition between the selection of initial EMU members in May 1998 and the introduction of the Euro on 1 January 1999 will influence the ultimate success of the single-currency project.

Central to launching EMU are the rates at which the members' currencies are converted into Euro in Stage 3--the relative values of national currency units and the Euro. Those conversion ratios have critical economic consequences. Because ratios against the Euro fully determine the relative values of EMU members' national currencies--*bilateral* conversion ratios-- they will influence the members' relative competitiveness at the outset and affect the distribution of wealth in EMU. At the same time, expectations of the terms on which currencies will enter EMU will dominate foreign exchange markets as 1999 approaches. However, EU law tightly constrains the choice of conversion ratios between EMU member currencies and the Euro. With the need for a smooth transition in mind, this paper assesses available strategies for choosing conversion ratios and proposes an approach that potentially avoids most difficulties. The paper takes as given that renegotiation of the EU laws covering EMU is impossible at this late date.

Section 2 starts by examining the two key legal constraints on the introduction of the Euro. The Maastricht treaty prohibits a jump in the ECU's external value as a result of the new currency unit's introduction. The December 1995 Madrid European Council coined the name "Euro" for the new European currency and decreed that 1 Euro should equal 1 ECU in the third stage of EMU. Either rule alone, I argue, implies that the bilateral national-currency conversion

ratios implied by conversion ratios between national currencies and the Euro must equal the bilateral market exchange rates prevailing at the end of market trading on 31 December 1998 (the end of the second stage of EMU). In addition, the Madrid Council 1:1 rule necessarily leaves the Euro's value uncertain until 31 December 1998.

Section 3 assesses a strategy of "letting markets decide" closing Stage 2 exchange rates, which become the irrevocably fixed conversion factors for Stage 3. The market-based strategy entails excessive volatility in exchange rates (though not necessarily indeterminacy), and could produce seriously misaligned Stage 3 conversion factors. Consistent with this hazard, EU members have announced that they will deliberately choose and then preannounce the Stage 3 bilateral conversion ratios. Section 4 shows, however, that the mere announcement of the intended conversion factors need not drive market exchange rates to desired levels on 31 December 1998. The rules of Maastricht and Madrid simply do not allow governments to set conversion rates independently of market developments, and that constraint is fatal to credibility.

Given the inefficacy of pure preannouncements, national central banks must be prepared to intervene in foreign exchange markets to ensure that preannounced bilateral conversion ratios equal market exchange rates on the last day of Stage 2. Section 5 assesses the vulnerability of several intervention schemes to market pressures. Of these, one strategy seems least hazardous. EMU central banks can manage the transition to the Euro by Stage 2 trades in appropriately designed Euro forward contracts maturing early in Stage 3. The approach limits spot exchange-rate volatility in Stage 2, is resistant to speculative attack, and drives 31 December 1998 market exchange rates into exact equality with preannounced Stage 3 bilateral conversion ratios. But the plan fails if countries can leave EMU between May 1998 and Stage 3. Section 6 summarizes.

2

2. The Maastricht treaty and EMU conversion rates at the start of Stage 3

Article 1091(4) of the Treaty on European Union calls for the EU Ecofin Council, "acting with the unanimity of the Member States without a derogation" from EMU membership, to choose mutual conversion rates at which EMU member currencies "shall be irrevocably fixed," along with the rates at which those currencies will be fixed to the new single currency. The fixing of those rates is to occur at the start of the third stage of EMU, now scheduled for the first day of 1999, although nothing prevents the Council from announcing before then (as it now plans to do) its intentions as to the bilateral conversion rates it will later decree between participants' currencies.[1]

Critically, the Maastricht treaty mandates that the 1 January 1999 adoption of conversion rates between the new European currency and the currencies of EMU members "shall by itself not modify the external value of the ECU" [Article 1091(4)]. (The reference is to the European Currency Unit basket of the EU.) A major motivation for this requirement was to stabilize

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[1]Under current transition plans national banknotes and coins may remain as legal tender in EMU countries for up to three and a half years after Stage 3 starts. European notes and coins, to be placed in circulation at most three years after the start of Stage 3, will obviously have the status of legal tender immediately upon introduction. Six months later "the changeover to the single currency will have been completed for all operations and all agents. National banknotes and coins will lose their legal tender status . . . ." (European Monetary Institute 1995, p. 2.) Until then, national central banks (which will have been absorbed into the European System of Central Banks, or ESCB) will be required to exchange national banknotes at par value, guaranteeing the "irrevocably fixed" exchange rates mandated in the Maastricht treaty for the period before the changeover to the euro is complete. According to the last-cited source (p. 3), "all monetary policy operations will be announced and executed in the European currency by the ESCB; all accounts held by counterparties with the ESCB will be in the European currency; . . . [ESCB] operations in [foreign exchange] markets will be effected and settled in the European currency. . . ." However (p. 1), while "private economic agents should be free to use the European currency . . . they should not be obliged to do so before the deadline set for the completion of the changeover . . . ." Thus private deposits may continue to be calculated in national currency units for some interval after Stage 3 begins, although the value of such deposits in Euros will be fixed by the par values set at the start of Stage 3.

expectations in the private ECU market (Gros and Thygesen 1992, p. 356).[2]

In this section I show that on a narrow face-value interpretation of the Treaty, this requirement *alone* leaves the Ecofin Council no choice but to adopt on E-Day (Euro Day, 1 January 1999) Euro conversion factors such that the implied bilateral conversion ratios equal the market exchange rates prevailing at the foreign exchange market's close on Thursday, 31 December 1998.[3] There are no other implied constraints for the Euro conversion factors themselves, that is, for the "scale" of the Euro. The December 1995 decision of the Madrid European Council to redenominate all ECU contracts in Euro on a one-for-one basis shares the implication of the Maastricht treaty concerning bilateral conversion factors, as I show below, and furthermore specifies how the Euro's scale must be chosen.

Implications of the Treaty's mandate

The most natural interpretation of the Treaty's Article 109l(4) is that the setting of Euro conversion rates on 1 January 1999 should not *ceteris paribus* modify the exchange value of the ECU as of its closing level on 31 December 1998. On this reading the article refers to the effect of the new conversion rates *themselves* on the value of an ECU, analogous to the effect of a

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[2]As Peter Kenen has pointed out in comments on this paper, the language in the Maastricht treaty closely parallels that in the European Council's resolution of 5 December 1978 on the European Monetary System, which states that revisions in the composition of the ECU basket "will, by themselves, not modify the external value of the ECU."

[3]The Treaty leaves the precise definition of the closing exchange rates that might apply unclear. Are they to be Frankfurt, London, or New York closing rates, for example? In what follows I will assume that some definite yardstick of end-1998 market exchange rates has been agreed. The assumption must be that quotations from one (at least) of the major organized European markets will be used.

realignment within the EMS on the ECU's value (at central rates) in terms of various currencies.[4]

Why does Article 109l(4) force the Ecofin Council to choose Euro conversion rates consistent with closing bilateral market exchange rates among EMU member currencies? Let $ECU_\$$ be the ECU's market value against an arbitrary currency (the dollar, say) at the last moment of Stage 2 when markets are open. The arithmetic basket definition of the ECU implies

$$ECU_\$ = \sum_{i=1}^{12} a_i S_{\$/i}$$

where a_i is the number of i currency units in the basket and $S_{\$/i}$ is the price of EU currency i in terms of dollars at the close of 1998 markets.[5] Let $I \leq 12$ of the countries whose currencies are in the ECU basket also be chosen for EMU (that is, they are among the "ins"); let the decreed immutable conversion rates on E-Day be $C_{i/E}$ units of "in" currency i per Euro; and let us initially focus on the German mark, whose bilateral conversion rate against "in" currency i therefore will be $C_{DM/i} = C_{DM/E}/C_{i/E}$. To show the constraint imposed by Article 109l(4), I compute the

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[4]This claim is controversial, but I see no other reasonable and feasible interpretation of 109l(4). In any case, even if the Maastricht treaty did not constrain Stage 3 conversion factors to equal final Stage 2 market bilateral rates, the Madrid Council's rule equating the ECU to the Euro, discussed later in this section, plainly would. Gros and Lannoo (1996) and Begg et al. (1997) draw the same basic inference as I do from the Maastricht treaty and the Madrid 1:1 rule. Arrowsmith and Taylor (1996) (for example, on p. 19) suggest that Euro and bilateral conversion rates for EMU must be set with reference to their market values on the first day of Stage 3 rather than the last of Stage 2. Their interpretation seems contrary to the Maastricht treaty's intent that "irrevocable fixing" prevail from the very start of Stage 3. Kenen (1997) offers a detailed discussion of the distinction between "backward" and "forward" looking interpretations of Article 109l(4), and explains why the backward-looking criterion used here is much more plausible.

[5]Article 109g of the Maastricht treaty froze the ECU's composition, so the Austrian, Finnish, and Swedish currencies are not included.

modification in the dollar value of the ECU implied *as a matter of algebra* by the switch to the

Stage 3 conversion ratios. That is, I calculate the hypothetical dollar value of the ECU that would

have prevailed at the end of Stage 2 had ending Stage 2 bilateral market rates equaled the Stage 3

bilateral conversion ratios, *ceteris paribus*:

$$ECU_\$' = S_{\$/DM}\sum_{i=1}^{I} a_i C_{DM/i} + \sum_{i=I+1}^{12} a_i S_{\$/i} \, .$$

(Note: This result is *not* a prediction about the market value of the the former ECU basket after

markets open in Stage 3, since the preceding value is calculated using the twelve component

currencies' dollar exchange rates at the close of Stage 2.) Treaty Article 109l(4) requires that

$$ECU_\$' = ECU_\$,$$

or, equivalently,

$$\sum_{i=1}^{I} a_i S_{\$/i} = S_{\$/DM}\sum_{i=1}^{I} a_i C_{DM/i}.$$

Now this equation alone doesn't obviously constrain the bilateral conversion factors very

tightly. It will hold for any E-Day realignment preserving the number of DM that, at the end of

Stage 2, were contained in the ECU sub-basket consisting of EMU currencies.[6] However, the

preceding argument can be repeated for each of the in currencies--including currencies not in the

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[6]Such a realignment would also preserve the number of DM in the ECU basket itself at the end of Stage 2.

6

ECU basket. For the French franc, for example, the conclusion is that

$$\sum_{i=1}^{I} a_i S_{\$/i} = S_{\$/FF} \sum_{i=1}^{I} a_i C_{FF/i} = S_{\$/FF} C_{FF/DM} \sum_{i=1}^{I} a_i C_{DM/i}$$

must hold, where the identity $C_{FF/i} = C_{FF/DM} \cdot C_{DM/i}$ has been applied. But obviously the last two

displayed equations cannot both hold true unless $S_{\$/DM} = S_{\$/FF} \cdot C_{FF/DM}$. By triangular arbitrage in

the foreign exchange market on 31 December 1998, however, $S_{\$/DM}/S_{\$/FF} = S_{FF/DM}$. Thus,

invariance of the ECU's value with respect to external currencies requires that

$$C_{FF/DM} = S_{FF/DM},$$

that is, that the bilateral conversion ratios of Stage 3 must equal the bilateral market rates

prevailing at the last moment of trading (however defined) in 1998. The same relation must hold

for any pair of "in" currencies.

What explains this result? Suppose the 1 January 1999 choice of EMU conversion ratios

depreciates the French franc against the DM as compared with the end-1998 market outcome,

while realigning other internal bilateral exchange ratios to hold steady the DM value of an ECU

basket's "in" component. Then at the new EMU conversion ratios and 31 December 1998 dollar

exchange rates, the dollar value of the franc equivalent of the ECU's "in" component will exceed

the dollar value of the Deutsche mark equivalent of the same ECU sub-basket (and similarly for

every other external currency). The reason is that the preceding E-Day realignment implies that

the basket (and the ECU basket itself) is worth more francs than at the close of Stage 2, whereas

7

the 31 December dollar/franc rate is given. In short, there is no obvious canonical numeraire for measuring the ECU's "external value" at the new conversion rates; only if these are consistent with the prior market bilateral rates is the numeraire problem avoided.

One could hope to sidestep the question by insisting that the Maastricht treaty had in mind only one of the many possible ways of evaluating the ECU's external market value on E-Day. But it is not at all obvious which one to choose, nor would the choice be politically easy. Furthermore, changes in the ECU's "internal" value would result, possibly opening the way for legal complications. In any case, the apparent latitude is removed by the Madrid European Council's edict of December 1995 that 1 Euro shall equal 1 ECU as of the start of Stage 3.

The Madrid Council's 1 Euro = 1 ECU rule

In December 1995 the Madrid Council coined the name "Euro" for the new European currency and decreed that 1 Euro must be equivalent to 1 ECU in Stage 3. The main motivation for the 1:1 rule is legal. The Maastricht treaty labeled the new European currency ECU. Thus, the new currency can be called Euro without a treaty revision only if it is decreed that the Euro and ECU are equivalent in Stage 3. In particular, the equivalence of the Euro and the official ECU basket must hold at the moment the Euro is first introduced, giving rise to the constraint that one Euro have the same value as one ECU at the start of Stage 3.[7]

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[7]The 1 Euro = 1 ECU rule thus reflects the intent of the Maastricht treaty that the official basket ECU should merge seamlessly with the new EMU currency--an intent already embodied in the "no jump" clause of the Maastricht treaty analyzed in the last subsection. Nonetheless, I treat the Madrid Council stipulation separately from treaty Article 109l(4) to highlight the somewhat different constraints these rules imply when interpreted literally. (After 1 January 1999 the Euro is to replace the ECU on a one-for-one basis in all contracts, private as well as public, unless otherwise specified in the contract. Similarly the U.S. nullified private contractual gold clauses in

Because the official ECU basket will cease to exist as of the start of the third stage--the

Euro will replace it--it is hard to interpret the constraint 1 Euro = 1 ECU as applying to any ECU

value other than the final market value of the basket on 31 December 1998. Furthermore, as in the

last subsection, the constraint is a matter of pure definition: the Euro's initial value is must be

defined to equal that of an ECU on 31 December 1998.[8] But an analogous question to the one

raised in the last subsection arises now: in what numeraire(s) must this constraint hold?

Presumably the answer is: in any currency one chooses. If so, then the Madrid Council decree

itself implies that bilateral conversion factors for the start of the third stage must equal the most

recent bilateral market exchange rates. This, as we have seen, is necessary and sufficient for the

start of the third stage itself to cause no jump in the external value of the ECU. In addition,

however, the Madrid decision places a constraint on the initial value of the Euro itself, something

the Maastricht treaty does not do.

Let $S_{DM/ECU}$ be the market price of the official ECU basket in terms of DM at the 1998

market close, and let $C_{DM/E}$ again be the immutable Stage 3 conversion rate for DM into 1 Euro.

In order for the constraint 1 Euro = 1 ECU to govern the Euro's introduction when both sides are

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the 1930s. For legal misgivings see Arrowsmith and Taylor 1996, pp. 29-34.)

[8]Begg et al. (1997, p. 10) assert that "the initial price at which the ECB first buys or sells
Euros for nonparticipating currencies on 1 January 1999 (or the first working day after that) will
be the same as the last quotation of the ECU on 31 December 1998." This obviously is *not* the
meaning of the 1:1 constraint, for at least two reasons. First, there is no reason to expect that the
ECB will make such transactions on its first day of operation--it is certainly under no obligation to
do so, nor does its mandate to convert EMU members' national banknotes at par imply that
obligation. Second, after the long holiday weekend the Euro's equilibrium value against outside
currencies might no longer correspond to the 31 December 1998 value of the ECU. The
expectation that the ECB would offer to buy or sell Euros at a disequilibrium rate would place
speculators in an ideal position to profit at the bank's (and EMU taxpayers') expense.

valued in DM, the equality

$$C_{DM/E} = S_{DM/ECU} = \sum_{i=1}^{12} a_i S_{DM/i}$$

must hold. This constraint must hold equally, however, in terms of any other "in" currency, for example, the French franc. Thus

$$C_{FF/E} = S_{FF/ECU} = \sum_{i=1}^{12} a_i S_{FF/i} = S_{FF/DM} \sum_{i=1}^{12} a_i S_{DM/i},$$

where triangular arbitrage among the end-1998 market rates has been assumed. The last two equations imply that

$$C_{FF/E}/C_{DM/E} = C_{FF/DM} = S_{FF/DM} .$$

In words, the general constraint 1 Euro = 1 ECU again implies that bilateral Stage 3 conversion factors must equal end-1998 bilateral exchange rates, simply because it is the obvious intent of the Madrid European Council directive that the equivalence of the ECU and Euro should be independent of the yardstick used to measure their respective values.

In practice the 1:1 rule is implemented by setting $C_{DM/E} = S_{DM/ECU}$, $C_{FF/E} = S_{FF/ECU}$, etc., on E-Day, where the ECU prices in terms of "in" currencies are based on market prices at the close of 1998 trading. Plainly this procedure both guarantees that 1 Euro = 1 ECU, regardless of how the two currencies' values are expressed, and that bilateral Stage 3 conversion factors equal end-1998 bilateral exchange rates ($S_{FF/DM} = C_{FF/E}/C_{DM/E} = C_{FF/DM}$, where triangular arbitrage in the

10

foreign exchange market on 31 December 1998 guarantees the first equality). The result applies to "in" currencies not represented in the ECU basket.

An immediate consequence, however, is that the "in" currency rates against the Euro are very unlikely to be known before 31 December 1998. Arrowsmith (in Kenen 1996b), Arrowsmith and Taylor (1996), Begg et al. (1997), and De Grauwe and Spaventa (1997) point out that in all likelihood conversion rates of the "in" currencies into Euros cannot be chosen in advance of E-Day, and still be expected satisfy the constraint that 1 Euro = 1 ECU when the third stage begins. The reason is that the currencies of the "outs," which are included in the ECU basket, will be likely to fluctuate unpredictably in the interim. For all practical purposes, therefore, the 1:1 rule guarantees that ultimate Euro conversion factors will be random (although *bilateral* conversion rates need not be).

Does this uncertainty over the scale or "size" of the Euro, i.e., whether it contains 1.9 DM, 2.1 DM, etc., really matter? Varying the Euro's scale amounts to a completely neutral currency reform, since it changes the internal price level measured in Euros and the exchange rate against external currencies in exact proportion. However, the unpredictability of the relationship between the Euro and national "in" currencies prior to the third stage will retard the process through which agents in the economy become accustomed to calculating in terms of Euro. The result will be to prolong the attachment to national currencies, and probably to make more costly or even delay the introduction of the Euro at the retail level.[9]

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[9]Arrowsmith and Taylor (1996, p. 18) suggest that knowing the Euro's scale in advance of E-Day would aid the ESCB's "administrative preparations" for EMU in the second half of 1998. The importance of such advantages is the subject of some debate. Predetermination of the Euro's scale would also allow Euro redenomination of public debts during Stage 2. In turn, redenomination would enhance the credibility of preannounced Stage 3 conversion factors.

3. Disadvantages of "letting markets decide" end-1998 bilateral exchange rates

As noted earlier, the Stage 3 bilateral conversion factors will have important and possibly long-lasting consequences, in large part because those factors will determine relative intra-EMU relative price levels, given sticky goods prices. One approach to choosing the conversion ratios is to "let markets decide" on the end-1998 bilateral exchange rates, which then become the bilateral conversion factors for Stage 3. The argument in favor of this approach is a variant of the classical Chicago case for floating exchanges: markets look forward and are better able to ascertain economic fundamentals than are governments. This section shows that even in a world of rational expectations, the Chicago argument fails in the context of the transition to Stage 3. A deliberate, preannounced choice of Stage 3 bilateral conversion factors appears preferable.

Intending to avoid currency volatility, the ECOFIN Council decided in September 1997 to preannounce bilateral conversion ratios when EMU members are selected in May 1998. However, the Council left open the option to take prior market developments into account in choosing the conversion ratios to be announced. Under that strategy the problems discussed below might remain relevant during the period preceding May 1998, albeit in an attenuated form.

Excessive volatility under a "free float"

The textbook modeling concept of a "free float"--in which exchange-rate fundamentals evolve exogenously--has no counterpart in reality, but sometimes is a useful theoretical abstraction. It is useful, in particular, for evaluating the claim that markets should decide end-1998 bilateral exchange rates. One can imagine that to allow a clear verdict to emerge from the market, the newly admitted EMU members adopt zero-feedback monetary policy rules starting in May 1998

12

(e.g., identical *k*-percent rules for money-supply growth).

The Chicago argument that markets provide stabilizing speculation breaks down, however, given the restrictions on the Euro's introduction. In brief, the market's understanding that transitory shocks will be frozen forever into the Stage 3 conversion factors discourages the stabilizing speculation that would occur under a hypothetical perpetual free float. The result is accentuated exchange volatility, especially as Stage 3 nears. A heightened response to temporary shocks, however, makes end-1998 market rates a poor guide to sustainable Stage 3 conversion factors. The risk of badly aligned conversion factors going into Stage 3 would be considerable.

A convenient (if somewhat oversimplified) vehicle for illustrating the point is the monetary model of exchange rates (see Mussa 1976). This model states that the equilibrium date-*t* bilateral exchange rate S_t obeys the difference equation

$$S_t = (1-\lambda)Z_t + \lambda E_t (S_{t+1}), \tag{1}$$

where $E_t(\cdot)$ is a conditional expectation and the random variable Z_t represents the exchange rate's "fundamentals" on date *t* (including such factors as relative money supplies, competitiveness, etc.). Above, λ is defined as $\eta/(1 + \eta)$, where η is the nominal interest rate semielasticity of real money demand. As is well known, the model can be derived from the assumptions of uncovered interest-rate parity and purchasing power parity, although slightly weaker assumptions would lead to a similar model.

Let date *T* be the first trading day of the third stage, and let *t* be any prior date. Then as is well known (see, for example, Mussa 1976), the equilibrium exchange rate can be written as

$$S_t = (1-\lambda) \sum_{j=0}^{T-t-1} \lambda^j E_t(Z_{t+j}) + \lambda^{T-t} E_t(C_T), \tag{2}$$

where C_T is the immutable bilateral conversion rate to be set in Stage 3. (Thus, the date $t < T$ market exchange rate is a weighted average of expected fundamentals between dates t and $T - 1$ and the rate expected to prevail from the start of the third stage on date T).

To implement equation (2) one must first determine the date t expectation of C_T. On date $t = T - 1$ equation (2) reads

$$S_{T-1} = (1-\lambda)Z_{T-1} + \lambda E_{T-1}(C_T)$$

(assuming contemporaneous fundamentals are observable). Since the Maastricht treaty requires that $S_{T-1} = C_T$, so that $E_{T-1}(C_T) = E_{T-1}(S_{T-1}) = S_{T-1} = C_T$, the last equation gives the mandated Stage 3 bilateral conversion factor as

$$C_T = Z_{T-1}. \tag{3}$$

Thus the rational date t expectation of the third stage conversion factor is

$$E_t(C_T) = E_t(Z_{T-1}).$$

The exchange rate's entire path through the end of Stage 2 can now be derived using (2). Suppose the fundamental Z_t follows an autoregressive stochastic process of the form

$$Z_t = \rho Z_{t-1} + \epsilon_t,$$

where $0 \le \rho \le 1$ and ϵ_t is a random white-noise shock. Then for $j + t \le T - 1$,

$$E_t(Z_{t+j}) = \rho^j Z_t$$

while

$$E_t(C_T) = E_t(Z_{T-1}) = \rho^{T-t-1} Z_t.$$

From equation (2), it therefore follows that for $j + t \le T - 1$,

$$S_t = (1-\lambda) \sum_{j=0}^{T-t-1} \lambda^j \rho^j Z_t + \lambda^{T-t} \rho^{T-t-1} Z_t = \frac{1 - \lambda + \lambda(1 - \rho)(\lambda\rho)^{T-t-1}}{1 - \lambda\rho} Z_t. \tag{4}$$

In contrast, under a hypothetical free float with no prospect of EMU (which a perpetual regime of ± 15 percent bands might approximate), the exchange rate solution would be

$$S_t = (1-\lambda) \sum_{j=0}^{\infty} \lambda^j \rho^j Z_t = \frac{1 - \lambda}{1 - \lambda\rho} Z_t. \tag{5}$$

It is evident from comparison of equations (4) and (5) that unless $\rho = 0$ or 1, equation (4) implies a more sensitive response of the exchange rate to the fundamentals than does (5), and hence higher volatility in the exchange rate. (Even if $\rho = 0$, however, exchange rate volatility eventually becomes sharply higher, but only on date $t = T - 1$.) It is also apparent that because the

15

factor $(\lambda\rho)^{T-t}$ grows as t approaches T (recall that $\lambda\rho < 1$), the excessive volatility (compared to a free float) will grow as the third stage nears.
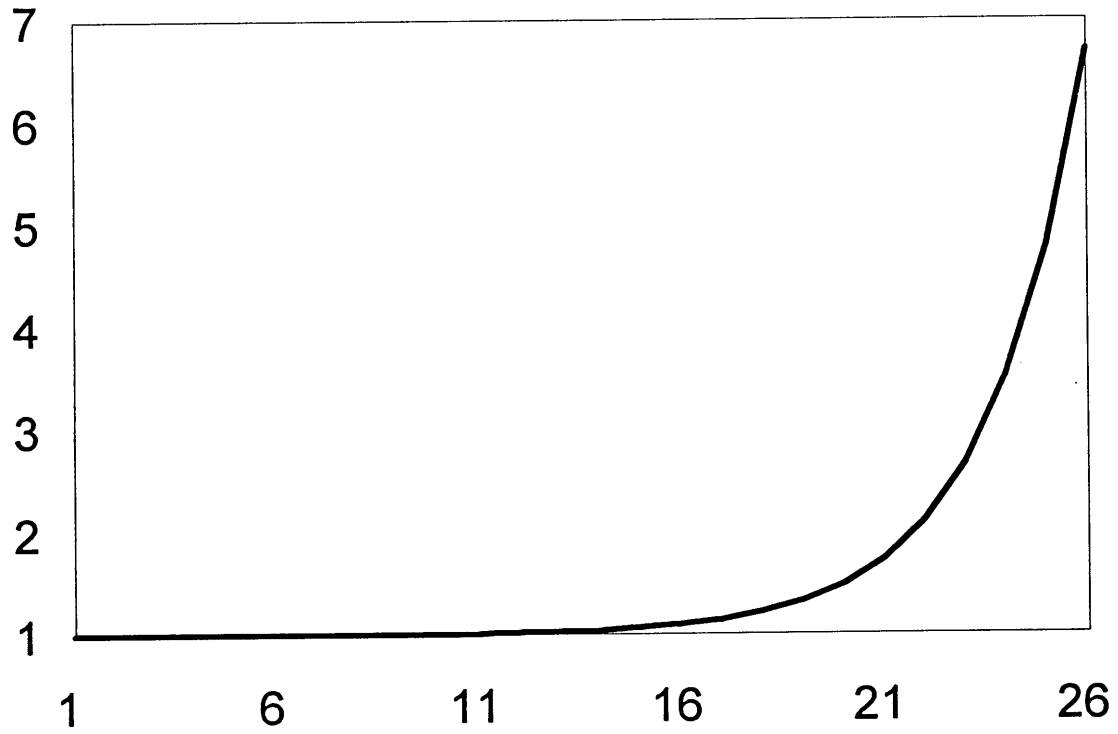
Figure 1 shows the ratio of actual to "normal" (i.e., free-float) volatility when the model parameters are $\lambda = 0.95$ and $\rho = 0.7$. Just before Stage 3, volatility is nearly seven times its level absent the prospect of a monetary regime shift. While the precise numerical settings used in the figure have been chosen in part for their dramatic effect, the results still show what *could* happen.

What is the intuition? Suppose traders expect that an end-1998 bilateral exchange rate will be frozen by Stage 3. A zero-persistence shock to fundamentals will induce no additional volatility in the exchange rate, even in that case, because it has no impact on expectations of the end-1998 rate. (The exception is a zero-persistence shock occurring on the last day before Stage 3; see below.) At the other extreme, a permanent shock also induces no *additional* volatility: its effects are already expected to persist into the indefinite future whether or not the exchange rate is frozen at the end of 1998.

Extra volatility comes, however, from shocks of intermediate persistence, because some fraction of their effects, which normally would die away completely over time, instead gets frozen forever in the 31 December 1998 exchange rate. In effect, their persistence is enhanced, and because the resulting increment to persistence is greater the closer is the end of Stage 2, a given shock will have a progressively more pronounced exchange rate impact as 1999 approaches. Figure 2 illustrates this effect, showing the expected future decay patterns of two transitory shocks occurring on different dates before the date on which fundamentals are frozen, 31 December 1998.
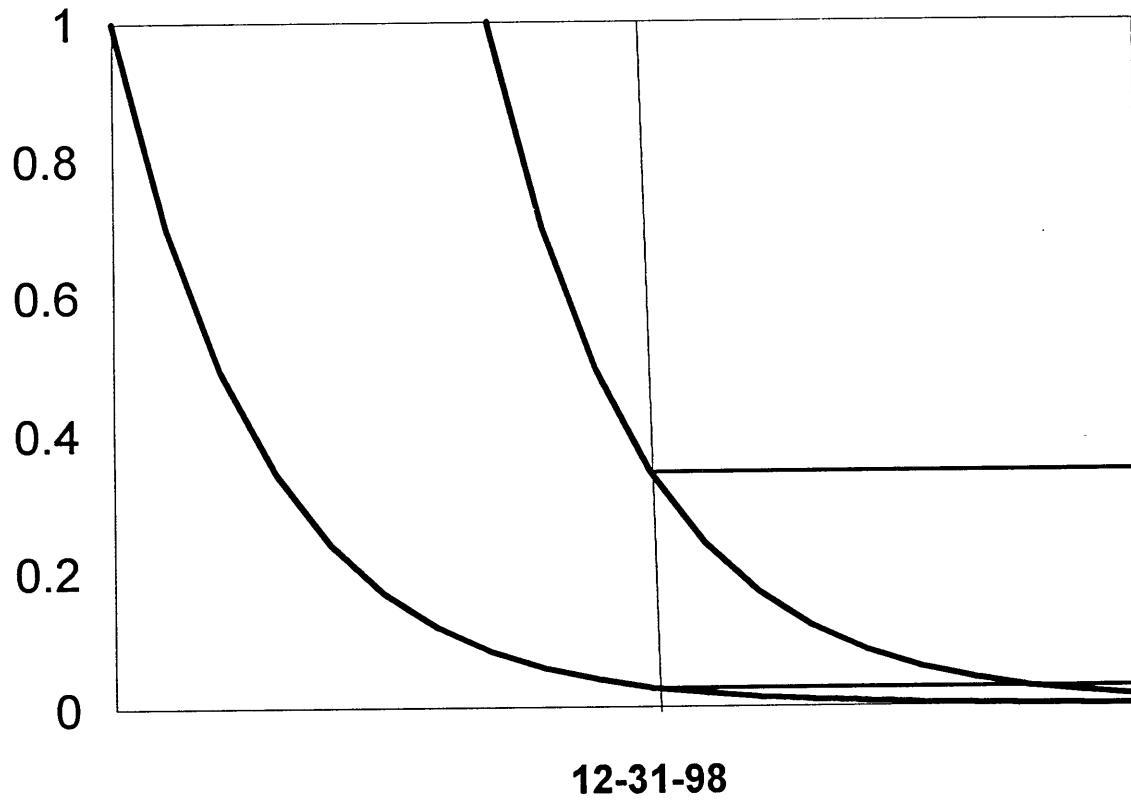
The extreme case is that of a purely transitory shock occurring on 31 December 1998

16

Figure 1

Ratio of actual to "normal" exchange-rate volatility
(example: lambda = 0.95, rho = 0.7)

Figure 2

12-31-98

Temporary shocks become more persistent when the fundamentals are expected to be frozen in the future

itself. Stabilizing speculation will not mute the shock's impact, which will be as large as if it were

a permanent change. The main lesson is that "leaving matters to the market" is a badly misguided

strategy in the present context because any stabilizing speculation the market normally would

perform is being prevented by the very nature of the regime change ending Stage 2.[10]

Aside from producing possibly misaligned relative price levels in Stage 3, currency

volatility toward the end of Stage 2 risks political tensions among prospective EMU members and

reduced public confidence in the single-currency project. A last disadvantage of leaving the

bilateral Stage 3 conversion factors to the market is the creation of needless uncertainty, which in

turn could slow the achievement of precisely the kinds of trade gains that a single currency is

supposed to yield.

Exchange-rate indeterminacy among the "ins" absent a terminal peg?

Basing their argument on the Mussa 1976 exchange-rate model of the last subsection, Begg et al.

(1997) assert that unless the final Stage 2 bilateral exchange rates can be credibly preannounced

or set by purposeful intervention, they will not only be excessively variable, they will be

indeterminate. The worry comes from a basic proposition of monetary theory: simply announcing

that a bilateral exchange rate will be pegged from a given date is consistent with a continuum of

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[10]I have ruled out persistent shocks to the *growth rate* (rather than level) of fundamentals. In that case the exchange rate under the Maastricht scenario is less volatile than under a free float, but the more volatile rate is the one that would better reflect the present discounted value of future expected fundamentals (Deaton's paradox). It may well be that the prospect of future pegging reduces the set of fundamentals to which exchange rates respond. For example, political shocks occurring after the start of Stage 3 might no longer affect Stage 2 exchange rates. I have abstracted from this possibility, but with no real loss of generality, because Stage 2 exchange rates would still be more volatile under the prospect of future pegging at a market rate than under the prospect of future pegging at a predetermined rate.

relative money supply paths starting on that date, hence with a continuum of equilibrium (fixed) exchange rates. Begg et al. (1997) hold that indeterminacy will apply in the Mussa model not only to bilateral rates of "in" currencies but also to rates against outside currencies such as the dollar.

However, indeterminacy of bilateral "in" exchange rates need not arise in the last subsection's model; indeed, equation (3) and the steps in its derivation show that there is a perfectly determinate equilibrium for bilateral "in" rates in terms of end-of-Stage 2 fundamentals, and that the restrictions of the Maastricht treaty and the Madrid Council require no adjustment of those fundamentals to accommodate market expectations. (As I will show in a moment, rates against outside currencies such as the dollar also are uniquely determined in the Mussa model.) Why the difference between that result and those claimed by Begg et al. (1997)?

Determinacy comes from the peculiar time lag involved in the transition, between Stage 2 and Stage 3, from national monetary policies to the single EMU monetary policy. After the official market close on 31 December 1998 the Ecofin Council must meet to set the Stage 3 conversion factors, following a proposal from the European Commission and after consultation with the ECB. Since the ECB cannot begin operations in Euro until the conversion factors are set, there will necessarily be a gap between the sampling of end-1998 market rates and the effective start of Stage 3. Most likely that gap will extend from the London or Frankfurt market close on Thursday, 31 December, through the start of business on Monday, 4 January, the next regular business day, although conceivably the gap could be made smaller.

The discussion in Begg et al. (1997), however, assumes that there is no trading gap, or, alternatively, that a small gap is the same as no gap. An appendix to this paper shows that the latter unrealistic assumption produces the indeterminacy conclusion for bilateral "in" rates in the

Mussa model (as well as indeterminacy for closing Stage 2 "in" rates against the dollar).

Intuitively, those rates would be indeterminate (as in the standard monetary-theory account) were the ECB required to begin settlement operations *immediately* upon the close of business on 31 December 1998. In that case, autonomous liquidity redistributions through the TARGET clearing system would ensure instantaneous validation of whatever closing Stage 2 exchange rates the market chose. But banks in the Euro zone will not be open to make payments through TARGET until 4 January. It is fully consistent with the Maastricht treaty for the ECB simply to take note of the closing market exchange rates in Stage 2, to introduce the Euro after some delay on 1 January 1999 and, later still, to begin settling Euro zone payments through TARGET. If London closing rates are the benchmark exchange rates, a trading gap would exist even if private banks and TARGET are open at the earliest legally possible moment, that is, at midnight, 1 January 1999.

Begg et al. (1997) make several different arguments for indeterminacy. They claim (p. 17) that bilateral "in" exchange rates are undetermined on the last day because equilibrium exchange rates, which necessarily are forward looking, cannot look forward to a market that does not exist. However, the determinate result in equation (3) rests on the fact that from the perspective of 31 December 1998, determinacy does not require a future market for trades of "in" currencies. In the absence of Stage 3 markets, traders look forward to the official conversion factors decided on 1 January 1999. Begg et al. (p. 17) also contend that "a hands-off policy combined with the promise of no change in the exchange rate means that the French central bank must use its monetary policy instruments to peg the French money market [interest] rate to the German one . . . ." While such a policy could indeed produce indeterminacy in the closing DM/French franc rate, the policy itself is unnecessary for compliance with the Maastricht treaty. In the well-determined equilibrium of the

19

last subsection, French and German interest rates are automatically equalized with no need for purposeful monetary actions by the Banque de France or Bundesbank on 31 December 1998.[11]

Flood and Garber (1997) show how interest-rate targeting could be used to dampen exchange volatility progressively without inducing indeterminacy.

Indeterminacy of dollar exchange rates?

De Grauwe (1997) argues that even if bilateral "in" rates are determined, the ECU/dollar exchange rate on the last day of trading is not, because of alleged indeterminacy in the rates between the dollar and "in" currencies. He concludes that even a credible preannouncement of Stage 3 bilateral conversion ratios would not preclude broader exchange market instability in the runup to Stage 3. In this subsection I derive a unique equilibrium formula for the closing Stage 2 dollar exchange rates of the "ins," contrary to De Grauwe's proposition.

Let $T - 1$ be the last trading moment of 31 December 1998 and T the first one of 4 January 1999, which I take (inessentially) as the effective start of Stage 3, TARGET system and all. On date $T - 1$, equilibrium of the DM/\$ exchange rate requires that

$$S_{DM/\$,T-1} = (1-\lambda)Z_{DM/\$,T-1} + \lambda E_{T-1}(S_{DM/\$,T}),$$

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[11]This is a special case of the argument that exchange rates are indeterminate because the *national* central banks will validate any rates the market sets at the close of Stage 2 trading. It is hard to think of a plausible scenario under which the national central banks would have incentives to do so. Begg et al. (1997, p. 17) also argue that to implement the Maastricht treaty at the end of Stage 2, "the Bundesbank must use its instruments to peg the German money market rate to the overnight rate of the U.S. dollar." This construction of what the treaty requires is far-fetched if one accepts that the "no jump" provision is not about changes in market exchange rates between 31 December and 4 January. In any case, equality of interest rates is not a sufficient condition for no change in exchange rates *ex post*. The ECB would also have to stand ready to intervene in the Euro/dollar market at the start of Stage 3, a requirement the Maastricht treaty does not lay down.

where $S_{DM/\$}$ is now the (log) DM/\$ spot exchange rate and $Z_{DM/\$}$ the (log) relative DM/\$ fundamental. Of course, there is no DM/\$ exchange rate *per se* on date T, which occurs in Stage 3 after the DM has been replaced by the Euro. Rather, the Stage 3 national-currency conversion factors agreed on 1 January 1999 yield an implicit rate at which a dollar could be transformed into DM-denominated notes or bank deposits by buying Euro in the foreign exchange market and then redenominating them in DM,

$$S_{DM/\$,T} = C_{DM/E} + S_{E/\$,T},$$

where the Stage 3 DM/Euro conversion factor $C_{DM/E}$ carries no time subscript because it is irrevocably fixed. (Remember, exchange ratios are now logs.) Thus the equilibrium condition in the DM/\$ market at the end of Stage 2 is

$$S_{DM/\$,T-1} = (1-\lambda)Z_{DM/\$,T-1} + \lambda E_{T-1}(C_{DM/E} + S_{E/\$,T}).$$

Assume next that Euro/dollar exchange rates are determined in the customary way in Stage 3 (possibly with a different relative interest elasticity of money demand). For present purposes and without loss of generality, let $Z_{E/\$} = M_{E/\$}$, the log difference of the EMU and United States per capita money supplies. Then, with a possibly new weight α replacing λ in the analog of equation (2), the $T = 4$ January 1999 equilibrium exchange rate is

$$S_{E/\$,T} = (1-\alpha)\sum_{j=0}^{\infty} \alpha^j E_T (M_{E/\$,T+j}).$$

Above, however, the relative supply of monetary Euros $M_{E/\$}$ can be expressed as

21

$$M_{E/\$} = -C_{DM/E} + M_{E/\$,}^{DM},$$

where the last symbol denotes the supply of Euros *measured in DM* units less the U.S. money supply (all in logs). Combining the last three displayed equations shows that the 31 December 1998 DM/$ rate is a determinate function of the *DM values* of expected future Euro supplies:

$$S_{DM/\$,T-1} = (1-\lambda)M_{DM/\$,T-1} + \lambda E_{T-1} [(1-\alpha)\sum_{j=0}^{\infty} \alpha^j M_{E/\$,T+j}^{DM}].$$

Those DM values can be calculated using the determinate bilateral Stage 3 "in" conversion ratios. So the closing Stage 2 DM/$ rate is determinate, as is the closing Stage 2 ECU/$ rate.

Observe that the random "size" of the Euro, $C_{DM/E}$, cannot be a cause of dollar-rate indeterminacy because it simply drops out of the preceding calculation. If the DM were for some reason worth twice as many ECUs at the end of Stage 2, hence twice as many Euros in Stage 3, the EMU money supply in terms of Euros would be twice as big, but its size in terms of DM would be the same. The Stage 2 closing DM/$ exchange rate is unaffected.

What of the argument that closing "in" exchange rates against the dollar are not well-determined because the Euro money supply is unknown--the Euro is a "new product"? The Euro is a new product, but in the case assumed here its value is linked in a well-defined way to the closing Stage 2 values of existing products.

The indeterminacy problem under delayed foreign-exchange settlement

Funds traded in most "spot" foreign exchange transactions actually become available only two

business days after the trade (because of the need to transfer central-bank funds in two separate banking systems). The market for same-day foreign exchange remains thin. Thus, it might be appropriate to think of the "spot" exchange rate as a two-day forward rate. However, if delayed-settlement rather than same-day settlement 31 December 1998 exchange rates provide the EMU bilateral conversion factors, exchange-rate indeterminacy can indeed arise at the end of Stage 2.[12]

Under delayed settlement, Stage 2 national-currency trades could still have value dates in Stage 3, despite the absence of Stage 3 markets for new trades. A 31 December 1998 trade of 1 French franc for DM at the market rate of $S_{DM/FF}$, for example, would result merely in the exchange of $S_{DM/FF} \cdot C_{E/DM}$ Euros for $C_{E/FF}$ Euros, possibly on 5 January 1999 (two business days later) but more likely on 4 January, since the Euro exchange could be processed virtually instantaneously through the TARGET system.

The terms of the resulting Euro trade show that the only motivation for delayed-settlement shifts between "in" currencies on 31 December 1998 (assuming risk neutrality) is an expected discrepancy between the current market exchange rate and the Stage 3 bilateral conversion factor. At the close of trade on 31 December, when the delayed-settlement rate and therefore the Stage 3 bilateral conversion factors are observable, the *sole* requirement for exchange-market equilibrium is $S_{DM/FF} = C_{DM/FF}$ (even under risk aversion), and at this rate there is no trade. Condition (1) need not hold for the delayed-settlement rate, so current (31 December) fundamentals are irrelevant.

Thus the system becomes purely self-referential, and any set of 31 December bilateral delayed-settlement exchange rates is consistent with market clearing on that date provided the

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[12]I am indebted to David Bowman, Jon Faust, and Dale Henderson, as well as to William Allen, for independently raising the issue of delayed versus same-day settlement.

conversion factors they imply are consistent with EMU money-market equilibrium on 4 January. But the latter equilibrium is guaranteed by TARGET, which will promptly redistribute liquidity throughout the Euro zone to ensure a uniform nominal Euro interest rate. Accordingly, Stage 2 exchange rates become indeterminate. This argument is quite different from the one advanced by Begg et al. (1997), who suggest that indeterminacy arises even when the same-day settlement rate is the one pegged at its market level (that is, in the Mussa 1976 model).

One could avoid the problem by taking same-day settlement rates as benchmark rates.[13] If the same-day settlement foreign exchange market is judged too thin to serve as a basis for Stage 3 conversion factors, one might then argue that the relevant benchmark for judging the ECU's value at the end of Stage 2 is the (determinate) wholesale spot exchange rate prevailing on Tuesday 29 December, since trades at that rate will be consummated on 31 December. Thus, indeterminacy could be avoided through judicious definition of the ECU's "external value." The other species of excess volatility described earlier would remain, however.[14]

Moral hazard problems

To build Stage 3 on the foundation of end-1998 bilateral exchange rates has several other grave

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[13]In comments on this paper, Peter Kenen has suggested that same-day settlement might become more widespread by the end of Stage 2 because of the current efforts of the Group of 20 private bank consortium to set up a real-time gross foreign exchange settlement system by March 1998. By regularizing the direct exchange of payments information among EMU national central banks, the completion of the TARGET system during 1998 would allow same-day settlement of "in" currency trades by the end of Stage 2.

[14]The delayed-settlement dollar exchange rates of EMU currencies are determinate if the bilateral Stage 3 conversion ratios are policy-determined. If end-of-Stage 2 delayed-settlement bilateral rates are left completely to the market and are the basis for Stage 3 conversion ratios, however, their indeterminacy will carry over to "in" exchange rates against non-EMU currencies.

disadvantages, some of which have been raised already by other authors (e.g., Begg et al. 1991 and 1997, several of the essays in Kenen 1996b, or De Grauwe and Spaventa 1997).

Because central banks are big players in exchange markets, a regime of "letting the market decide" opens the door for official manipulation of exchange rates for domestic purposes. Once the core EMU members have been chosen, the exchange-rate stability convergence criterion becomes inoperative. While unilateral realignments can be ruled out, some countries might be tempted to depreciate their currencies within the existing ERM band. This beggar-thy-neighbor strategy would allow them to begin Stage 3 with more competitive real exchange rates. It would also render their public debts smaller when redenominated in terms of Euros. As Froot and Rogoff (1991) have stressed, national central banks might feel less need to safeguard low-inflation reputations at this stage, as they are about to be placed under new management.

4. The impossibility of credible pure preannouncements

If a strategy of letting markets choose is inadvisable, then the prospective EMU members must not only preannounce the Stage 3 bilateral conversion factors (as has now been decided), they must also induce markets to establish the desired ratios as equilibrium exchange rates on 31 December 1998. Keen-eyed observers (such as Kenen 1996a) argue that if the bilateral exchange ratios authorities desire can be preannounced credibly, stabilizing speculation will automatically drive end-1998 market rates to the desired levels. In that case, even if national monetary policies do not target exchange rates in the final months of 1998--a possibility reviewed in the next

section--the market outcome nonetheless will painlessly ratify official intentions.[15]

The first logical problem with this strategy of pure preannouncement comes from the

Maastricht treaty itself. By requiring ratification of any market outcome, the treaty precludes a

fully credible commitment to implement any announced set of bilateral ratios on 1 January 1999;

see also Begg et al. (1997, p. 43). In technical terms, a Nash equilibrium in which the authorities

preannounce Stage 3 conversion factors, and markets drive end-of-Stage 2 rates to those levels,

simply is not subgame perfect (the equilibrium depends on noncredible threats). The true situation

is even less favorable for a plan of "credible" preannouncement, however. I now show that there

may be no Nash equilibrium at all in which official promises are believed and kept.

Equilibrium with pure preannouncement

Let us accept the assumption of market rationality, and suppose for a moment that authorities can

precommit to a set of preannounced conversion factors *without* being legally bound to adopt

closing Stage 2 exchange rates. Even so, the end-1998 spot exchange rates need not necessarily

equal the preannounced Stage 3 conversion factors. The implication is that under the Maastricht

and Madrid rules that actually govern the Stage 3 conversion rates, official preannouncements will

have no effect on exchange markets. Neither of the claims in the last two sentences may be

obvious, so I now substantiate them.

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[15]De Grauwe and Spaventa (1997) point out that a decision taken at the Dublin European
Council (December 1996) requires the E-Day conversion rates to be expressed as rates against the
Euro. Bilateral conversion rates between any two "in" currencies are to be derived by converting
the first currency into Euros, then converting the resulting sum of Euros into the second currency.
The Dublin constraint would not preclude authorities from informally announcing the bilateral
conversion factors that they intend to derive from their ultimate choice of Euro conversion
factors. (I am ignoring inaccuracies due to rounding.)

First, there is the claim that spot exchange rates need not converge to "credibly" preannounced Stage 3 conversion factors by the close of Stage 2 markets. Assertions to the contrary are implicitly based on the notion that trading always occurs in continuous time, so that even minor anticipated discontinuous jumps in asset prices--which imply instantaneously infinite arbitrage profits--are precluded. However, the major European exchange and money markets will close on Thursday 31 December 1998 and the Euro money market will probably not open until Monday 4 January 1999. In that case, a slight discrepancy between final Stage 2 exchange rates and Stage 3 conversion factors is not ruled out by arbitrage considerations: if interest parity holds, all that is required is some small interest differential over the long holiday weekend. As an example, suppose that when markets first open on 31 December 1998 French and German interest rates are equal with the DM/French franc exchange rate equal to the preannounced bilateral conversion ratio for Stage 3. Suddenly there is an unexpected permanent increase in German money demand. Germany's overnight interest rate will rise on 31 December, and the DM will simultaneously appreciate so that (i) the German money market clears and (ii) the new French-German overnight interest differential equals the percentage depreciation of the DM against the franc between the end of Stage 2 trading and the implementation of the promised Stage 3 conversion factors. On 4 January 1999, Euros will flow from France to Germany through TARGET, ensuring equal interest rates in the two countries' money markets.

A likely minor discrepancy between preannounced bilateral conversion factors and market exchange rates on 31 December 1998 may seem like a small matter, but now recall that in reality the EMU authorities are bound by the decisions of Maastricht and Madrid. This brings me to the second claim above, concerning the ineffectiveness of announcements. Even a small discrepancy

27

between promised rates and immediately prior market rates is of critical importance because *in case of any discrepancy the Maastricht treaty's Article 109l(4) compels the Ecofin Council to choose the market rates.* That circumstance will lead economic actors to base their actions entirely on what they believe market exchange rates will be at the close of 1998 trading, not on what the authorities say they will be at the start of 1999 trading. Thus, a strategy of simply preannouncing bilateral conversion factors, without intervention to support the desired outcome as the 31 December 1998 equilibrium, in theory may have no effect at all!

A formal analysis

Let us suppose that the authorities announce in advance that the bilateral conversion ratio C_T^1 is to be implemented at $T = 4$ January 1999 (the first market day of EMU). Then if time $T - 1$ corresponds to the time of the market's close on 31 December 1998, *and on the tentative assumption that market actors take the announced conversion factors as 100 percent credible,* the 31 December 1998 market exchange rate S_{T-1} [using the model of equation (1)] will be

$$S_{T-1} = (1-\lambda)Z_{T-1} + \lambda C_T^1.$$

There are two immediate consequences of this result:

• There is no presumption that $S_{T-1} = C_T^1$. Making this substitution above, one can see that the two rates will be the same only if, through pure chance or through official intervention, the fundamentals are so aligned on 31 December 1998 that $Z_{T-1} = C_T^1$.

• The Maastricht treaty requires the actual conversion ratio C_T to equal the market

exchange rate $(1 - \lambda)M_{T-1} + \lambda C_T^1$ rather than to C_T^1. This fact means that the tentative

assumption that the announced rate was credible is untenable.

We can find the rational expectations exchange rate in the following way. Any market

actor who thinks all others believe in C_T^1 will expect the conversion factor

$$C_T^2 = S_{T-1} = (1-\lambda)Z_{T-1} + \lambda C_T^1$$

to materialize instead. If one agent finds it rational to forecast C_T^2, however, so will they all. But if

all agents believe C_T^2, each individual will see that the Maastricht treaty really implies the

conversion factor will be

$$C_T^3 = S_{T-1} = (1-\lambda)Z_{T-1} + \lambda C_T^2 = (1-\lambda)Z_{T-1} + \lambda[(1-\lambda)Z_{T-1} + \lambda C_T^1].$$

Continuing to argue in this manner, one sees that the only credible exchange rate announcement is

that the Stage 3 conversion factor will be the fixed expectations point

$$C_T^* = \lim_{n \to \infty} C_T^n = (1-\lambda)\sum_{j=0}^{\infty} \lambda^j Z_{T-1} + \lim_{n \to \infty} \lambda^{n-1} C_T^1$$

or

$$C_T^* = Z_{T-1}.$$

But this is simply the "free float" solution of equation (3). Given Article 109l(4), market

participants will expect the conversion factor to equal the 31 December 1998 fundamental,

regardless of any supplementary pronouncements the participating authorities might make.[16]

Two empirical precedents: Resumption in the United States (1879) and Great Britain (1925)

Is the theoretical point developed in the last subsection of any empirical importance? Two actual

episodes of expected exchange-rate pegging, the United States return to a full gold coin standard

in 1879 and sterling's return to gold convertibility in 1925, provide contrasting perspectives.

In January 1875 Congress passed the Act to Provide for the Resumption of Specie

Payments. Under the Act, the paper "greenbacks" issued during the Civil War were to become

fully convertible at par into gold coin on a fixed date, 1 January 1879. In addition to other

provisions, the Act abolished the mint charge for coining gold. Although skepticism about

resumption lasted well into 1878, the greenbacks did become payable in gold on schedule.[17]

Figure 3 shows the price of greenbacks in gold coin (as a percent of par) throughout

December 1878 as the fixed date for resumption approached. By 17 December, over two weeks

ahead of the scheduled date, the greenback had reached its gold par and remained there, without

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[16]When the trading interval is of arbitrary length h (it was assumed above that $h = 1$), then the equation of monetary equilibrium becomes a generalization of the one used so far,

$$S_t = \frac{h}{h+\eta} Z_t + \frac{\eta}{h+\eta} E_t (S_{t+h}),$$

where λ in equation (1) above is interpreted now as $\eta/(h + \eta)$. It is clear that as $h \to 0$, so that the limit of continuous trading is approached, $S_{T-h} \to E_{T-h}(S_T)$. This result implies that in continuous time, closing exchange rates for 31 December 1998 will indeed approach the rates promised for the start of Stage 3, if those rates are believed. This is the result asserted in some of the literature, but it does not generally hold without continuous trading.

[17]See Barrett (1931).

30

Figure 3
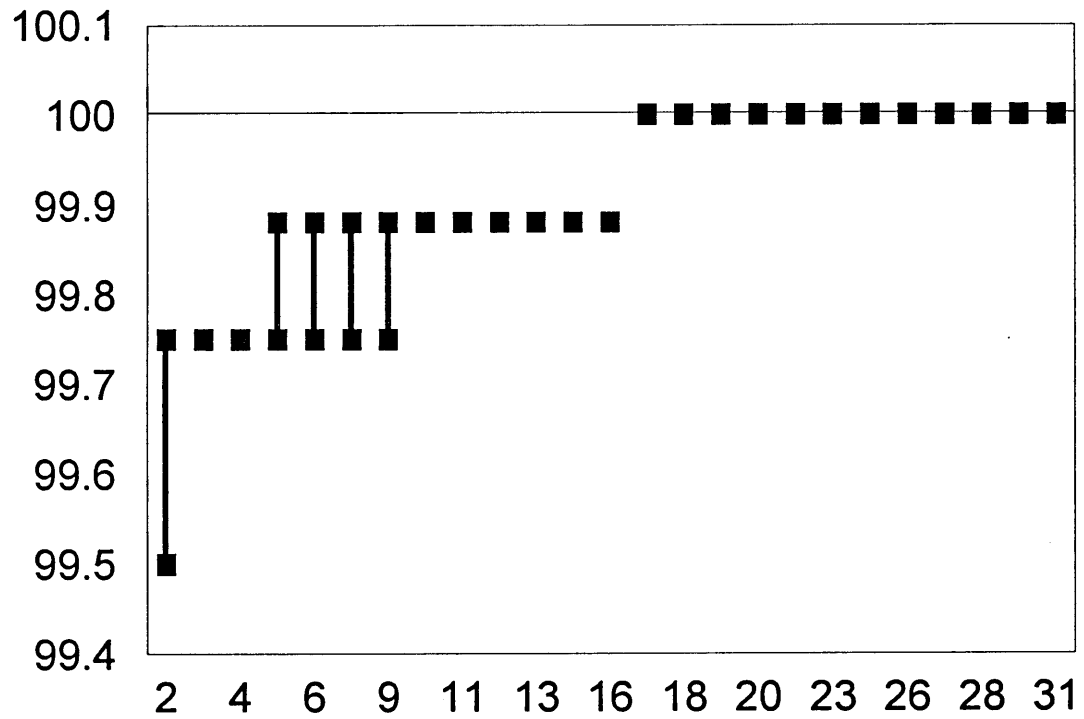
Price of greenbacks in gold coin, high and low quotations,
daily data for December 1878 (quoted as a percent of par)

fluctuation, until resumption had been accomplished on 2 January 1879.[18] Thus, we have a clear

case in which market price converges fully to an expected peg ahead of fixing--but one that in a

sense works *too* well because final convergence occurs long before the expected event!

The likely reason for this phenomenon is that even prior to resumption, greenbacks and

gold coin circulated in the United States as parallel, and on the margin highly substitutable

currencies. Thus both currencies could continue to circulate only if markets expected their relative

price (itself determined by the likelihood of resumption) to remain constant (Kareken and Wallace

1981; Weil 1991). Once resumption on the scheduled date became certain, however, the only

equilibrium was for the greenback's price to move to par and remain there.

The pound sterling's 1925 return to the gold standard at its prewar parity provides an

example possibly more relevant to the imperfectly substitutable national currencies that the Euro

will supplant. Unfortunately, the circumstances of the British episode make its interpretation

somewhat ambiguous. A return to gold effective immediately was announced in Chancellor

Churchill's budget speech late in the afternoon on Tuesday, 28 April. Under the new policy, paper

could once again be converted to gold (and vice versa) at a the prewar price of 84 shillings, 11.5

pence per fine (i.e., pure) ounce, or £4.2479 per fine ounce. Gold coinage, suspended in World

War I, was not restored. Thus currency substitution between paper and gold, as in the case of the

greenbacks, was not a factor.

By the weekend before Churchill's speech, markets certainly anticipated that a return to

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[18]Data on daily high and low prices of greenbacks come from Mitchell (1908, p. 338).
Barrett (1931, p. 227) states that resumption occurred on 2 January 1879 because 1 January fell
on a Sunday. However, table 1 in Mitchell (1908) implies that New Year's Day 1879 (a holiday
with no market trading) was a Wednesday and that 2 January, therefore, was a Thursday.

gold at prewar par would be announced the following Tuesday. What they apparently did not know was that the return would go into effect *immediately*.[19] The price of gold at the 28 April 1925 morning London fixing was £4.3 per ounce (86 shillings even), fully 1.23 percent above the par price that prevailed on 29 April and thereafter. At the time of that fixing, though, Churchill had not yet spoken so the imminence of the return to gold was still unknown. The relevant gold price for the question at hand would be a market price shortly before the return to gold, but incorporating full knowledge of the British government's intentions. That is, what gold price would markets have set on Tuesday morning, 28 April, if (counterfactually) they had known the contents of Churchill's impending afternoon speech?

Obviously we cannot answer the question with confidence. But if we assume that the surprise component of Churchill's budget speech affected all nominal sterling values in proportion, then the hypothetical full-information gold price can be estimated using exchange-rate data. The *Financial Times* for 29 April 1925 (p. 1) notes that sterling's dollar price jumped from $4.81⅝ to $4.84 as a result of Churchill's speech, a gain of 0.49 percent. A similar increase in sterling's gold price relative to the morning fixing would still have left that price quite distant (more than half a percent) from the restored parity level.

It thus seems quite possible that the morning gold price on 28 April would have been slightly above par even if markets had obtained advance copies of Churchill's speech. Translated into the context of EMU, this is bad news for the pure preannouncement approach to attaining

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[19]The British government decided to announce the return to gold in the April budget speech on 20 March 1925; see Moggridge (1972, p. 78). Accurate rumors of a large Federal Reserve Bank of New York support facility circulated on 24 April. However, a perusal of the contemporary financial press leaves no doubt that markets, despite anticipating the broad content of Churchill's announcement, were to some degree surprised by the timing of the return to gold.

desired Stage 3 conversion ratios. For pure preannouncement to work, 31 December 1998

exchange rates must converge on precisely-defined targets. In light of historical precedent this

seems a tall order, even ignoring the many other possible sources of imperfect credibility.[20]

Delayed foreign-exchange settlement once again

The analysis of the last three subsections is too pessimistic if delayed-settlement exchange rates

are used as the Stage 3 benchmark rates. If markets believe the authorities' promised bilateral

rates will be implemented with probability 1, delayed settlement market exchange rates on 31

December 1998 will necessarily equal the promised rates, as discussed in section 3.

In assessing the likelihood of this outcome, one must confront the possibility that risk-

averse market participants harbor some uncertainty about the rates to be chosen, even if their

expected values equal the official announcements. In that case 31 December 1998 delayed-

settlement exchange rates could still differ slightly from expectations of the conversion factors to

be set on 1 January. This difference would undermine the pure preannouncement Nash

equilibrium. Of course, there remains the more fundamental issue that even if a Nash equilibrium

with convergence exists, it is not subgame perfect under Article 109l(4). This problem is the

indeterminacy of section 3 in another guise: it is an equilibrium for the authorities to ratify

whatever delayed-settlement rate the market throws up at their close in Stage 2.

The preceding analysis suggests that a plan to base Stage 3 conversion factors on long

averages of past and current market exchange rates--what De Grauwe (1996) and De Grauwe and

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[20]Indeed, Goodhart (1993, p. 239) suggests that in the Stage 3 changeover phase, "minute" shifts in intra-EMU currency rates could occur in foreign markets outside European business hours, when the ESCB is closed.

Spaventa (1997) call the "Lamfalussy rule"--will not necessarily satisfy Article 109l(4), apart from other disadvantages that those authors identify. Since the closing Stage 2 rate need not be influenced by announcements about future rates, a promise to peg a bilateral rate at its historical average need not drive that rate to equality with the average just before Stage 3 commences.

5. Strategies for exchange intervention

Suppose that the countries joining EMU announce that the current EMS bilateral central parities will serve as the Stage 3 bilateral conversion factors. Begg et al. (1997) argue convincingly that such a choice would be economically and politically sensible. Such an announcement might not remain perfectly credible through the start of Stage 3 even in the absence of the Maastricht and Madrid constraints. Absent those provisions, however, the EMU countries would have retained the option, which they no longer have, of executing their intentions on E-Day without regard to the market's perhaps volatile expectations the day before.

In view of the difficulties explored above, the central banks joining EMU must be ready to intervene before the end of Stage 2 to bring closing bilateral exchange rates precisely into line with announced Stage 3 conversion ratios. Otherwise the market may make the critical decision over Stage 3 relative prices in a setting where it is ill-equipped to do so.

Given a need for intervention, there are still several strategies EMU members could follow in the run-up to Stage 3. They could lock bilateral spot rates when the Stage 3 conversion factors are first announced, they could leave all intervention until the last moment, as suggested by Begg et al. (1997), or they could follow a strategy of progressively narrowing allowable fluctuation ranges, perhaps through interest-rate targeting as demonstrated by Flood and Garber (1997). This

section evaluates these three approaches, showing that there is a way of implementing the last one through forward intervention that is highly credible and poses little or no risk of speculative attack--provided no country selected for EMU in May 1998 can defect before Stage 3 starts. The approach builds on one proposed by Flood and Garber (1997), although it avoids an aspect of their plan that may be incompatible with current arrangements for the operation of Stage 3 and derives its credibility from a feature of Stage 3 diffrerent from the one they identify.

Immediate locking of spot rates

Immediate locking of spot exchange rates would have the advantage of signaling the authorities' determination. But the strategy would expose the EMU countries to speculative attacks on their bilateral spot rates, attacks that could sow political discord and undermine the public's faith in the EMU process. That is what happened after the 1992-93 EMS crisis, and the credibility of EMU has been rebuilt in a setting of considerable potential room for maneuver in exchange rate policies (the ±15 percent fluctuation bands for most EMS rates).

A strategy of locking spot rates might be workable, at least in principle, if both countries concerned with a bilateral rate intervene symmetrically, extending intervention credits in unlimited amounts and eschewing sterilization. But in practice it is rash to assume that credible monetary coordination can start before the institutional framework removing national-government control over exchange policies--the ESCB--has been given indivisible control over EMU monetary policy.

One can envision a self-fulfilling crisis scenario in which a bilateral parity is attacked, but the "weak-currency" partner, perhaps hoping to secure the competitive or fiscal advantages of depreciation, reneges on its intervention commitment leaving the "strong-currency" partner liable

35

for the entire intervention burden. Nor can the most determined intervention by one partner

ensure its desired outcome if the other intervenes at cross-purposes: in that case there would be a

race of printing presses. These nightmare scenarios may be unlikely, but the denouement of the

1992-93 EMS crisis also would have appeared unlikely several weeks before it began.

There are other reasons why intervention commitments could be viewed as noncredible

prior to E-Day. Severe shocks may hit the EMU countries, including speculative attacks on "out"

currencies and subsequent realignments vis-à-vis the "ins"; a continuation of rising unemployment

rates; differential relaxation of macro policies following admission to EMU in May 1998, as

suggested by Begg et al. (1997); and national political reversals such as a German constitutional

crisis or government defeat in the sensitive fall 1998 election. In some countries the central bank

and the political leadership may take different views of the wisdom of proceeding rapidly to EMU,

perhaps in light of the prospective list of first-round members. In that case, making pegged

exchange rates the centerpiece of the transition process would give national central banks

additional power to pursue independent agendas.[21] On balance the hazards are greater if a

relatively large group of initial entrants is selected, as now seems quite likely.

Last-minute intervention

Begg et al. (1997) suggest that EMU members preannounce bilateral central rates as the Stage 3

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[21]Gros and Lannoo (1996) rightly observe that the national central banks of the "ins" can carry out nonsterilized interventions without changing the EMU-wide monetary aggregates. They conclude that the EMU-wide aggregate will become more important as 1999 nears, and that governmental commitments to large-scale nonsterilized interventions in support of exchange-rate targets therefore will become more credible. However, the declining importance of nation-specific money targets pertains only to certain aspects of exchange-rate credibility.

conversion factors, maintaining mutual exchange flexibility (through broad bands) after the first EMU members are selected and intervening to peg spot exchange rates, if necessary, only in the closing moments of Stage 2.

This strategy requires no early "signal" of determination from the authorities. It leaves the success of the transition uncertain until the last minute of Stage 2, and from that perspective appears risky. Furthermore, the strategy may not be fully credible: if market exchange rates on 31 December 1998 are distant from the preannounced conversion factors, will central banks be willing to push them back into line in short order? While intervention in the delayed-settlement market is a powerful weapon on the last day of Stage 2 (for reasons discussed at the end of this section), the question of subgame perfection arises here once again. One can well imagine that many member states would be reluctant to initiate EMU with last-minute exchange-rate changes that some national electorates would regard as revaluations.

Central banks therefore will be drawn into spot-market intervention well before the end of Stage 2 if spot rates stray far from agreed conversion ratios. It is better to be prepared for the eventuality of intervention before 31 December 1998 than to deny that it may become necessary.

Steering market rates toward preannounced conversion ratios

A middle road between last two strategies is for intervention to begin earlier in Stage 2 than the last day, but to tighten the allowable ranges of bilateral spot exchange-rate variation only gradually. De Grauwe and Spaventa (1997) and Gros and Lannoo (1996) advocate this strategy.

Their approach allows flexibility early on, when the scope for at least the foreseeable shocks may be greatest, but eventually rather narrow pegging is required and so vulnerability to

speculative attack becomes an issue unless the commitment of national central banks to intervene also grows progressively harder to question.

De Grauwe (1996) has suggested that the first-wave EMU members "frontload" monetary cooperation by committing to coordinated policies in advance of the ECB's start of operations in 1999. Such commitments, if feasible, would admit credible spot-market intervention policies that gradually drive bilateral exchange rates to target levels at the last moment of Stage 2. The major hurdle is that national actors with divergent interests could violate the undertakings on which the intervention agreement is based, perhaps pleading the *force majeure* of a speculative onslaught.

Exchange-rate management that is resistant to speculative attack: A safe passage to Stage 3?
There is a way to manage spot rates flexibly as Stage 2 ends, steering them to preannounced levels while maintaining high resistance to speculative attack. The plan requires minimal alteration of existing EU monetary arrangements. Its credibility rests on the facts that (i) official forward trades of EMU national currencies with value dates in Stage 3 are really trades of Euros for Euros and (ii) the ESCB issues Euros. The strategy works by pegging forward exchange rates at the preannounced conversion ratios.

Flood and Garber (1997) have already advanced a very similar plan based on official forward exchange trades of *national* currencies prior to Stage 3. They argue that the imminence of the TARGET settlement system will give national central banks immense power in Stage 2 to peg market rates for foreign exchange transactions with value dates in Stage 3. TARGET, they contend, gives the Banque de France (for example) an unlimited capacity to carry out forward purchases of francs against DM provided the value dates occur after the start of Stage 3. They

reason that TARGET will commit the Bundesbank in Stage 3 to supply all the DM the Banque de France needs to fulfill its forward commitments. In their account, the credibility of TARGET "reaches back" into Stage 2--there is no need for further policy coordination.

Flood and Garber's (1997) general point that the impending change in monetary institutions can lend additional credibility to certain Stage 2 commitments is important and correct, but there are two aspects of their interpretation that may clash with current legal provisions for the transition to Stage 3. Under the Maastricht treaty and subsequent EU legislation, the Banque de France cannot promise to pay DM deposits in Stage 3, nor can the Bundesbank pay out DM deposits to cover the Banque de France's market obligations. Instead, all ESCB monetary policy operations are required to be carried out in Euros (see footnote 1 above). The ESCB can deliver only national-currency notes, a feature that would seem to make Flood and Garber's specific proposal impracticable. A second problem is that it is as yet far from clear what types of actions taken by national central banks in Stage 2 will represent binding commitments on the ESCB. Certainly some national central bank actions in Stage 2 (and in Stage 3) will be viewed as generating Stage 3 liabilities of the national governments, not the ESCB.

Trade in a set of contracts different from traditional forward foreign-exchange contracts could, however, achieve the end Flood and Garber advocate while reducing possible legal problems. The contracts I have in mind specify forward trades of the Euro-equivalents of specified amounts of national currency units. The nature of these contracts suggests that the operational features of TARGET are not central to enhanced credibility. My proposal shows that the credibility of Stage 2 forward intervention need not rest on forward delivery of national currencies through TARGET, which EU law seems to forbid, but would follow simply from the ESCB's

willingness to let each member national bank create Euros to discharge its own prior obligations.

Suppose that in May 1998 the initial EMU members are elected and it is announced that the current bilateral EMS central rates $C^*_{j/k}$ will also be the Stage 3 bilateral conversion ratios. While allowing spot exchange rates to fluctuate, the EMU central banks now offer to sell (and buy) the following contingent forward contracts in unlimited amount:

On 4 January 1999, the central bank promises to deliver $C^*_{j/k} / C_{j/E}$ Euros in exchange for the simultaneous delivery of $1/C_{k/E}$ Euros, where $C_{j/E}$ and $C_{k/E}$ are the (random) national-currency j and k values of the Euro, to be determined by the market's closing ECU values on 31 December 1998.

This contract provides that if the *ex post* bilateral conversion ratio $C_{j/k} = C_{j/E}/C_{k/E}$ equals the preannounced rate $C^*_{j/k}$, then the national central bank will discharge its obligation on 4 January 1999 by exchanging $1/C_{k/E}$ Euros for $1/C_{k/E}$ Euros, i.e., through a one-for-one trade of Euros.[22]

For this plan to be feasible, the ECB must promise to backstop national central banks with the Euros needed to fulfill these earlier financial commitments after they are absorbed into the ESCB. This is not necessarily automatic, as I have argued, but the legal difficulties in creating such a guarantee need not be great. Since the preceding contracts have no monetary or fiscal

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[22]As a concrete example, suppose the EU decides to set $C^*_{DM/FF} = 0.298164$ (the current bilateral central rate). Suppose further that at the end of Stage 2, market exchange values for the official ECU are 1.958591 DM/ECU and 6.568835 FF/ECU. Then for each contract it has sold, the ESCB will have to pay out $(0.298164)/(1.958591) = 0.152234$ Euros and it will receive $1/(6.568835) = 0.152234$ Euros after rounding. (Clearly the contracts must specify the rounding convention to avoid potentially large total payments even when promises are kept.)

consequences if the preannounced conversion factors are implemented as promised, no violation

of the "indivisibility principle" is necessarily implied.[23]

The effect of offering these contracts would be to peg at $C^*_{j/k}$ market forward exchange

rates with value dates on 4 January 1999, including the critical 31 December 1998 delayed-

settlement rate--which would then be taken as the benchmark for applying the Madrid Council

formula of section 2. Why? A private trader seeking to sell 1 French franc for DM with a 4

January 1999 value date is committing to the *ex post* purchase of $F_{DM/FF} \cdot C_{E/DM}$ Euros with $C_{E/FF}$

Euros on that date, where $F_{DM/FF}$ is the relevant forward exchange rate prevailing when the

contract is signed in Stage 2. But this is precisely the same trading opportunity that EMU central

banks are offering in unlimited amounts at the implicit bilateral forward rate $C^*_{DM/FF}$. It follows

that $F_{DM/FF} = C^*_{DM/FF}$ must hold in equilibrium, in particular on 31 December 1998, when the

relevant market exchange rate is the one for delivery the next business day. This equality means

that the promise of the bilateral conversion factor $C^*_{DM/FF}$ can indeed be fulfilled, subject to EU

law, on 1 January 1999. (The scheme works even if only a subset of central banks offers the

contracts, provided official contract offers on any other terms are prohibited.)

The plan has the additional advantage of narrowing the range of spot exchange-rate

fluctuation as Stage 2 progresses by pinning down terminal forward rates. If national central

banks follow their usual interest-targeting procedures in Stage 2, covered interest rate arbitrage

with a fixed forward exchange rate will limit spot-rate movements.

Finally and crucially, the scheme is resistant to speculative attack because authorities can

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[23]If the promised conversion ratios were not implemented, there would be a fiscal transfer
between the public and the ESCB. This feature gives the contracts a credibility-enhancing aspect.

always let go of the spot rate so as to insulate national interest rates. No reserves of foreign currencies are needed to operate the plan: the fulfillment of the forward contracts requires only a one-for-one exchange of Euros--provided the contracts are consistently offered on the same terms throughout Stage 2 and EU law is respected on the first day of Stage 3. As noted, credibility is due to the ESCB's ability to print Euros, not its ability to create national currency deposits.

Of course, the preceding contracts presuppose the *impossibility* of a country's defecting from EMU between its selection in May 1998 and Stage 3. Defection--due to an internal constitutional crisis, say--cannot be fully dismissed at this stage, however. It would be possible to redesign the contracts to cover the contingency of defection, but the uncertainty would sap the willingness and ability of the EMU countries to intervene credibly without limit in Stage 2. Furthermore, an official EU acknowledgment of defection uncertainty is highly improbable, as that in itself would undermine credibility. Naturally, a non-negligible chance that EMU comes apart during the "end of the beginning" makes a reliably safe passage to Stage 3 unattainable.

6. Summary

This paper has analyzed the constraints EU law places on the introduction of the Euro. Given the legal constraints, there still exist several strategies for choosing the irrevocably fixed relative prices of EMU member currencies against the Euro. Unfortunately, most of these have potentially damaging side effects. One approach, based on official Stage 2 offers of contingent Euro forward contracts with value dates at the start of Stage 3, allows a highly credible preannouncement of the bilateral currency conversion factors to be set on E-Day, 1 January 1999. But that approach assumes no country selected for EMU can exit before the start of Stage 3.

Appendix *Determinacy versus indeterminacy: A question of timing*

Suppose monetary authorities pledge that from date $T - 1$ on, the exchange rate will be constant at its market level as of date $T - 1$. In some market settings, carrying out the pledge might require the monetary authorities simply to ratify any exchange rate the market throws up on date $T - 1$. This appendix argues that the planned scenario for launching the Euro need *not* be one of those settings in the Mussa (1976) exchange-rate model.

Return to the model of eq. (1). Imagine that on date $T - 1$ the market settles at an arbitrary exchange rate S^A. If the monetary authorities intervene on date $T - 1$ to set $Z_{T-1} = Z^A = S^A$, and fix fundamentals at that level forever, then by eq. (1), the exchange rate will remain constant at $S^A = Z^A$ from date $T - 1$ on. The monetary authorities will have fulfilled their pledge, but since S^A was arbitrary, the result of this official behavior is exchange-rate indeterminacy on (and by implication, before) date $T - 1$.

But the monetary authorities need not behave in this way, for they are able to fulfill their pledge even if they do not intervene until date T. Suppose again that the market outcome on date $T - 1$ is the arbitrary rate S^A. If the authorities stick to a preannounced level of Z_{T-1} but instead permanently set $Z_T = Z^A = S^A$ starting only on date T, the pledge of a constant exchange rate from $T - 1$ on will again be fulfilled, regardless of the levels of S^A and of Z_{T-1}. (In Stage 3 of EMU, TARGET would equate Z_T to Z^A.) This commitment capability renders the equilibrium unique. Since the authorities needn't validate the date $T - 1$ rate S^A, that rate, unless equal to Z_{T-1}, will not satisfy eq. (1) with $S_{T-1} = E_{T-1}(S_T) = S^A$. The result is an incipient expected nominal return advantage for one of the currencies. Under interest parity, individual traders therefore would defect from a candidate equilibrium with $S_{T-1} = S^A \neq Z_{T-1}$, collectively driving the market exchange rate to $S_{T-1} = Z_{T-1}$ instead. The latter is the equilibrium of equation (3).

A vow to peg nominal exchange rates to their levels at the close of business on 31 December 1998 thus does not, *in itself*, preclude a monetary policy stance that leaves exchange rates well determined. In other words, commitment to monetary policies that do not fully accommodate closing Stage 2 exchange rates is perfectly consistent with the pegging requirement. Indeed, the determinate policy package above is exactly congruent to the pegging strategy currently envisioned: the ECB will take note of the closing bilateral market rates on 31 December 1998, then adjust national money stocks on 4 January 1999 (if necessary) and afterward to maintain those rates permanently in the form of Euro conversion factors.

A seemingly slight difference in the pegging scenario would indeed produce indeterminacy. I now discuss that alternative, which throws light on the possibility of credible commitment to a non-validating monetary policy under the actual scenario.

Imagine that market activity ends at 5 P.M., but that the Maastricht treaty requires constant bilateral exchange rates starting at $\tau =$ 4 P.M., 31 December 1998, rather than 5 P.M. In that case the participating central banks would have no recourse but to validate the 4 P.M. market exchange rates, regardless of their levels, and those rates therefore would be indeterminate.

To see this result, suppose authorities attempt to proceed, as in the argument above, by forswearing validation of the time τ exchange rate; for concreteness, suppose they announce a definite level for the time τ fundamental Z_τ. Instead, they vow to set $Z_{\tau+h} = Z^A = S^A$ permanently for any arbitrary exchange rate level S^A that the market throws up at time τ, where h is a small positive interval of time. Now, however, that strategy does *not* necessarily produce an exchange rate constant at S^A from time τ forward. The exchange rate generally will deviate from S^A somewhere in the continuous time interval $(\tau, \tau + h)$. The only way to avoid that possibility, and simultaneously fulfill the requirement of a constant exchange rate starting at time τ, is to make h as small as possible. But this means setting $Z_\tau = S^A$, contrary to the pledge not to validate the time τ market exchange rate. Thus, it simply isn't credible to commit to a definite level for the time τ fundamental if a pegging requirement is in place, unless there is a finite gap in market trading starting immediately after τ.

Determinacy comes from the pause in trading over the long weekend starting at the market close on 31 December 1998. Central banks gain additional powers of precommitment that they could not possess were they burdened with the need to begin pegging earlier in the day. They are much less constrained in how their threatened reactions to arbitrary market outcomes affect the exchange rate's subsequent path.

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45

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